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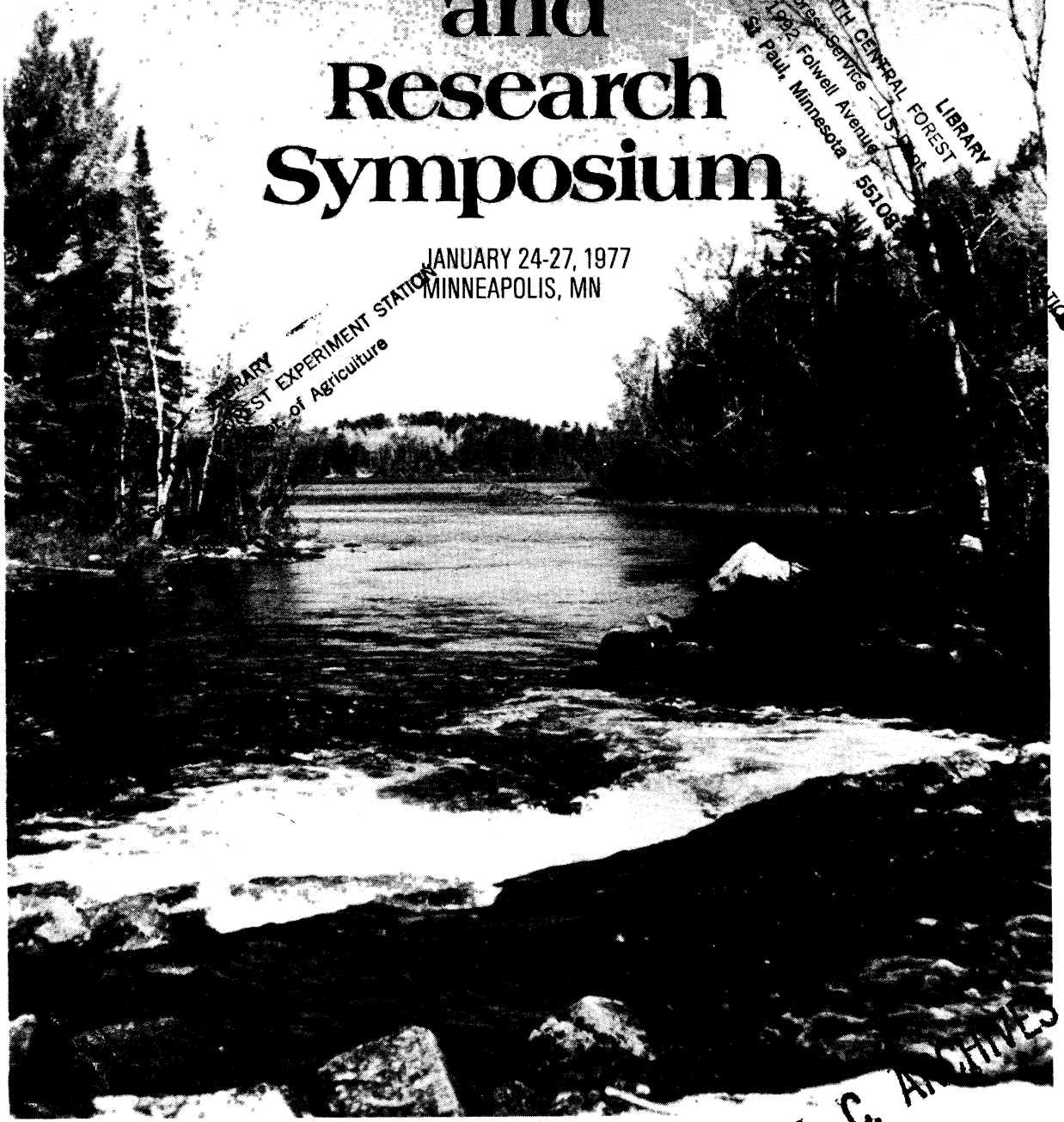

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1992 Folwell Avenue
St. Paul, Minnesota 55108

1977

PROCEEDINGS

Symposium
RIVER RECREATION MANAGEMENT and RESEARCH

January 24-27, 1977

Minneapolis, Minnesota

Sponsored by:

North Central Forest Experiment Station
Backcountry River Recreation Management Research Project

Co-Sponsored by:

University of Minnesota, College of Forestry

Northeastern Area, State & Private Forestry,
Forest Service, U.S. Department of Agriculture

Interagency Whitewater Committee

Bureau of Land Management, U.S. Department of Interior

Minnesota Department of Natural Resources

Tennessee Valley Authority

U.S. Army Corps of Engineers, Department of Army

National Park Service, U.S. Department of Interior

Bureau of Outdoor Recreation, U.S. Department of Interior

Office of Water Research and Technology
U.S. Department of Interior

FOREWORD

The first national symposium on river recreation management and research was held January 24-27, 1977 in Minneapolis, Minnesota. The purpose of the Symposium was to encourage and stimulate the exchange of ideas, problem solutions, and research needs within this rather broad field. To do this, we sought to assemble key representatives of the various groups concerned with river recreation--river planners and managers, public agency administrators, researchers, students, private entrepreneurs, representatives from outdoor recreation and conservation organizations, and private citizens. A key part of the Symposium was the discussion (formal and informal) generated among these people.

The timeliness of this Symposium attracted nearly 400 participants from 44 States and 5 Canadian Provinces, representing all of the groups concerned with river recreation noted above. This diversity among participants (geographically as well as professionally) and the open and enthusiastic dialogue during the 4-day gathering attested to the intense interest in river recreation management and research activities. The significance of the Symposium was further illustrated by a telegram from Senator Frank Church, of Idaho, author of the Wild and Scenic Rivers Act of 1968, "...I am deeply aware of the need for research and scientific debate to develop the best inventory and management techniques to insure protection of our nations river resources. Your efforts this week in bringing together distinguished scientists and agency managers is a significant step toward that goal."

The Symposium was conceived by the Backcountry River Recreation Management Research Project of the North Central Forest Experiment Station. Social scientists here are embarking on a broad new program of research focusing on the study of human behavior under a variety of river settings and conditions. Because the mission is to carry out such research nationwide, we were challenged by the scope and complexity of the assignment and realized that the Forest Service is only one of many management and research organizations involved in these activities. So, as background for beginning our research, we sought through the Symposium to review recent river recreation management and research accomplishments and to identify research problems and priorities, both social and environmental, that need to be solved.

The formal activities of the Symposium were divided into four General Sessions (23 papers presented orally) which all participants attended, and three Workshop Sessions (9 papers presented orally) each consisting of three concurrent workshops which participants attended according to their interests. Ten informal evening discussions were also held on a variety of timely subjects, such as urban river recreation planning, river safety, and managing river use in desert environments.

Papers by General Session and Workshop speakers along with 23 contributed papers not presented were printed in a preliminary proceedings and mailed to registrants 2 weeks before the Symposium for study.

The 65 papers herein are arranged according to the general format of the Symposium. There are four topics pertinent to river recreation management and research activities that contain 32 papers presented in General Sessions and Workshops. These are followed by 23 contributed papers on a variety of subjects. Next are the summary papers of the nine workshops and of the Symposium in general. Following these is a list of literature cited in all the papers. Finally, there is a list of Symposium participants.

The papers in this Proceedings represent the most definitive state-of-the-knowledge currently available concerning river recreation activity. As such, they should serve as an important collection of reference material upon which future research, planning and management, and general dialogue among interested publics can build.

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THE ROLE OF RIVER RESOURCES IN OUTDOOR RECREATION

RIVER RECREATION: HISTORY AND FUTURE

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ABSTRACT.--The recent rise of interest in river recreation must be seen against a background of fear of wild rivers as part of the uncontrolled wilderness. Revolutions in ideas, equipment, and technique paved the way for the transformation of river running from a high-risk expedition to family fun. The future will see increasing competition for the recreational potential of rivers, particularly for float trips. Management must not only determine carrying capacities but devise equitable ways of allocating space to commercial, noncommercial, educational, and other groups under those quotas. The "percentage of disappointment" is one alternative for allocating use. If wilderness values are to be emphasized in management, the noncommercial, do-it-yourself trip involving physical and psychological preparation of each member appears to have higher priority than commercially outfitted and guided "safari" trips.

Time was--and not so long ago in the United States--when rivers had little or nothing to do with recreation. River running, of course, began with the beginnings of the nation and existed before then in the canoeing and kayaking traditions of the first North Americans. Waterways were transportation corridors, highways through country that roads and railroads had not yet made easy of access. Later generations found rivers useful for hydropower, irrigation, sanitation, sewage disposal, and making the morning coffee. But running them for fun was not part of the picture.

Until very recently Americans did not like their water white. Rapids were dreaded and cursed as obstacles to navigation. Well-worn portage trails testified to the determination of early travelers to avoid white water. When money and technology became available, the rapids on key rivers in the transportation network were bypassed by locks or buried under flatwater impoundments. The death of a rapid was reason for celebration, another step in the conquest and transformation of the wilderness of the New World in man's interest. Following the biblical injunction, the crooked had been made straight and the rough place plain.

The recent emergence of rivers as meccas for outdoor recreation can be explained by changes in American attitudes which, in turn, are products of changing environmental circumstances. The ending of the frontier in 1890 is part of that change. So is the shift of American from a predominantly rural to a predominantly urban population, a fact which marked the 1920s. This rise of an urban-industrial civilization fundamentally altered the American conception of wild and natural things. The penthouse perspective was radically different from that of the log cabin. What had been an adversary became a novelty. What had been feared for its solitude became appreciated for the relief it afforded from a complex, crowded civilization. What had been hated as dangerous became coveted as challenging. What had been a source of national embarrassment became an object of national pride. Pioneers, in short, were too close to the wild to appreciate it. Ironically, the rise of civilization made possible the appreciation of the wilderness (Nash 1973).

Wild rivers were a beneficiary of this revolution in American thinking. In regard to rivers we can date the changeover in attitude from antipathy (or at least indifference) to affection rather precisely. In 1928 the Swing-Johnson Act authorized the first major dam on the mainstem of the Colorado River. Then called Boulder Dam, but later renamed Hoover, its completion in 1935 was a reason for universal jubilation in the United States. A wild river had been tamed. The engineers were heroes, and as Lake Mead began to fill, a proud nation proclaimed Boulder Dam the eighth wonder of the civilized world.

Thirty years later the tables were almost totally turned. Again engineers proposed a dam on the Colorado River--upstream from Hoover Dam in the Grand Canyon. But this time the engineers did not seem to be the agents of progress that they had in the 1930s. For a great many Americans the Colorado River in the Grand Canyon was not a monster to be shackled and put to work for the economy, but something valuable in its own right and already working to enhance the quality of American life. Reflected in the thousands of letters to Congress and the Lyndon B. Johnson administration, this point of view carried the day. There were enough dams on the Colorado, people said. Let part of the river alone; let it be lonely; dedicate it to backcountry recreation. In 1968 the cheers that 40 years before greeted the authorization of Boulder Dam now sounded in support of the defeat of the Grand Canyon dam projects (Nash 1970). Americans seemed to be saying that rivers had other values besides spinning turbines. It was three centuries in coming, but the day in the sun of public favor for wild rivers finally arrived.

One of the classic ironies in American environmental history is that the kind of public attention that saved the Grand Canyon from being dammed in the 1960s constituted a new threat to rivers--or at least to their wilderness qualities. Having worked to inform Americans about the losses involved in flooding much of the inner Canyon, opponents of the dams watched with alarm as a different kind of flood--a human one--threatened to engulf the river. Statistics in the following tabulation tell a remarkable story:

Travel on the Colorado River Through the Grand Canyon of Arizona

Year	*Number of People*
1867	1[1]
1869-1940	73
1941	4
1942	8
1943	0
1944	0
1945	0
1946	0
1947	4
1948	6
1949	12
1950	7
1951	29
1952	19
1953	31
1954	21
1955	70
1956	55
1957	135
1958	80
1959	120
1960	205
1961	255
1962	372
1963-1964	44[2]
1965	547
1966	1,067
1967	2,099
1968	3,609
1969	6,019
1970	9,935
1971	10,385
1972	16,432
1973	15,219[3]
1974	14,253

[1] *Some contend that James White, a trapper fleeing the Indians, floated the Grand Canyon on a makeshift log raft two years before the famous expedition of John Wesley Powell.*

[2] *Travel on the Colorado River in these years was curtailed by the completion of Glen Canyon Dam upstream and the resultant disruption of flow.*

[3] *The downturn in visitation was the result of the institution by management of a quota system. The numbers applying for the available permits continued to rise sharply.*

By 1972 the possibility of the Colorado River in Grand Canyon being loved to death was very real. The new frontier of river protection was to save the waterways from their friends. Nothing could signal more dramatically the intellectual revolution that between the 1930s and the 1960s transformed the relation of rivers and Americans.

Ideas were not the only change agents in the transformation of river running from the category of a high-risk expedition activity to that of a family vacation. The technique of running white water also changed and improved. Much of the credit here must go to a taciturn Utah trapper named Nathaniel Galloway. In the 1890s Nat Galloway began to run the Colorado and its tributaries. He took the wealthy Columbus, Ohio, industrialist Julius Stone down the Colorado in 1909 in the first commercially-guided, recreationally-motivated river trip in American history. In running rapids Galloway departed from the tradition of John Wesley Powell and previous river explorers by assuming a rowing position facing downstream. From this vantage point Galloway could spot obstacles ahead of his moving boat and, by rowing upstream, slow his pace while "ferrying" left or right. Powell's crew had rowed as if they were on a lake or ocean, facing their wake and rowing so as to increase their speed toward obstacles they could not see. Perfected on the Colorado by the Kolb brothers and Norman Nevills, the Galloway technique greatly increased the river runner's margin of safety.[4]

River boats also improved markedly after 1900. First there were the improved wooden and metal "cataract" boats, but the quantum jump occurred when new materials such as aluminum, fiberglass and neoprend rubber came to the assistance of river travel. Amos Burg pioneered the use of inflatable rubber rafts on the Snake and Colorado Rivers in the 1930s. Then World War II made its contributions to river recreation. From the Pacific theater came the so-called "ten-man" raft used by downed aviators, and used by troops in assaulting the beaches of enemy-held islands. Multi-chambered, flexible, buoyant, and strong, the 15-foot-long military boats and their commercially produced imitations proved superb river crafts. Harry Aleson took one through the Grand Canyon in 1949. In 1954 the legendary "woman of the rivers", Georgie White, tied three "ten-man" rafts together to produce a rig with exceptional stability in big rapids. By this time the Hatch family of Vernal, Utah was also using inflatables for commercial trips on Western rivers.[4]

The European theater of World War II also advanced the art of running rivers. As the Germans retreated, burning their bridges behind them, the advancing Allied forces depended on inflatable pontoons to provide temporary bridging. After the war these huge rubber sausages appeared on the surplus market and, shortly thereafter, on Western rivers. Georgie White lashed enough together to carry 40 people and their equipment through the Grand Canyon.

Still another factor in the recent boom of river recreation (I am speaking here primarily of multi-day float trips) was the discovery by the public that rivers offered a relatively easy way into backcountry. Excluding mechanized transportation (a tenet of most wilderness legislation), how else could you move through 25 miles of roadless country a day without taking a step? Compared to backpacking river travel is a breeze. A magic, flowing carpet does the work, carrying the gear that makes camping palatable even to the most fastidious. Of course you have to get back to your car--or have it brought to you at the end of the run--but on the river it is, literally, all downhill. Families who would pale at the thought of a 100-mile backpack, eagerly join a river trip of the same length. I have taken 5-year-olds and people over 80 on major river trips; blind people and paraplegics have run the Grand Canyon. This is, of course, wonderful, but the rivers have become crowded.

The future of river recreation is not hard to discern. The trend is upward. River running is at the take-off point in popularity occupied by downhill skiing in the 1950s. The need of an increasingly civilized people for contact with uncivilized environments will certainly increase. Equipment will improve and, in all probability, decrease in cost as a result of mass production. "How-to" books will instruct the novice while guidebooks and

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[4] *Collins, Robert O., and Roderick Nash. 1977. The big drops: ten legendary rapids on rivers of the American West. Oxford Univ. Press. (In press.)*

maps will open the last overlooked streams to increased usage. Television specials and documentaries, such as those that made skiing and surfing glamour sports, will whet the public appetite for whitewater. New companies will join those already offering commercial river trips, and the number of do-it-themselvers (many "graduates" of commercial trips) will increase enormously. We are, it would seem, only at the beginning of a trend toward the increased popularity of river recreation.

The pressure this certain popularity will place on management is enormous. One of the first broad decisions that will have to be made, and one that determines the nature of their experience, is the number of people to be permitted to run a given river. The options vary along a wide spectrum. Let's start with "amusement park" rivers. In this case--and we are close to it already on rivers like the Snake in Jackson Hole and the Youghiogheny--management would accept all comers. Find enough water to float your boat and you could run--bumper to bumper. In such a scenario upstream tows, similar to ski lifts, have a place. For the price of a tow ticket a river runner could have his boat hauled upstream for another run of a favorite rapid. He would wait in line, watching other boats run, and then have his 15 seconds of glory. Again the analogy to downhill skiing is compelling. In both situations the attraction is more the run (hill or rapid) than the total environmental setting. Wilderness camping is not a primary interest. On amusement park rivers, as with downhill ski hills, the user wants to get in his 15 runs and retreat to a lodge or condominium. He needs road access and he is not disturbed by crowds except when they make the lift lines too long. He is a white water freak, a "rapidomaniac". That is all that really interests him about rivers. He rejoices in the surging water as he would in a roller coaster. Hence the amusement park designation.

At the other end of the spectrum is the wilderness river. Here the user's objective is to be alone with his group of friends in a beautiful natural setting. They run rapids, but only as part of a total experience that very much includes wilderness camping. In retrospect the white water may not even be the most memorable part of the river journey. For management, maintaining a wilderness means limiting the number of users to a level far below what the amusement park rivers can accept. And here, as we shall see, is one of management's biggest headaches.

In thinking about this spectrum (there are obviously many possibilities between the antipodes discussed) the cardinal rule for the future is the preservation of diversity. There should be amusement park rivers *and* there should be wilderness rivers. There should be rivers where jet boaters can scream upstream and rivers where canoeists can glide quietly down. Preservation of diversity is the hallmark of the American democratic tradition. It has usually been defined in *human* terms, but the concept could be extended to the *environment*. The optimum environment is diverse just as the optimum society is. The beauty of the Wild and Scenic Rivers Act is that it accomodates diversity in the amount of development. Recreational river management in the future will be challenged with the task of keeping options open for Americans, matching a particular environment to its optimum use, with an eye, always, on the relative amount of public demand for a given experience. This is why coordinated regional and national planning is essential in the future of river recreation. It may be that the Youghiogheny should become an amusement park and Pine Creek a low-use, wilderness river; the Middle Fork of the Salmon and amusement park and the Selway a wilderness.

There are temporal as well as spacial roads to diversity. In the future it may be possible--indeed necessary--to use a single river for more than one kind of recreational experience. Temporal segregation of various uses could occur. For example, May could kayak month in the Grand Canyon. In June small, rowed rafts could be permitted in numbers so limited as to protect the wilderness quality of the place. August might be big-boat and big-numbers month with volleyball courts erected in advance at the campsites. September could find small, nonmotorized boats back on the river in limited numbers. Under this arrangement a very diverse use could be made of a single river and user conflicts kept to a minimum. It is an option, I believe, that the recreational demands of the future will make increasingly attractive.

In thinking about recreational river management, as well as about the care of terrestrial areas such as those in the National Wilderness Preservation System, "carrying capacity" have been magic words. When the term was first taken from the grazing industry and applied to recreation in the 1960s, it had the appeal of a panacea. Management was simple: find out the physical, biological, and what I have called the "social" carrying capacity (Nash 1973) of an area and use a quota and permit system to limit the number of users. Problem solved, right? Wrong! No sooner were quotas established on popular areas than the question arose as to who would fill them. How, in other words, would *allocation* under carrying capacity management be handled?

The question is complicated by the fact that the recreational river user is not a monolithic group. The deepest cleavage runs between commercial (or guided) and noncommercial (private) river parties. Expressed another way, it is between Americans who want to experience a river trip but lack the equipment and expertise to do so on their own and Americans who can do it for themselves. There are, of course, other categories of river runners, such as educational groups, but the dynamite issue in the future of recreational river management will be dividing the pie between the commercial and noncommercial sectors. The issue is already the subject of lawsuit and, given the inevitability of increasing demand in both sectors and a fixed user quota, the pressures will only increase.

In thinking about this issue it is well to dispose of some confusing myths. *None* of the following are true as generalizations upon which policy should be based: (Myth 1) All commercial boatmen are demi-gods who satisfy every customer and always protect the resource; (Myth 2) noncommercial river users are pot-smoking hippies with long hair and poor equipment; (Myth 3) Only the big, expensive, motor-powered pontoon rigs can make trips on white water, like the Grand Canyon's, safely; and (Myth 4) River running is so difficult that only 22-year-old weight-lifters who have been down the particular river 20 times are competent to run a successful trip. The point of all this is that good river trips can be run by both commercial and noncommercial parties and so can bad river trips. Another point is that any reasonably well-coordinated individual can learn to row a boat on a white water river with a few days' practice. The sport is for most people less difficult to develop competence in than is downhill skiing. Commercial boatmen and outfitters frequently profess dismay at the numbers of private floaters in the country these days. In fact the commercial operation has been a major factor in creating the noncommercial interest. People who run commercially one year, and who are participation rather than service oriented, may well be running noncommercially with a group of their friends the next year. The availability of good, reasonably priced equipment (see Verne Huser's paper in this symposium) facilitates their plans. I believe, then, that there is a definite numerical relation between the numbers who run rivers commercially and the numbers who want to run them privately.

The public is served by both commercial and noncommercail river trips. In allocating available river time between these sectors it may be helpful to consider the concept of "percentage of disappointment". The essential idea here is a management policy that aims at denying permits to the same percentage of applicants in the commercial and noncommercial sectors. Alternately, it means granting permits to the same fraction of applicants. An example of an equitable arrangement under the "percentage of disappointment" plan would be the following:

Number of applicants for noncommercial trips	*Number permitted to run*	*Percentage of disappointment*
600	200	67%
Number of applicants for commercial trips	*Number permitted to run*	*Percentage of disappointment*
9,000	3,000	67%

The hooker in this system is determining the number of *bona fide* applicants for each sector. One method is relying on honest reporting from both commercial and noncommercial sources. Another, with less loopholes, is for all applicants to go through management which then conducts a lottery within each sector. The winning private parties get permits; the winning commer-

cially oriented individuals are referred to the outfitter of their choice.

On amusement park rivers there appears to be little reason to favor commercial trips over noncommercial or vice versa. But on rivers managed for wilderness values it is relevant to note that the highest dividends from a trip may go to those with superior physical and psychological preparation. There is an adage that the more you put into something the more you get out. The person who plans a trip, organizes food and equipment, prepares him or herself to row or paddle, and actually runs the river seems to be ahead on this score of the person who simply writes a check and shows up. Any commercial boatman will admit, although perhaps not publicly, that they get more from the trip than the "cattle" they herd down the river. Looked at another way, if self-sufficiency is one of the most important parts of a wilderness experience, then the management policy which favors self-sufficiency (that is, do-it-yourself trips) would seem more appropriate to a wilderness environment. As it stands, most commercial river passengers are hardly self-sufficient; even more than guided parties of backpackers (who at least have to walk and carry), the river passenger is caught in the safari syndrome. They don't row, seldom cook, and experience few of the satisfactions of really contributing to a wilderness journey. The "percentage of disappointment" formula does not have a discriminating factor built into it, but management interested in maximizing the value of wilderness or wild river to the public might well want to consider discriminating against the safaris in favor of the do-it-yourselfers.

Another distinct possibility for the future of river and related backcountry recreation management is the "wilderness license". We currently require drivers of automobiles to demonstrate proficiency before being allowed to use the public roads. Why not require a similar show of competence from would-be wilderness users? The tests, which might have both written and field components, would be designed to insure personal safety, courteous conduct to other users, and protection of the resource. Certification could possibly depend on taking a course similar to the one the United States Coast Guard now offers to offshore power boat operators. The wilderness license, at any rate, would guard against the unqualified noncommercial user who does occasionally appear on rivers today.

The United States has a unique resource in its long backcountry rivers in relatively close proximity to major population centers. These rivers are worthy of the best our society can provide in the way of planning and management. And we can be sure of one thing. The decisions made today and tomorrow will create patterns that will solidify with time into institutions. The superb resource at stake should call forth our best management efforts.

SOME LEGAL ASPECTS OF RIVER RECREATION MANAGEMENT IN THE EAST[1]

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ABSTRACT.--The theme of this paper is the almost incredible multiplicity and the complex interrelation of overlapping governmental controls and private lawsuits affecting rivers and streams in the East. Its aim is to present a basic formula or approach to help identify, understand, and distinguish these interwoven legal control mechanisms. Its techniqué involves an octagonal form of analysis. To enliven the presentation, certain basic principles, cases, and authorities are incorporated into a form of fable based upon Siegfried's Rhine Journey.

FOREWORD

In order to condense and better exemplify certain basic principles of a complex, lengthy, involved subject, I have resorted to the time-honored approach of the fable. Because this paper is to be presented in Viking country, and is about rivers, what better form could the fable take than the old Norse legend that Wagner wove into Siegfried's Rhine Journey?

Obviously all the names, locations, characters, incidents, and events are entirely fictitious, and no resemblance to any actual persons or entities, corporate or otherwise, living or dead, is intended. Hopefully, the legal principles and conclusions set forth do have some validity and application to the real world because this is the object of the exercise.

The cases and other authorities, where cited, are actual reported cases and existing authorities, but expansions upon them, or their use in the fable are not intended to in any way reflect upon the actual participants. For example, Captain Soma Boat Line, Inc., in a reported decision in 1973, did sue the City of Wisconsin Dells for an allegedly low bridge. However, this is where it stopped. The name of the character "Commodore Coma" in the fable was deliberately chosen because not many people bear that unlikely name, and, to the best of the author's knowledge, Captain Soma Boat Line, Inc., has never been involved in any serious accident, nor is it associated with any conglomerate, fictional or otherwise, such as "Nippon-Hewes, Ltd." To any fine families of German extraction living in fictitious counties in Northern Wisconsin who might be named "Fafner," please be assured that the character "Fafner" is based on that of the 5,000-year-old talking dragon slain by Siegfried. But, to any *actual* 5,000-year-old talking dragons who might take offense, the author boldly says: *Hab acht, Brueller!*--the sword, Notung, is sharpened and ready!

A river is more than an amenity, it is a treasure.--JUSTICE HOLMES, *New Jersey v. New York*, 283 U.S. 336, 342 (1931)

Hast du dem Rhein das Gold zum Ringe geraubt?--R. WAGNER, *Siegfried*, Act II, Sc. 3

If the use and enjoyment of a river is a treasure, no gold hoard of the Nibelungs was ever jealously guarded by more dragons than today's typical back-country stretch

[1]*All footnotes appear at end of paper.*

of water. These guardians are paper dragons, but fierce and numerous: laws and ordinances, regulations, licenses, citations, injunctions, trespass and damage suits...this guard roster, reflecting Federal, State, and local governmental control efforts, and often including private lawsuits, could be extended almost indefinitely. What is at stake? Enjoyment of the treasure is directly related to the measure of legal control achieved. Effective management requires at least a substantial amount of effective legal control.

The *THEME* of this paper is the almost incredible multiplicity and the complex interrelation of overlapping governmental controls and private lawsuits affecting rivers and streams in the East. Its *AIM* is to present a basic formula or approach to help identify, understand, and distinguish these interwoven legal control mechanisms. Its *TECHNIQUE* involves an octagonal form of analysis.

I. DISTINGUISHING PUBLIC RIGHTS AND RIPARIAN RIGHTS

Riparian rights as they concern this study are those rights to use and enjoy a river or stream that the law confers upon the owner of the land abutting the water as an adjunct to his ownership of the enclosing banks or upland. Such rights may only be asserted by that owner or someone claiming in his name.

Public rights is a term lawyers and judges have traditionally used to describe certain privileged uses or enjoyments by members of the general public in a river or stream that in many eastern States must be "navigable in fact" by State law definition. The concept is a peculiar one, traceable far back into the mists of the early Common Law, and the rationales supporting it vary drastically from State to State, and decision to decision.

Under any of the widely varying rationales used by the Courts to support it, the effect of the public rights concept is to accord nonriparians a share in the use and enjoyment of a river or stream that otherwise might be largely monopolized by private owners along its banks. Again, the nature and extent of the uses permitted, and the criteria, as to which rivers or streams fall within the concept varies markedly from State to State.[2]

There is a strong hint of conflicting social philosophies running through this court-created dichotomy--rugged individualism vs. egalitarianism, private property vs. collectivism. Serious social conflict is probably more apparent than real.[3] There are probably more conflicts today among nonriparians in asserting apparently incompatible public rights than there are between riparians as a group versus nonriparians as a group. After all, a riparian on the Brule is a nonriparian when he fishes on the Popple.

Waite (1967), in a exhaustive comparative analysis of public rights in water in four eastern States, criticizes the use of this dichotomy as being more productive of discord, emotionalism, and fuzzy thinking than of productive logical results. Nevertheless, he feels compelled to use it, stating: "In spite of the fallacies and detrimental effects inherent in placing permitted water uses in two groups labeled either "public" or "private", the distinction is still made in the cases, and lawyers customarily speak of the permitted uses as "rights." Therefore this essay, oriented as it is toward lawyers' law, continues the familiar terminology."[4] On the same basis, this paper will employ the dichotomy as a form of legal shorthand.

II. AN OCTAGONAL RELATION

The basic legal controls that surround and constrain the establishment or exercise of these rights can be illustrated by an octagon (fig. 1). The nonriparian and riparian rights enclosed by the octagon are separated by the shifting, wavy, broken line. They appear on the diagram to be fairly equally divided as to area occupied. This may or may not accurately reflect the state of the law today.[5] The important point is that the line shifts back and forth within a finite, restricted area in reaction to legislative, administrative, or court decisions. A mass of such decisions favoring exclusive use by riparians *should* crowd the public users narrowly against the sides. Likewise a mass of such decisions favoring the public users *should* limit the private rights of riparians. The diagram *should* reflect reality in that the total usable water resource is also finite and restricted. But does it? The analysis below explores this question.

To enliven the presentation, let us follow the adventures of Siegfried ("Sig")

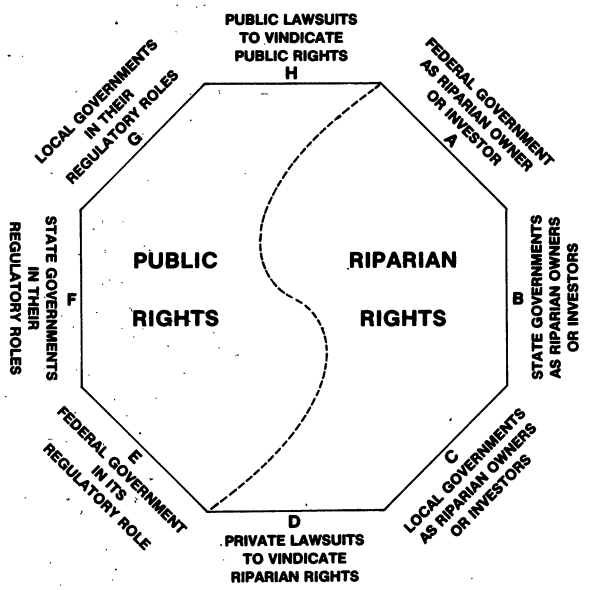

Figure 1.--*Eight segments representing the basic function of Federal, State, or local governmental management, or a lawsuit by a private interest in the courts to vindicate some respect of claimed public or riparian rights.*

Schmoe, Average American Boater, as he travels down the Rind, a river of modest size located in an entirely imaginary county of northern Wisconsin. The lettered paragraphs (A-H) below match those in figure 1.

A. THE FEDERAL GOVERNMENT AS RIPARIAN OWNER OR INVESTOR

Sig must first gain access to the river for his boat across *some* intervening riparian owner's property before he can enjoy his public right to do a little fishing. He has heard that some of the riparian owners, particularly Fafner and Alberich further downstream, are pretty touchy about trespass--particularly with boat trailers. He doesn't want to go to court or pay a fine for land trespass.

Fortunately, there are about 1 1/2 million acres of National Forest land in Wisconsin, one imaginary tract of which includes a segment of our imaginary Rind. As owner of the banks or upland, the United States is thus a riparian owner, and Sig, as a member of the public, is welcome as a licensee as long as he obeys the general regulations.[6] In the three-State Northwoods Lake Country there are about 7 million acres of National Forest land, substantial portions of which are strategically located to provide access to rivers.[7]

Other Federal land-managing agencies, including the National Park Service, Bureau of Sport Fisheries and Wildlife, Corps of Engineers, and TVA also offer "sponsorship" to the public to get on the rivers in the East to enjoy State-created public rights.[8]

In Sig's case, by driving a little farther he finds not only legal access to the river through a National Forest tract, but also a parking area for his car and boat trailer. He parks happily noting that the other 549 or so Americans with whom he must share this particular parking space are elsewhere today.[9]

Through additions to State and Federal properties purchases under the Federal Land and Water Conservation Act, Federal grants and loans to State and local governments and private groups, together with technical assistance and planning aid coordinated through Interior's Bureau of Outdoor Recreation, the United States fills the role as "big investor" as well as "big riparian" for people like Sig. According to one recent count, 90 separate Federal agencies and bureaus were contributing toward this and similar outdoor recreation efforts.[10]

As Sig prepares to launch his boat, he overhears a dispute involving a Forest Service special use permittee who maintains a commercial boat livery at the launching site. A Township law officer is stoutly maintaining that carrying on a business in this location is violating a Township zoning ordinance, but the Forest Service Assistant Ranger responds vigorously that Federal property is not subject to local zoning ordinances.[11] The noise of Sig's motor prevents his hearing the immediate outcome of this dramatic confrontation.

B. STATE GOVERNMENTS AS RIPARIAN OWNERS OR INVESTORS

As Sig ventures forth into the current and leaves National Forest boundaries behind, he begins to feel uneasy about whether the State courts would really find this river "navigable in fact." He is reassured to see a log floating by, and he notes several light aluminum canoes. He knows his position is legally sound in Wisconsin, because of an 1877 court ruling based on the log alone.[12] He now knows that he has a battery of what

lawyers have variously termed "rights" or "facets of the public interest"[13] including at least recreational boating, fishing, swimming, and related activities. He obviously must still have a valid State fishing license, which he has; as well as a convenient six-pack. He assumes consumption of the latter is a sufficiently "related activity" in Wisconsin, and is about to assert this right[14] when his attention is riveted to a sight on the left bank of what he knows to be State Forest land.

Emerging from an inlet comes Brunhilde ("Hildy") water skiing behind a powerful motorboat. Hildy, in addition to being a scenic beauty herself, likes to assert two other well established public rights in Wisconsin--enjoying scenic beauty and water skiing.[15]

Hildy has gained access to the river across State Forest land as a licensee. The State of Wisconsin administers some 90,000 acres of State Park land, some of which has access potential. Although some State Forest tracts may be strategically located for public river access, the State has less acreage than some other eastern States because the bulk of tax delinquent cutover forest lands (totalling 1.9 million acres) was turned over to County governments.[16]

Unlike the wide discretionary management authority vested in Federal land-managing agencies such as the Forest Service, the State Bureaus managing Wisconsin's Forests and Parks operate under more explicit and narrow statutory guidelines.[17]

Hildy and a number of other local belles were to be the centers of attraction in a series of local water ski pagents. The Committee had asked the Department of Natural Resources (DNR) for authority to put in access ways, parking lots, and toilets, and to erect bleachers to accommodate the public on State Forest land. The request was denied because the Attorney General of Wisconsin had earlier concluded in an October 1974 decision that the DNR lacked authority to construct spectator sports facilities in State Forests, nor could it lease State Forest property to another unit of government or to private interests for the purpose of providing spectator sports faciliites such as bleachers for watching a water ski show.[18]

However, public recreation is encouraged in State Parks and Forests, and the Division of Highways will build and maintain roads in these areas on DNR request. The DNR also has expressed statutory authority to: "...acquire the necessary land to build access roads to other lands under its care--those which otherwise would be inaccessible or which the department concludes would be increased in value and usefulness if the road were built. If other lands contain watercourses, this authority may be used to obtain access to them."[19]

State government, besides its ownership-access role, plays a pivotal role in investing State and Federal recreational funds, supervising the use of these funds through formulating and enforcing guidelines for Local government and private interests, and generally coordinating the State's recreational effort. The ORAP, and ORAP-200 programs, in Wisconsin are prime examples.[20]

C. LOCAL GOVERNMENTS AS RIPARIAN OWNERS OR INVESTORS

As Sig continues his journey, he observes Commodore Coma's excursion boat just drawing away from the shore of a County Forest tract ahead. The Commodore gained access to the river as a riparian because he owns a boat dock some miles downstream. On the river, however, he is asserting a public right of commercial boating.[21] His engine became balky on this run, but he had hesitated to put in for repairs on Alberich's or Fafner's land. He had waited until he got to County Forest land because the law in Wisconsin as to whether he would have been a trespasser on private riparian banks has been very much in doubt since *Doemel v. Jantz* in 1923.[22] This case held that the riparian owner had the *exclusive* right of access even over the strip of land between *his* ordinary high- and low-water marks. Although the courts in Missouri took exactly the opposite view in a classic 1954 test case,[23] the *Doemel v. Jantz* principle has never been flatly reversed in Wisconsin.

Governmental riparian ownerships thus offer needed initial legal access for non-riparians. They also furnish a haven for all river users in emergency situations or as pleasant stopovers for a picnic or rest.

Counties and municipalities (cities, towns, townships, and villages, e.g.) also manage forests or parks with key river *access* possibilities. For example, an extensive county park network and 1,460,000 acres of county forests are open to the public under local government regulations in Wisconsin.[24]

These local governments are "creatures of the States" in that their powers are only such as are delegated to them by the State. Nevertheless, as governmental bodies they have privileges not accorded a private riparian owner. For example, in Wisconsin: "County boards have condemnation powers to provide public highways to navigable waters. In the same manner, town boards have condemnation powers to reserve river fronts and lake shores for public use. The town also has authority to build an access road to the public shoreline area and may condemn land for that purpose. Village boards have similar condemnation powers. City governing bodies may acquire, by condemnation or other means, rights of access to and the use of waters, scenic or other easements, or other property or interests in property for public purposes."[25]

State aid for the acquisition by local government bodies of lands or interests to provide access to navigable lakes and streams is provided by various statutes including those implementing the ORAP programs. This kind of grant assistance, in expanding direct governmental property control, reflects the role of both Federal and State governments as investors as well as riparian owners.

D. PRIVATE LAWSUITS TO VINDICATE RIPARIAN RIGHTS

Ominous woods lie ahead of Sig on both sides of the river, the trees festooned with "No Trespassing" signs. He approaches the land of the grim Fafner.

Fafner is grimmer than usual. The constant roar of Hildy's towboat has put his nerves on edge.[26] He recently had to sue some nonriparians for trapping *his* muskrats.[27] Last winter some members of Hildy's Committee for an Ice Pageant celebrating "Miss Nonriparian Ice Skater" tried to saw ice blocks from *his* segment of the river.[28] He sued of course.

Now a hapless nonriparian, who has tried to bring a boat across Fafner's land, is trapped. The two struggle on the riverbank as Fafner tries to qet a license number while invoking *Doemel v. Jantz* in a terrifying growl.

If the Wisconsin Supreme Court declines to reverse or distinguish this old decision, the nonriparian will be found in trespass unless his attorney can find some suitable legal defense such as Wisconsin Statutes § 236.16(3). If Fafner had recently subdivided his land for sale, he might be subject to the following: "Where subdivisions of land are created which abut a stream or lake, "public access at least 60 feet wide" must be provided so that public access exists at not more than one-half mile intervals. But the definition of subdivision is quite restrictive, and in the northern sectors of the state, *the statute is often avoided or ignored.* Also, the statute has no effect on shoreland not "subdivided"--for example, it is not subdivided when four or fewer lots are created or when more than four lots of over an acre and a half each are created. (Citations omitted, emphasis added)."[29]

Besides defensive suits by riparians against public users, the body of cases includes riparian vs. riparian to resolve conflicting property uses, riparian vs. Federal, State, or Local Governments to resist eminent domain (condemnation); or to resist regulations or zoning.[30]

E. FEDERAL GOVERNMENT IN ITS REGULATORY ROLE

The river widens. Commodore Coma's excursion boat approaches a low bridge maintained by a township. As Sig watches in horror, a tall lady standing up in the bow eating a sandwich suddenly drops to the deck as the Commodore swerves the boat violently toward the higher bridge center. Had she not dropped, she might well have had nowhere to insert the rest of her sandwich.[31]

With a volley of seven-seas oaths, the Commodore swears to go to court to compel the township to abate the bridge as a nuisance.

In his violent swerve, the Commodore lost control, placing the boat in the opposite channel, so that the powerful speedboat, towing Hildy rapidly back upstream, collided violently with the excursion boat. In the fire and explosion that followed, one passenger was drowned, several others were injured, and both boats were demolished. Damage claims totalling several million dollars were subsequently filed.

In several of the lawsuits filed in State courts, attorneys for both the Commodore's Company and the owner of Hildy's tow boat moved that the cases be removed to Federal court on the grounds that the town-

ship had failed to secure approval for the bridge construction from the Corps of Engineers. Further, they claimed that the Admiralty jurisdiction of the Federal government attached under Art. III sec. 2 of the Constitution. Because the Commodore's boat and company were both owned by a large conglomerate, Nippon-Hewes, Ltd., the practical effect might be to limit recovery of damages so as not to exceed the value of the boat under the peculiar Limitation of Liability Doctrine in Admiralty Law.[32]

The township argued that although the Rind at the accident point was "navigable in fact" under *State* law for the purposes of the Trust Doctrine[33] and the attachment of public rights, it was not for the purposes of the Commerce Clause of the U.S. Constitution and the "paramount navigation easement" of the United States. They introduced a Code of Federal Regulations volume[34] listing the Rind for dredging and other national navigation improvement purposes as being "navigable to the Schmidlap Memorial Bridge"--which was 3 miles downstream from the accident site. They introduced evidence of DNR approval of the bridge construction.[35] To the contention that the river included waters subject to the jurisdiction of the United States under the Coast Guard regulations because the headwaters and substantial segments flowed through National Forest land, the township introduced a letter from the Coast Guard District Commandant in 1958 to the Wisconsin Legislative Council. For the purposes of enforcement of federal navigation, vessel inspection, and boating laws, the Coast Guard has interpreted the term as meaning "the navigable waters of the United States."[36]

These are two vivid, if perhaps atypical, instances where Federal regulatory powers were *not* applied using the liberal Federal tests for navigability under the Commerce Clause. More often under this Clause, such regulatory agencies as the Environmental Protection Agency, Corps of Engineers, Federal Power Commission, Commerce Department, and Coast Guard take *affirmative* actions such as improving or regulating navigation or building dams, *negative* actions such as prohibiting waste discharge or regulating point and nonpoint source pollution, or *permissive* actions such as licensing a wide variety of projects or practices.[37]

F. STATE GOVERNMENTS IN THEIR REGULATORY ROLE

Although shaken by the tragic accident, Sig continues his Rind journey. Ahead, on both banks, lie the extensive riparian holdings of Alberich, a wealthy retired eccentric. Sig has to change course to avoid a pier jutting into the river that moors Alberich's powerful speedboat, "Wotan III".[38]

Although the Rind here "is navigable in fact" under the liberal Wisconsin test for attachment of public rights, it is upstream from the Schmidlap Memorial Bridge. Therefore, although a potential Federal "paramount" navigation easement exists, it has not yet been asserted to displace or supplement State licensing authority for the pier.

Under Wisconsin law, Alberich owns his land from each bank to the thread of the stream. Because he owns both banks, he has legal title to the entire riverbed.[39] His ownership is subject to all public rights as developed by Wisconsin case law and the legislature however. This is theoretically so because, long ago, the courts frowned on naked assertions of the State's Police Power under the Tenth Amendment. Therefore, a quasi-property concept, the Trust Doctrine, was developed to rationalize the State's "police" restrictions on the use of private property.[40] The State, and before it the Territory, were always supposed to hold the moving water body as the corpus of a trust for all the people.[41] Although the soil title passed to the riparian, the moving water did not. Therefore, the State could regulate water surface use and compel reasonable water consumption. Because Alberich's pier extends into the corpus and interferes with at least some public rights of navigation or recreation, it has to be licensed by the DNR.

The concept creates some odd results at times when literally applied, but it seems to work, and is deeply embedded in Wisconsin property law.[42]

Utilizing Police Powers under the Tenth Amendment and the Trust Doctrine, numerous bureaus and commissions centering around the DNR perform many of the same basic regulatory duties as their Federal counterparts in the *affirmative* improvement work, *negative* protective activities, and *permissive* licensing. In addition they have the added

task of supervising and approving standards for local governments when these zone or regulate river activity.

G. LOCAL GOVERNMENTS IN THEIR REGULATORY ROLE

Passing gingerly by Alberich's pier, yielding careful right-of-way to departing boats as required by local ordinances, Sig hears a violent discussion between the Chief of the township Water Safety Patrol and Alberich. A Joint Township Ordinance[43] has been adopted flatly limiting boat horsepower on this part of the river, and the Wotan III far exceeds the limit. Alberich tells the Chief that the ordinance violates Wisconsin Statute § 30.77 and is contrary to the case law. "Section 30.77 provides that any municipality may enact ordinances that are in strict conformity with the Statewide provisions regarding boating, water skiing and skin diving and with the rules of the Department of Natural Resources. Any town, village or city, in the interest of public health or safety, may enact ordinances relative to the equipment, use or operation of boats, water skiing and skin diving if they are not contrary to or inconsistent with the Statewide provisions."[44]

Because counties and municipalities are "creatures of the State", care must be exercised to avoid unlawful delegation of the State's public trust responsibilities for navigable waters. Local governments, through zoning and regulation under State superivision, may limit commercial and industrial activities and farming, define and zone flood plains, and otherwise aid the State in its role as trustee.[45]

H. PRIVATE LAWSUITS TO VINDICATE PUBLIC RIGHTS

Alberich is further annoyed because Moe Mime, the well known metallurgist and champion of public rights, has just filed suit against him alleging that because a part of Alberich's river frontage is under the Forest Cropland law,[46] he (Mime) cannot only hunt and fish there, but also bring his boat across it for river access.[47] The suit is still pending.

Meanwhile, Commodore Coma, filing suit against the township to abate the bridge (a riparian suing to vindicate a public right) is told by the court that he lacks standing to sue.[48]

CONCLUSIONS

Sig comes ashore on the highway right-of-way at the Schmidlap Memorial Bridge, ending his Rind journey. He tosses the Magic Octagon back into the Rind. He has learned:

1. That three levels of government and many agencies are busy sponsoring or investing so that more members of the public can legally get on the river to enjoy public rights.

2. That having more people on the river does not necessarily mean an expansion of public rights as court defined, although seemingly it curtails or restricts the enjoyment of some exclusive private rights.

3. That more people on the river seemingly requires more regulation by more governmental agencies, thus restricting public rights as court defined.

4. That the courts' theories rationalizing these problems have an air of unreality, founded as they are on archaic property law concepts.

5. That goals or objectives to balance all these conflicting interests are left to the creative tensions and sometimes rivalries among many levels of government. Perhaps it will work out.

Meanwhile, Hildy awaits him at the bridge in her red convertible, her blonde hair only slightly singed from the accident, calling: *O Siegfried! Dein war ich von je!*[49] We'd better let him go now.

FOOTNOTES

[1]*The statements or views expressed herein are exclusively those of the author and do not necessarily represent the views or policies of the United States Department of Agriculture, nor any service, function, or agency included within or connected with that, or any other federal body.*

[2]*G. G. Waite,* A Four State Comparative Analysis of Public Rights in Water *(1967) (hereafter cited as* Waite, Comparative Analysis); *T. Lauer,* The Common Law Background of the Riparian Doctrine, *28 Mo. L.*

Rev. 60 (1963); H. Ellis, J. H. Beuscher, C. Howard, J. P. DeBraal, Water Use Law and Administration in Wisconsin (1970) (hereafter cited as Water Use Law), especially Ch. 3 and 9.

[3]J. A. Kusler, Carrying Capacity Controls for Water Recreation Uses, 1973 Univ. of Wis. L. Rev. 1; G. G. Waite, The Dilemma of Water Recreation and a Suggested Solution, 1958 Univ. of Wis. L. Rev. 542. For a blistering attack on governmental control of natural resources under Vermont Act 250 see J. McClaughery, The New Feudalism, 5 Environmental Law 675-702 (1974-1975): "The central thrust of the Vermont experience: the effort to replace freehold property by social property, which is the basic tenet of the New Feudalism;" but compare Waite, Comparative Analysis, supra, p. 3: "Extending some control to non-riparians represents a major triumph of political democracy over land-based feudalism" (obviously the gentlemen differ somewhat on their definitions of "feudalism"); and J. L. Sax, Takings Private Property and Public Rights, 81 Yale Law Journal 149 (1971): "The public has rights as well as property owners;" (the present author's experiences with landowner reaction in the Missouri Ozarks to condemnation proceedings for the Eleven Point River under the Wild and Scenic Rivers Act have convinced him that there is a problem, but the protestors are still far from taking to the barricades).

[4]Waite, Comparative Analysis, supra, p. 11.

[5]The balance, in Wisconsin, seems to have swung heavily in the seventies toward public users rights in zoning of shoreline areas, and regulation of riparian owners. Just v. Marinette County, 56 Wis. 2d 7, 201 N.W.2d 761 (1972). For a thorough analysis of this case and the general state of the law, see: F. Bosselman, D. Callies, J. Banta The Taking Issue (1973), pp. 161, 217, 260, 295.

[6]36 CFR 251.1(a)(2) "Temporary use or occupancy of National Forest lands by individuals for camping, picnicking, hiking, fishing, hunting, riding, boating, parking of vehicles and similar purposes may be allowed without a permit...."

[7]Committee on Interior & Insular Affairs, U.S. Senate, The Recreation Imperative, 93d Cong. 2d Sess. (1974), pp. 94, 177, 192 (hereafter "The Recreation Imperative").

[8]The Recreation Imperative, supra, Ch. 3, pp. 25-37, 84-85.

[9]Ibid, p. 135. In the Northeast, he would have to share with about 1,139 other people.

[10]Ibid, pp. 154-155.

[11]Of the 765 million acres of land and inland water surface held by the United States, 728 million acres are held in a proprietarial capacity. Less than 1/20 is held under exclusive legislative jurisdiction where the State in which the land is located has ceded all power to make laws and regulations to the Federal Government. However, under the Supremacy Clause of the Constitution and Art. IV, Sec. 3, the Property Clause, State authority to control Federal property and activities is limited: A State has civil and criminal jurisdiction over lands within its limit belonging to the United States, but this jurisdiction does not extend to any matter that is not consistent with the full power of the United States to protect its land, to control their use, and to prescribe in what manner others may acquire rights in them. Opinion of the Solicitor, U.S. Dept. of Agriculture, No. 728. But see: K. S. Landstrom, State and Local Governmental Regulation of Private Land Using Activities on Federal Lands, 7 Natural Resources Lawyer 77 (1974): Several forms of local government may overlap upon the territory within which the tract of Federal proprietary land is located. Under a complex of overlapping existing and potential Federal, State and local land use regulatory controls, and with a maze of regulatory controls from various levels of government not based on land usage, the importance of seeing that State or local governmental controls are extended to cover Federal proprietary lands may be overlooked. However, the Supreme Court, in several very recent decisions, has reemphasized that the States may not regulate federal installations and activities without "a clear congressional mandate," or "specific congressional action" that makes this authorization of State regulation "clear and unambiguous." Such Congressional waivers are virtually nonexistent at this time. See EPA v. California, 74-1435, decided June 7, 1976, 44 LE 4781, 8 ERC 2089; Hancock v. Train,--U.S.--, 96 Sup. Ct. 2006, 2013; Kleppe v. New Mexico,

--U.S.--, 96 Sup. Ct. 2285 (1976), 44 LW 4878 (6/17/76).

[12]Waite, Comparative Analysis, supra, 15; Olson v. Merrill, 42 Wis. 203 (1877), Willow River Club v. Wade, 100 Wis. 86, 76 N.W. 273 (1898); Water Use Law, supra, 40.

[13]Waite, Comparative Analysis, supra 9 and footnote 12. The term is that of Dean Trelease who argued that the right of an individual to sue to enforce the public rights has not been clearly settled.

[14]Query: Would a local ordinance or DNR Regulation barring "bottles and cans" be enforceable? Or politically feasible?

[15]State v. Public Serv. Comm., 275 Wis. 112, 118, 81 N.W.2d 71 (1957); Muench v. Public Serv. Comm., 261 Wis. 492, 506-508, 53 N.W.2d 514, 520-52 1 (1952); Nekoosa-Edwards Paper Co. v Railroad Comm., 201 Wis. 40, 47, 228 N.W. 144, 147, 229 N.W. 631 (1930). Water Use Law, supra, Ch. 9. Public rights in Wisconsin appear to include fishing, hunting, boating for pleasure, sailing, swimming, skating, water skiing and the enjoyment of scenic beauty on navigable waters. Many other eastern States have a much shorter, more limited list as to rivers and streams. An interesting and unresolved Constitutional question is whether the State can ever be called on to pay just compensation if it broadly expands these public rights to strikingly diminish traditional riparian rights. See Water Use Law, supra, pp. 42 note 100 and 68 note 198.

[16]Water Use Law, supra, pp. 175-176; The Recreation Imperative, supra, 175.

[17]Wis. Sta. Annot § 27.05-28.11(3).

[18]Op. Atty. Gen., October 17, 1974 (see Wis. Stat. 28.04).

[19]Water Use Law, supra, 176.

[20]Ibid, 177, Ch. 353 Wis. Stat. Annot.

[21]See note 15, supra. It is sometimes difficult to determine when a riparian may be suing for diminution of value to his property or business (riparian) and when he is asserting his public rights as a citizen. See Waite, Comparative Analysis, p. 29, and note 17 (denial of a monopoly of access to navigable waters).

[22]Doemel v. Jantz, 180 Wis. 225, 193 N. W. 393 (1923). Based on the author's research to September 7, 1976, 15 subsequent cases in Wisconsin had cited the Doemel case with approval, and it had not been overruled. Six other eastern States had also cited it as authority. Consider, however, the same Court's views when another factor is inserted. In Polebitzke v. John Week Lumber Co., 163 Wis. 322, 158 N.W. 62 (1916), it was held lawful to enter on the riparian shore for logging purposes between the two water marks. Recall the log test for navigability and Wisconsin's past interest in the timber industry--important insight can thereby be gained as to how the list of public rights is formed. A lot depends on the era.

[23]Elder v. Delcour (Missouri), 269 S.W. 2d, 17 (1954).

[24]Water Use Law, supra, p. 175-179.

[25]Ibid, 176.

[26]Fafner has scant legal remedy at present except the law of nuisance, or possibly local ordinance violation. See: Noise Control Act of 1972, 42 U.S.C.A. § 4901, et seq. Thus far, Federal efforts have been directed toward large scale aircraft and highway problems, and manufacturing sources. Local noise problems have been left to State or local regulation. Cf.: motorcycle noise. See Note 44 below for one effort by local ordinances in Wisconsin to prescribe horsepower limits.

[27]Munninghoff v. Wis. Conservation Comm., 255 Wis. 252, 38 N.W.2d. 712 (1949) held that the riparian had the exclusive right to propagate muskrats.

[28]Haase v. Kingston Co-operative Creamery Assoc., 212 Wis. 584, 250 N.W. 444 (1933) gave the riparian the exclusive right to use of the ice, but recognized the public right to ice skate on the frozen surface (obviously away from areas where the riparian is cutting the ice). Query: in a clearcut factual situation involving ice fishing, who would prevail in Wisconsin? Riparian or public?

[29]Water Use Law, supra, pp. 174-175.

[30]See e.g., Water Use Law, supra, agricultural irrigation 256-262, shoreland rights 36, zoning (local government) 408, obstructions to navigation 35, access 19, 35, cattle watering, reasonable use 18,

protection from municipal sewer pollution 398-399, etc.

[31]Compare with similar hazards in traveling by post coach in early Victorian England as recounted by the devilish Mr. Alfred Jingle in Charles Dickens Pickwick Papers, p. 33, Signet Classics (1964).

[32]H.L. Auten, The Role of the U.S. Coast Guard and State Agencies in the Promotion of Boating Safety, 37 Temple Law Quarterly 446, 450 (1964); L. R. Harolds, Limitation of Liability and its Application to Pleasure Boats, 37 Temple Law Quarterly 423-445 (1964); G. G. Waite, Pleasure Boating in a Federal Union, 10 Buffalo Law Journal 427-447, 439.; J. H. Gibson, Liability Under State and Federal Law: Boating and Water Sports, 11 Washburn Law Journal 418-439 (1971-1972).

[33]See infra, notes 39-42. Rivers may be (a) navigable in fact under the Federal test so as to authorize dredging, channel improvement, FPC dam licensing, EPA pollution regulation, Coast Guard policing and navigation control, etc.; (b) navigable in fact under the State test so as to authorize exercise of enforceable public rights; allow state or local agencies to apply licensing and restrictions on dredging, improvements, zone, etc.; or (c) non-navigable. In Wisconsin, due to the liberal test, it is hard to find a river in category (c). (a) and (b) can and do often coincide, and the location or national importance of the river or a segment of it is the key.

[34]See e.g., 33 CFR Part 2 (Coast Guard); 33 CFR Part 209 (Corps of Engineers) - obviously because the Rind is a fictitious river, you will search for it in vain by name.

[35]Water Use Law, supra, p. 487, for a discussion of the State's traditional jurisdiction until the Federal Government determines to assert its Supremacy.

[36]G. G. Waite, Pleasure Boating in a Federal Union, op. cit., p. 442. The same reach of a watercourse might be within the jurisdiction of the FPC or Department of the Army, yet Federal navigation rules might not apply to it. In a letter to the Wisconsin Legislative Council of January 14, 1958, Admiral E. H. Thiele, then Commander, 9th Coast Guard District, stated: "Certain rivers that have been improved by the Corps of Engineers have been declared by that agency to be navigable waters of the United States throughout all or part of their length." The Admiral listed a few rivers that had been held navigable but said it was impossible to list all the Federal navigable waters in the State. The Admiral said the Coast Guard recognizes its responsibility to enforce the Federal statutes on all these waters but indicated it didn't have enough men or equipment to do so. J. H. Auten, The Role of the Coast Guard and State Agencies in the Promotion of Boating Safety, op. cit., p. 450. The Coast Guard and other Federal agencies determine which waters are navigable and thus designate the extent of their jurisdiction; i.e., they promulgate rulings or issue statements of opinion with respect to the navigability of specific waters in connection with the administration of the functions or responsibilities assigned them by Congress. However, these rules or statements of opinion do not conclusively establish jurisdiction, because the jurisdiction of the United States can be conclusively determined only through judicial proceedings. In any event, federal jurisdiction is determined according to Federal law rather than according to the rule prevailing in the State where the waters are located. There are several practical consequences resulting from the application of Federal Admiralty jurisdiction rather than State law in a boating accident. (1) Limitation of liability might apply. (2) No jury trial. (3) Comparative negligence, as federally interpreted--especially significant in contributory negligence states. (4) The weird doctrine from The Jumna, 149 Fed. 171 (2d. Circ. 1906) dealing with damage arising from a cause that is "inscrutable." See D. Mattioni, Incidents of Maritime Collision Law, 37 Temple Law Quarterly 456 (1964).

[37]Water Use Law, supra, pp. 474-475.

[38]Ibid, p. 166 - Bond v. Wojahn, 269 Wis. 325, 69 N.W.2d 258 (1955). (Riparian vs. boater for property damage to pier extending 80 feet into the river. The court did not find sufficient evidence that the pier interfered with public rights.)

[39]Ibid, p. 44. "The rule that riparian rights exist by virtue of the ownership of the bank or shore in contact with the water, and not upon title to the soil under the water, has been uniformly followed in Wisconsin."

[40]Waite, Comparative Analysis, supra, *3, 19, 22.*

[41]Ibid, *21, 22.*

[42]Ibid, *21, 22. The same result might be reached by stating that the State's police power applies to regulate riparian activities, and that members of the public are privileged (i.e., free from a charge of trespass) as to certain enumerated activities. Professor Waite's policy arguments on continuing the doctrine (p. 19) are persuasive however. Cases such as those involving muskrats and ice (notes 26 and 27) are a little hard to reconcile as he recognizes. Treatment of the corpus in situations involving taconite development, and the bulkheading and extinction of parts of the Fox River at Green Bay also take some artful juggling. See* Water Use Law, supra, *72-73, 463-465 (taconite); 153-154 (bulkheading) -* Town of Ashwaubenon v. Public Serv. Comm., *22 Wis. 2d. 38, 125 N.W.2d 647 (1963); 126 N.W.2d 567 (1964).*

[43]Water Use Law, supra, *615 (Appendix F) shows an ordinance promulgated in the name of two towns and a village that illustrates the joint approach. It does not have a horsepower restriction.*

[44]Water Use Law, supra, *406; R. W. Cutler,* Chaos or Uniformity in Boating Regulations? The State as Trustee of Navigable Waters, *1965 Wis. L. Rev. 311. See p. 317. The Town Board of Burlington, (Racine County) Wisconsin, on June 11, 1963, adopted an ordinance prohibiting operation of boats having more than 50 h.p. on waterways within the Town. Leiske, a resident having a 75 h.p. boat sued. In* Leiske v. Town of Burlington, *Civil No. 62-001B, Racine County Court (4/17/64), the court held (1) Under the trust doctrine as set forth in the Muench case, the subject matter of the ordinance was of Statewide concern. (2) The 1959 Boating Act did not contemplate this kind of local legislation. (3) Even if delegation were proper, the classification standards were unreasonable.*

[45]Water Use Law, supra, *Ch. 15 (404-434).*

[46]Ibid, *404-434, 74- 75; Wis. Stat § 38.11(1), (5); Wis. Stat. § 5.341.*

[47]Ibid, *174-175.*

[48]*Commodore Coma might or might not be successful, depending upon the weight as a precedent accorded to* Captain Soma Boat Line, Inc., v. City of Wisconsin Dells, *53 Wis. 2d. 838, 203 N.W.2d 369 (1973), which appeared to say that an individual member of the public lacked standing to abate a public bridge.*

[49]*This and other odd-tag ends of German throughout are from the sound track of Deutsche Grammophon Gesellschaft's very fine recording of Richard Wagner's* Siegried, *Berliner Philharmoniker, Herbert von Karajan conducting. The author gratefully acknowledges the inspiration thus provided. Any sour notes in the transcription are his own.*

URBAN RIVERS AS RECREATION RESOURCES

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ABSTRACT.--Cites examples of current recreational developments of urban waterways: San Antonio River Walk, Wichita River Parkway, Trent-Severn-Rideau Waterway (Ontario) and New York State Canal Recreation Development Program. Documents benefits: protection of natural amenities, revitalization of downtown, provision of leisure activity, and increases in jobs, incomes, and taxes generated through commercial enterprises related to development.

URBAN RIVERS AS RECREATION RESOURCES

Recent emphasis upon wild and scenic rivers tends to overlook an equally important segment of recreational resource--the urban river. While there is much merit in programs to save the more fragile and primitive river landscapes, the recreational opportunities of urban rivers seem even more abundant. Fortunately, in America today, many urban river landscapes are experiencing a renaissance of conservation and development interest. Study of these trends shows that recreational potential is high but each city demands special study and planning.

The great potential of urban rivers comes from their ability to serve so many millions of people. Both social and economic gains are abundant whenever the rich resource assets of urban river corridors are redirected from waste containers and carriers to places of beauty, repose, and of great recreational utility. It is significant that the National Park Service, custodian of the prime natural wonders of the country, should state that "There is no doubt that a thriving recreation industry could be developed on most rivers of the United States, and such development would be most appropriate, not to say profitable, at places where the river runs through heavily populated areas" (Sudia [n.d.]).

RIBBON AND NODE TYPES

From a planning and development point of view, urban river recreation seems generally to be of two types--ribbon and node. The ribbon type treats a waterway as a parkway by providing an esthetically pleasing setting for distances along the watercourse. The node type provides a concentrated land-water interface at one location. Both are excellent demonstrations of waterway renewal in an urban setting.

The node type is well illustrated by the San Antonio River Walk (fig. 1). This four-by-six-block inner city complex is a concentrated mix of park and entertainment functions in a beautiful naturalistic setting. The park, points of interest, and business elements are intricately intertwined, forming a new amalgam. This amalgam has characteristics of each element but also is a unified whole with identity all its own.

A landscape analysis of the River Walk indicated that it could be divided into four environmentally cohesive but discrete areas (Gunn *et al.* 1972) (fig. 2). Area "A" contains landscaped walkways along the river but no shops. It offers open space and footpath linkage between the core and upper San Antonio. Area "B" is functionally

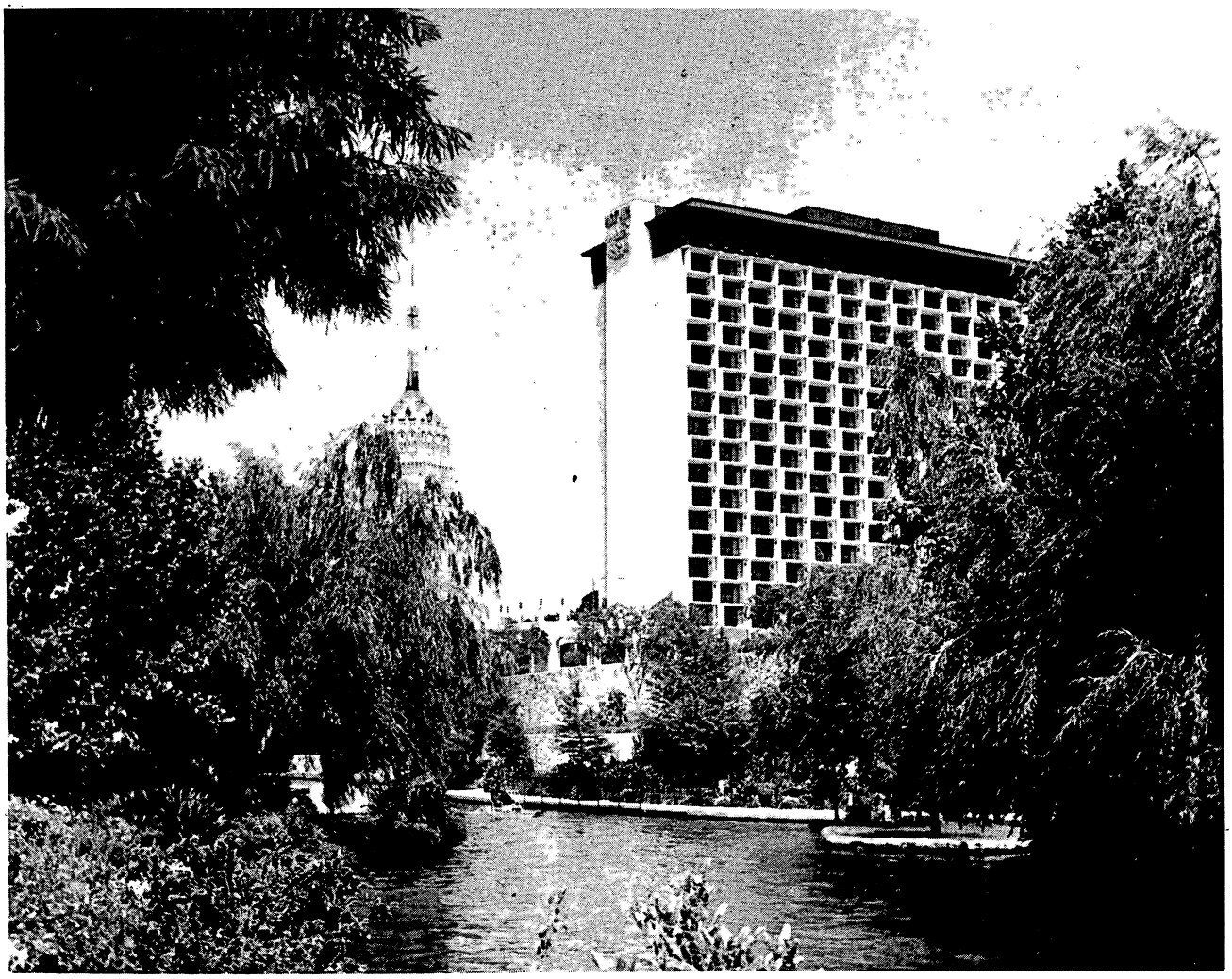

Figure 1.--*The San Antonio River Walk is an excellent demonstration of a node type of urban river recreational development.*

more of a destination area in a semi-tropical setting, flanked by a few hotels, a library and a hospital. Area "C" offers a pleasant landscape setting and features many shops, restaurants, hotels and places of entertainment. Area "D" is entirely man-made, excavated in 1968 to link the natural horsehoe bend of the river to a new civic center complex of theater, exhibition building, and arena.

Survey of both visitors and voters of San Antonio proved the River Walk to be a popular as well as a popularly-supported civic feature. The voters are extremely proud of it and express no concern over the fact that over 74 percent of the visitors are from out of town. They know the River Walk as "a great thing". "We take all our visitors to the River." "I love it; I go as often as possible." "...appreciate just knowning it's there" (Gunn *et al.* 1972).

The visitors, which reflect a very broad range of ethnic, age and income characteristics, like it because of: "trees, quiet, nature; feel more at home than anywhere else;" "lots of good views, pleasant to walk along, peaceful, no cares, fact

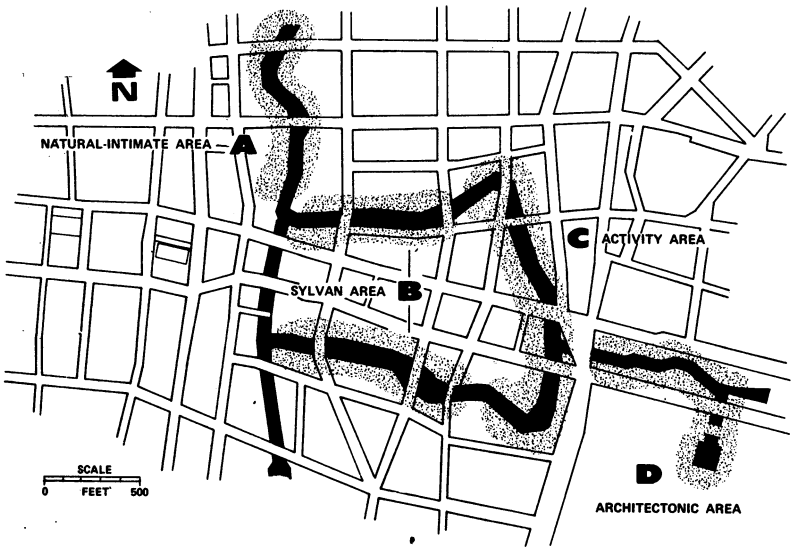

Figure 2.--*The River Walk occupies a relatively small area in downtown San Antonio and consists of four landscape environmental zones.*

that there is a river." "Clean, green atmosphere; helps relax--like a vacation spot in the middle of town" (Gunn *et al.* 1972).

Although the River Walk has had both lay and professional design inputs, it is not the result of one single plan at one time. Perhaps this is in its favor. It has avoided a narrow, single-purpose and sterile atmosphere that sometimes results from singular planning effort. Local citizen groups, governmental offices, architects, landscape architects and engineers have made valuable input from time to time. One visitor expressed his reaction this way, "Designed in sense that keeps human proportions, not regimented; not a national park, but commercial and natural--takes into account all human activities--dining, night life, relaxing; fact is downtown but completely divorced from city; like in country" (Gunn *et al.* 1974).

Rather than wait for some single agency to conceive, plan, and manage this area, as many as six major organizations and agencies collaborated on River Walk planning and management. It demonstrates that it can be done, and done effectively, and, at the same time, that the integrity of each organization is retained.

The ribbon type of recreational river development may have focal points but is dominantly a linear corridor concept. The city of Wichita is pursuing this concept along the Arkansas and Little Arkansas Rivers (fig. 3).

Stimulated by urban blight in the core of the city, plans call for redevelopment of the entire corridor, from core to the countryside, both to the north and south. "To be able to hike to the country from the heart of the city brings a great recreational resource close to those whose needs are greatest." Thus was the challenge expressed in a report in 1968 (River Corridor 1968).

Contrary to the node type of urban recreational water use, the theme is one of a series of regional parks utilizing both river and riverside. This linkage between the river proper and its setting was identified early in Wichita--a part of the comprehensive plan of 1923, park concepts in 1934, and open space and park plans in 1965 by the Sedgwick County Metropolitan Area Commission (River Corridor 1968).

Rather than provide concentrated recreational destination uses, such as those of the San Antonio River Walk, the objectives here are to provide for activities dispersed

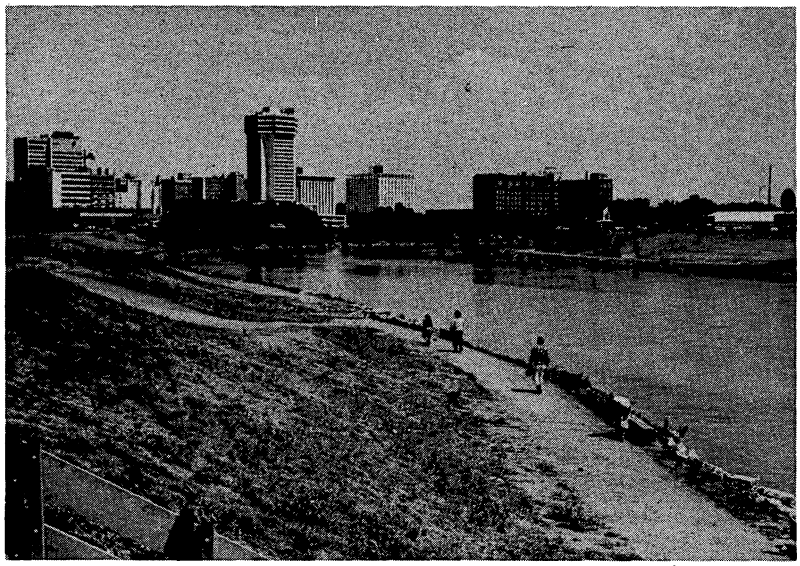

Figure 3.--*The ribbon type of urban river park and recreational development is being implemented in Wichita, Kansas along the Arkansas River.*

throughout the river corridor. These include: walking for pleasure, driving for pleasure, bicycling, sight-seeing, boating, nature walks, horseback riding, water skiing, and hiking. Plans for the acquisition and redevelopment of sites for these purposes are gradually being implemented.

As is true for most urban river recreation development, water stabilization is critical. Wichita implemented its plan for flood control in the early 1960's, directing flood waters around the west side of the city. Through urban renewal, strong city council leadership, and other sources, an inflatable dam has created an important reservoir. This water body offers a variety of esthetic and recreational activities and ties the new convention center to hotels and other adjacent land uses. Aquatic festivals and other recreational uses now spark interest in downtown activities (Gunn *et al.* 1974).

Through strong leadership of the planning director and public support of programs to improve the water corridor throughout the city, Wichita now enjoys a major renaissance of water as a civic amenity in the everyday life of its citizens.

URBAN-RURAL SYSTEMS

Recreational waterways that include both urban and rural (not wild) settings offer a new challenge with great promise for both node and ribbon types of development. Instead of treating each segment (urban and rural) separately, there are advantages of coordinating plans. Two outstanding examples, one in Canada and one in the United States, are worthy of study.

The Trent-Severn-Rideau Waterway in Ontario (fig. 4) extends 425 miles and utilizes old water transportation routes, originally used by Indians and fur traders (Rideau 1971 , Quinte 1973). The waterway was built for commercial shipping purposes in the early 1800's to avoid Indian and American conflict in the open waters of Lakes Ontario and Erie. Therefore, both land and water recreationists now have opportunities of viewing both urban and rural landscapes and historic sites along the way.

Of special interest are the 92 locks, linking 33 lakes and 6 major rivers. Many of the locks are still hand operated, just

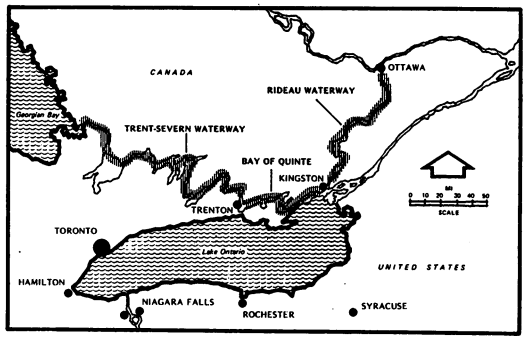

Figure 4.--*The Trent-Severn, Bay of Quinte and Rideau Waterways are interconnected and offer a 425-mile scenic and historic corridor in Ontario, Canada.*

as they were from the beginning. At Peterborough is the highest hydraulic lift lock in the world. Two chambers, 33 by 140 feet, actually lift and lower the boater in the water a height of 65 feet to the next level of the canal.

Of course, the greatest obstacle to planning such a corridor is the complexity of existing development and levels of government. The waterway corridor has a population of 800,000; includes 6 cities, 6 towns and 19 villages; and includes portions of 104 municipalities, 2 regional governments and 9 counties. The federal government has control of the water and lock-site lands but other public lands remain with the Crown in the right of Ontario. In 1969 on the Trent-Severn segment alone, there were 25,000 cottages en route and an additional 12,000 cottages on adjacent reservoirs. About 26,000 vessels use these waterways for recreation purposes today--there is no longer any commercial use.

As a result of growing interest in recreational use of these old commercial shipping lanes, the federal Minister of Transport and the Ontario Minister of Tourism and Information announced in 1967 that both federal and provincial governments would jointly study and plan for the future of this corridor. The Canada-Ontario-Rideau-Trent-Severn (CORTS) Committee was formed and sponsored studies resulting in two major reports that were given wide circulation. These reports provided basic descriptive information about the corridor and stimulated both private and governmental action. On February 20, 1975, a CORTS signing ceremony launched further action, forming two action groups to develop further work (CORTS 1975). One was the CORTS Advisory Committee composed of private citizens and the other was the CORTS Agreement Board providing government input.

Already, some development oriented to the waterway, in addition to the locks and lock sites, has taken place. The federal government has committed $44 million to the waterway over the 4 year period, 1975 to 1979. In 1973, the total cost to government was about $12.9 million. Restaurants, marinas and parks are being added. New services--lodging, tours, restaurants--are needed. The regional office of Parks Canada is inventorying characteristics of their lock sites along the Rideau. Ontario is initiating a program of provincial development policy and plan for their lands. While much is still in the planning stage, this waterway corridor represents a concerted regional effort to coordinate development for objectives of recreation and tourism as well as for conservation.

The New York State Canal Recreation Development Program represents another example of rural-urban regional waterway planning and development (New York 1975). The 524-mile Barge Canal route shown in figure 5 was chosen as the first effort of the State in establishing the Statewide system of recreationways. As with Ontario, these were originally constructed for commercial transportation. Portions still offer this but recreational use continues to outstrip this function. Included are the Erie Canal, Oswego Canal, Cayuga-Seneca Canal and the Champlain Canal.

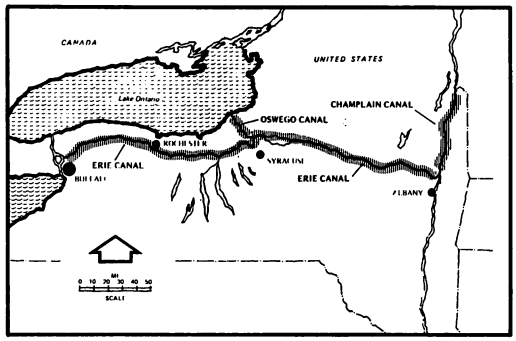

Figure 5.--*The State of New York is developing the recreational potential of a 524-mile corridor of old barge canals.*

The planning and development of this extensive corridor is both urgent and complicated. Portions of the waterway are already overused, especially urbanized areas with a notable need for boating, camping, day-use, fishing, winter and trail activities. The Canal passes through 21 counties, two-thirds of which are highly urbanized. The population of the region was 4.27 million in 1975 and is projected to be 5.05 million by 1990.

Rather than create a new canal authority, New York has decided to plan, develop and manage on a collaborative basis using existing agencies. The key actors are the State Department of Transportation (DOT) and the Office of Parks and Recreation (OPR). DOT manages the canal system and retains transportation as primary responsibility. It also operates and maintains those parks and trails located at lock sites. OPR has responsibility for recreation, agreeing that recreation shall not interfere with transportation functions. The agreement between DOT and OPR allows for policy changes as the planning process dictates and as experience, awareness and usage evolve. "This flexible attitude will allow new demands and knowledge to be incorporated into the system" (New York 1975).

In addition, many other units of government and local community groups are becoming an integral part of the program: the Department of Environmental Conservation, Bureau of Outdoor Recreation, Corps of Engineers, National Wildlife Service, National Park Service, Soil Conservation Service, regional planning boards, town, village and city planning agencies and trail and historical societies. OPR is working closely with local zoning boards and developers to create compatible land uses adjacent to lock sites and waterway parks. For example, "during the summer of 1973, six canal parks and three trails were developed by OPR in cooperation with DOT as a pilot project. The project was an overwhelming success with an attendance of over 200,000 in one season and became the basis for continuing canal development" (New York 1975).

Recommendations have been made for over 100 sites on the entire waterway. In each, comments are made on the type of recreational activity desired, the physical development needed, and the agencies who need to collaborate for development. Most of the recommendations are for swimming, camping, ice skating, horseback riding, boating, snowmobiling, motorized vehicle use, hunting and fishing, but emphasis is also placed on interpretive programs and development of historic sites and structures.

In 1975, about 174,000 people used the canal parks; another 30,000 used the old tow path trails. The State park attendants not only maintain the lock parks but also provide interesting interpretive programs for the visitors (Dyer 1976). While most of this use was at the State park lock sites, additional canal facilities are being developed by municipalities of St. Johnsville, Fulton, Montezuma, and Lockport (Guide to Outdoor Recreation 1976).

This example is also demonstrating new collaboration and cooperation on a large scale to provide new recreational opportunities from urban and rural waters at the

same time they are given greater conservation and protective measures.

REDEVELOPMENT PROBLEMS

Because most urban rivers have been used (and abused) for other purposes, recreational use today generally demands *re*development. This is not an easy task. It is complicated by the differences between cities--physical setting, historic background, financial capability, policies, and objectives. Hanna's study in 1974 of 119 major cities in the United States revealed that even though redevelopment is plagued with many obstacles, it is taking place.

For example, out of 107 major cities that have water resources suitable for redevelopment, 68 had proposals, 59 had proposals that had reached the planning stage, 28 were implementing plans and 14 had completed some kind of waterfront development (Hanna 1974). And, most of this interest has developed since 1960. A follow-up study in 1976 shows that 12 more cities have begun implementation (Hanna 1976).

The initiators of projects were about equally divided between government and nongovernment groups. However, the majority (64 percent) of projects that have resulted in development were initiated by nongovernment organizations, such as downtown businessmen, historical societies, service clubs, Chambers of Commerce, environmental groups and professional designers and planners. Hanna found that park departments play a passive role, both for proposal initiation and implementation of projects. At the same time, if a nongovernment agent, such as an architectural group, goes too far too fast, there is evidence to suggest the plans will be aborted. Local governments, at least for urban river recreation projects, appear to function well as response agents but not as initiators.

Most cities have difficulty with funding. Many cite this as the main obstacle for redevelopment. Funding for planning comes from a variety of sources but funding for development generally comes from city and federal sources.

Some responses from cities indicate the difficulties as they see them. Galveston-Texas City--"Resources not readily available--too many restrictions in the city core." Colorado Springs--"To date, the city has turned its back to its waterways." Harrisburg, Pennsylvania--"City has not had the financial resources to expend on park and recreation expansion" (Hanna 1974).

Hanna offers the following suggestions for cities contemplating redevelopment of water resources for recreation:

1. Treat every situation as unique. Solutions in other cities may not apply.
2. Create a proposal with which the community can identify. Blue-sky proposals are bound to defeat.
3. Citizen participation in both planning and follow-through is important.
4. An opportunistic approach that links development with some major event, such as a fair, has merit.
5. Anticipate funding problems before they develop.
6. Commitment by someone with action authority is important.
7. Anticipate sources of opposition and develop research information that either corrects improbable plans or refutes the opposing arguments.
8. Enter into redevelopment with a high degree of professionalism--designs that are creative but functional; funding that is possible; social sensitivity to needs of the community; a sensible relation to local economics.

Further analysis of studies of urban recreation potential revealed the need for following a series of guidelines even though each city has unique conditions (Gunn *et al.* 1974). These guidelines included three phases:

(1) A city should perform a preliminary investigation to identify water resources and to assess their characteristics, especially the factor of water level control. There is little need in proceeding further if flooding is a threat.

(2) Based upon the outcome of the preliminary investigation, a three-part investigation in depth should take place. An appraisal of the motivating factors should be made. An analysis of the site factors will indicate the potential for urban recreational use. Other factors, such as land economics, transportation and other externalities should be investigated.

(3) If the results of the above

studies are favorable, conceptual solutions and recommendations for development and implementation can be made.

CONCLUSIONS

Review of urban river development shows many gains in recent years. Truly a renaissance of urban waterfronts is taking place.

There is growing evidence that the recreational redevelopment of urban rivers can stimulate revival of downtown vitality. This is important at a time when urban core decay is more likely the rule. Property values can be recovered, civic interest can be redirected downtown, and business can be stimulated from both local and tourist markets.

Social gains from urban river redevelopment are great. Opportunities are abundant for ethnic mixing, for pleasurable relaxation, for low cost leisure, for diversity of interests, and for the re-establishment of a civic cultural center.

The planning-through-building strategies are difficult and not uniformly applicable to all cities. Each city has its own physical, social and political conditions that will influence approaches. Generally, however, there must be strong commitment on the part of political leadership.

There appear to be two patterns of development appropriate for urban recreation redevelopment of rivers: the "ribbon" type and the "node" type. Each is suited to different recreational functions and has its own special planning problems.

Traditional categories of either parks or business blocks may not be as well suited as newer and more creative concepts. For example, the park-business amalgam, illustrated by the San Antonio River Walk, provides the advantages of parklike settings and beautiful landscapes and yet offers opportunities for cultural activity, entertainment and economic gains from certain businesses, particularly restaurants, gift shops, conference centers, and hotels.

The urban-rural context is an important foundation for planning recreational river systems. Because many separate cities and counties are involved, individual local action--both private and public--is required. However, the extensive dynamics of rivers demand high level coordination, probably best carried out at the State level.

Urban river recreation is a growing and vital segment of total water recreation development that now holds great promise for both social and economic impact, if planned and managed to do so.

PROBLEMS RESULTING FROM THE INCREASED RECREATIONAL USE OF RIVERS IN THE WEST

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ABSTRACT.--Discusses impacts and conflicts created by increasing recreation use of rivers in the western United States. Problems addressed include environmental, social, and administrative interrelationships on rivers.

Rivers are fragile ecosystems that represent a multiplicity of resource values as well as recreational opportunities. Although users of western rivers face problems essentially similar to those in the East, certain impacts and conflicts are unique. Traditionally, resource managers have lacked data to develop specific guidelines for increased recreational use while at the same time keeping resource damage to an acceptable level. The challenge before us is not only in our ability to collect social and ecological data but to interpret and apply this information through the heat of controversy, planning, and decision making. Land managing agencies are faced with many river management problems created by increased user pressures, reductions in supply of quality white-water rivers, and myriad environmental, social, and administrative problems.

SUPPLY

Rivers, whether placid, wild, or scenic, are a limited resource, and the existing "supply" is under great pressure from a multitude of users. At one time, most rivers were pristine, pure, and plentiful, but the continuing encroachment of man has reduced their quantity as well as their quality.

To illustrate, as of June 30, 1975, 403 storage dams and dikes and 325 storage reservoirs, affecting thousands of miles of rivers in the West, had been constructed, rehabilitated or were under construction by the Bureau of Reclamation (Bureau of Reclamation 1975a). Although statistics on miles of rivers affected by impoundment projects is not known, channelization, dredging, landfills, and related construction of roads, trails, bridges, pipelines, wells, power stations, and transmission structures all affect the quantity and quality of the resource. A good example is the proposed New Melones Dam on the headwaters of the Stanislaus River in California, planned for completion in 1979. Currently, a 10-mile stretch of this river receives 78,000 visitor days[1] of use during a 6-month season. Most of this use would no doubt be shifted to other white-water rivers in northern California if this part of the Stanislaus is replaced by the reservoir.

Agriculture also has a real impact on rivers in the West. Water is removed for both croplands and livestock. These uses reduce the recreational quality of the river in terms of both esthetics and available water flow.

Exploration and development of energy resources has also taken its toll in reducing streamflow quantity as well as quality. Mineral extraction, desalinity

[1] *Vistor day: an aggregation of 12 visitor hours, where a visitor hour is the presence of one or more persons on land and waters for outdoor recreation purposes for periods aggregating 60 minutes.*

projects, and geothermal research place an additional drain upon the river ecosystem and surrounding recreational land. Proposed projects such as the development of phosphate resources in southeastern Idaho and the strip mining of coal in northwest Colorado are specific examples.

DEMAND

Increased leisure time and income, coupled with greater mobility of recreational marine equipment, have resulted in a phenomenal increase in recreational boating and water-related activities (fig. 1).

On the wild segment of the Rogue River, Oregon, total use increased from an estimated 2,800 visitors in 1971 to 7,200 in 1974. Similarly, use on the Rio Grande River, New Mexico, increased from a total of 17,000 visitor days before 1968 to 108,000 in 1974. More people floated the Colorado River through the Grand Canyon in 1972 than did from the period 1869 to 1969 (Dekker 1976). In 1973, on the Stanislaus River, California, recreational use was estimated at 31,000 visitor days and increasing at a rate of 10 to 15 percent per year (Welton and Harlow 1973). Noncommercial and special-interest use are also on the rise. Desolation Canyon in Eastern Utah saw a 250-percent increase in use from 1973 to 1974. Westwater Canyon, on the Colorado River near Moab, Utah, experienced a 380-percent increase during the same period.

Figure 1.--*The amount and variety of river use have increased tremendously in recent years.*

PROBLEMS

Certain environmental, social, and administrative problems consistently recur, according to river users, recreation planners, and resource managers.

Environmental Problem

Sanitation

A constantly moving ecosystem is difficult to analyze and protect from the impacts of increasing use. How to maintain cleanliness of portages, campsites (whether designated or not), roads, trails, swimming holes, and picnic areas, as well as the water itself, is a constant concern. Prevention of litter equals disposal techniques in terms of complexity.

The problem of waste disposal on sites accessible only by boat is complicated by health sanitation standards that prohibit installation of pit-toilet facilities. This causes problems on small campsites with limited space because the next alternative--chemical toilets--requires regular servicing from some type of vehicle. An example of controversy that can be created was the Bureau of Land Management's use of helicopters for removal of waste-holding tanks along the Rogue River in Oregon. Economical, self-contained portable units removed by helicopter were the selected method while visual and noise pollution trade-offs were made.

Another controversial problem is the determination of who should be required to take along portable toilets on downriver trips - the lone traveler or groups of a prescribed size?

We are slowly recovering from the tradition of using rivers as garbage disposals. However, it is still too common a sight to see junked cars, old refrigerators, and assorted debris along the river banks.

Vegetation

Trampling, compaction, and removal of vegetation for firewood by river users, hikers, and equestrian groups can cause portage erosion, campsite deterioration, and a general reduction in visual attractiveness along rivers. Poor design and construction of launching sites frequently adds to the deterioration of the resource. Inadequate parking facilities, campsites located above high water marks, and spectator concentration areas all lead to additional deterioration of the vegetative cover along the rivers.

Fire

Fire is still a major protection problem along river corridors where recreation occurs. The required use of spark arresters on stoves, fire pits, fire pans, fire blankets; restrictions on the number and types of fires allowed; and restrictions on the use of fuel (driftwood, dead-down, charcoal) are all fire protection methods that generate a variety of management problems.

Social Problems

Safety

One of the major concerns of Western river managers is the protection of the visitor's health and welfare. The manager utilizes information and education systems, rules and regulations, zoning, facility design and maintenance, patrolling, sanitation standards, search and rescue programs, and enforcement programs to promote public safety.

This is complicated on rivers where the ownership changes frequently along a stream and where gaps and overlaps of management jurisdictions exist. There are now rivers in the West where a group can float through the jurisdiction of at least 3 Federal agencies.

The variety of float equipment used - inflatable rafts, kayaks, surfboards, innertubes - makes it difficult to promote user safety.

Another serious safety hazard is the variability of river conditions with different streamflow levels. Unless recreation users understand the implications of a specific streamflow level they may not be prepared for hazards that exist during these conditions. River running during high runoff periods can be fatal even for the expert. However, most agencies administering the rivers cannot

legally prohibit users from entering the river.

Additional hazards are always present such as water conditions (temperature-potential hypothermia, flow-flood hazard), use of alcohol, glass and breakable equipment, and natural obstructions such as log jams, as well as artificial obstructions such as debris. To what extent should a managing agency provide for public safety? Can you separate safety from convenience when providing guide service? These and other questions arise when talking about safety and should be addressed.

Conflicts Between Uses

Probably one of the better examples of user conflicts is found on the Lower Colorado River between California and Arizona where jet boats zoom up and down the river while people float along in the same area in innertubes. There are rivers, such as the Bruneau-Jarbridge and Owyhee in Idaho, where use is limited to non-motorized boats, but on many others, such as the Rogue in Oregon, there are no restrictions on type of craft.

A potential problem is the conflict between motorized use of a river and the inclusion of that river in a wilderness designation which would by definition prohibit motorized use.

Allocation of Use

Apportionment of use, and identification and categorization of users pose difficult challenges in both the East and West. Should use be apportioned equally among all users? What are the rights of various users (i.e., commercial, non-commercial, educational, special interest, organized, unorganized, private, public, civic, profit, or nonprofit) in receiving allocations and use permits? How should we categorize user types? Are certain user rights greater than others? What is the most effective permit system: lottery, first-come-first-serve, no-repeat, or some combination? How should allocations be balanced and distributed among users? For example, in Canyonlands National Park commercial outfitters transfer passenger day[2] allocations among themselves in order to balance use ceilings and aid other outfitters in seasons of heavy or light use. Do allocations acquire a tenure or value? In some situations commercial guides are not making full use of the amount they request. In the Desolation-Gray Canyon segment of the Green River in Utah, 10 out of 38 guides made no use of their allocations at all and 10 other guides used less than 25 percent. Should time limits be set to use or lose permit allocations?

How many, if any, qualified commercial operators are needed to effectively meet demand? Which type of use meets the public demand better, the commercial operator or the private party? What about the educational, civic, organized, scouting, and church groups? There is support for recognizing educational use as a separate category with a separate allocation of use.

Administrative Problem

Managers are confronted with myriad administrative problems in dealing with recreational use of rivers. They constantly make decisions on complex, sensitive issues without adequate resource and user data. Additional studies are needed. Reliable estimates of use exist for very few rivers (Lime 1975a). Data needs include carrying capacity (ecological, social, and perhaps economic), socio-economic, demographic, economics of commercial operations, user group ratios, user patterns and preferences, trends in use, desired experience levels, motivations of the user, and restrictions on use.

Carrying Capacity

Managers want the answers to a number of questions about a river's carrying capacity. How much use can be allowed without permanent deterioration of the resource? What level of use can be allowed without jeopardizing the type

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[2] *Passenger day is synonymous with User day: any calendar day, or portion thereof, that an individual is accompanied or serviced by an operator or permittee on the public land.*

experience provided? How can river use be effectively monitored? For example, can crowded rivers be managed to provide a "wild" experience? Do groups of users assume an expected experience level? How effective are the methods of distributing use, i.e., limiting launches, controlling the number of users per boat, providing monthly allotments, allowing unrestricted use in off seasons?

Permit Allocation and Fees

Permits and fees are key management tools to allow the recovery of administrative costs, protect resource values, and assure the continued provision of specific recreational experiences.

When there are more permittees than necessary to provide adequate service to the public (e.g., provide use up to the alloted limit), some permittees operations become economically marginal. Management alternatives include a use-it or lose-it policy or a policy of allowing the transfer of allocations. Setting a use or lose policy for permit allocations may or may not solve the problem. If transfers of passenger days are allowed, techniques for adjustments are difficult. Minimum allocations need to be defined to determine the bottom limit for commercial feasibility. One of the more volatile issues involved with permits is the requirement for the permittee to have liability insurance. Getting insurance companies to provide coverage has been difficult in some States.

Enforcement

Trespass over and through public, private, and State land is a continuous problem for managers trying to control access to rivers. Protection of geologic, archeologic, and historic values is a major concern. Controlling vandalism, inspection of vessels and equipment, fire protection, pollution, issuance of citations, visitor safety and rules and regulations are all elements of an enforcement program. Agencies such as BLM, lacking any immediate authority must rely upon local sheriffs or other agencies to cite violators.

The multi-agency problem is further complicated by intermingled private, commercial, and agricultural land patterns on key river segments. Control is limited where such land is located at access points.

Interagency Coordination and Research

In many cases, recreation plans for portions of a river under different agency jurisdictions have not been fully coordinated. Chubb and Bauman (1976) found that, in many cases, National Forest plans are not coordinated with the plans for river management of State or other Federal agencies. Perhaps the overall management picture should be addressed at least at the regional level. The establishment of the Interagency White-Water Committee is a good example of the type of action that has helped in this area. Perhaps even a nationwide policy review should be considered to answer questions on proposed use allocations and variance in use policies among river segments that have the same management designation. Maybe master plans for rivers, backed by legislation, would benefit all rivers wherever their location.

Only after additional research on such topics as user demand, allocation priorities, types of use, and carrying capacities can we begin to solve some of the environmental, social, and administrative problems faced by the river manager.

CONCLUSION

This review of the problems points out some of the already identified problems. We can expect new areas of concern to arise as pressures continue to build. Solutions to these problems must be found or those rivers that remain available for recreation use will continue to deteriorate under the impacts of this use.

LEGAL ASPECTS OF RIVER RECREATION MANAGEMENT IN THE WEST

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ABSTRACT.--The paper analyzes the levels of law with which the river manager should be familiar, with emphasis on recent Federal statutes affecting the use of the Nation's waterways. It also analyzes the effects of a determination as to the navigability of a waterway, the importance of the reservation doctrine, and the effect of existing and future appropriations on river recreation management.

This paper provides a brief overview of the laws and legal doctrine applicable to river recreation management in the West, so that the river recreation manager will understand the legal framework upon which lies his authority and the authority of those with whom he must work. The legal framework includes the U.S. Constitution, interstate compacts, the various State constitutions, Federal and State statutes, county and local ordinances or laws, and case law. Of all of these, the statutes are the most significant. The constitutional law is important because it provides the basic authority for each level of government, even if in all cases, the full authority is not exercised. Case law is less important, but is helpful in illustrating points or in understanding how various laws are interpreted.

U.S. CONSTITUTION

The U.S. Constitution has four clauses of particular significance in this area: Property Clause, the Commerce Clause, the General Welfare Clause, and the Supremacy Clause.[2] Of some importance is the Tenth Amendment, which provides that all powers

[1]*The opinions expressed herein are those of the author and do not necessarily represent the opinions or views of the Department of Agriculture, Office of the General Counsel.*

[2]*The various powers as they appear in the Constitution are as follows:*

General Welfare. *Art. I, § 8, cl. 1. The Congress shall have power to...provide for the common Defence and general Welfare of the United States;*

Property Clause. *Art. IV, § 3, cl. 2. The Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States;*

Commerce Clause. *Art. I, § 8, cl. 3. The Congress shall have power...to regulate Commerce with foreign Nations, and among the several States,...*

Supremacy Clause. *Art. VI, paragraph 2. This Constitution, and the laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the authority of the United States, shall be the supreme Law of the Land, and the Judges in every State shall be bound thereby, any thing in the Constitution or Laws of any State to the Contrary notwithstanding.*

Tenth Amendment. *The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.*

not delegated to the United States are reserved to the States and to the people. It is significant that what is commonly called the police power is not delegated to the United States.

STATE AND LOCAL LAW

As far as the State constitutions are concerned, there are three important clauses. One is the presence in various forms of the police power. This permits the State to regulate the activities of its people and the use of its land.

Second, as important as the police power itself is the extent to which it is delegated to local governments. The authority of the local units of government depends upon what is delegated to them by the States. Their functions and importance to the river manager may vary, depending upon whether it is a water district, soil conservation district, drainage district, city, or county, and the powers granted to each by the State. When exercised by a county or city, the authority appears in the form of zoning ordinances. The impact of these ordinances on the river manager can be significant and will vary depending upon whether the local authority is development- or protection-minded. In many situations, Federal, State, and local interests may be involved. The river manager should have a knowledge of the underlying legal framework in order to resolve those problems where the interests and powers are not only overlapping but conflicting.

The third provision is that which, in several States, declares that all waters in the State are public waters.[3]

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[3]Wyoming Const. *Art. 8, § 1. The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the State, are herby declared to be the property of the State.*

New Mexico Const. *Art. XVI, § 2. The unappropriated water of every natural stream, perennial or torrential, within the State of New Mexico, is hereby declared to belong to the public and to be subject to appropriation for beneficial use, in accordance with the laws of the State. Priority of appropriation shall give the better right.*

Diversion Lake Club *v.* Heath, *86 S.W. 2d 441 (Tex. 1935).*

People *v.* Truckee Lumber Co., *48 P. 374 (Cal. 1897).*

Ex Parte Meier, *37 P. 402 (Cal. 1894).*

FEDERAL STATUTORY LAW

Although the constitutional framework is important, it would be unusual for a river manager to resolve a management problem solely by considering or applying the relevant constitutional principals. This is particularly so because, in many cases, the full constitutional power is not exercised. Usually, statutory law establishes the mechanism or system under which the river manager operates. At the Federal level, there are several Acts that affect river recreation.

One is the Wilderness Act of 1964, 16 U.S.C. § 1131. While not directed at rivers, it may include rivers within established units of the National Wilderness Preservation System, such as the Selway River within the Selway-Bitterroot Wilderness. The Wilderness Act provides for the management of wilderness areas in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and devotes wilderness to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use (16 U.S.C. §§ 1131(a), 1133 (b)). However, the President authorizes water resource projects (16 U.S.C. § 1133(d) (4)), but this authority has not been delegated.

In the Wild and Scenic Rivers Act of 1968, 16 U.S.C. § 1271, Congress established a system composed of wild, scenic, or recreational rivers. Section 10(a) establishes the management direction for components of the system: they are to be managed to protect and enhance the values for which they were included in the system, with emphasis on esthetic, scenic, historic, archeologic, and scientific features.

Section 5(c) requires the study of proposed rivers be conducted in cooperation with the States and political subdivisions of the State, and that the study contain a determination of the degree to which the State or its political subdivisions might participate in the preservation and administration of the river. Section 10(e) provides for cooperative agreements and participation by the States and their political subdivisions in the planning and administration of components of the system that include or adjoin State or county-owned lands.

Section 7(a)(b) prohibits the FPC from licensing, and any other Federal agency from

assisting in, a water resources project that would directly and adversely affect the values for which the component was designated. The authorization of water resource developments outside the component that do not diminish the scenic, recreational, or fish and wildlife values is not affected.

Section 13 is of particular importance because of what it states the Act does *not* do:

(1) It does not affect, with certain exceptions, the jursidiction or responsibilities of the States concerning fish and wildlife.

(2) The jursidiction over the waters of a stream shall be determined according to established principles of law.

(3) It does not constitute a claim or denial by the United States to exemption from State water laws (a similar provision is in the Wilderness Act).

(4) Designation of a stream is not to be construed as a reservation of the waters of that stream for purposes *other than those specified* in the Act, or in quantities greater than necessary to accomplish those purposes.

(5) It does not affect the existing rights of any State to the bed of navigable streams, tributaries, or rivers.

(6) Nothing in the Act may be construed to alter or conflict with the provisions of an interstate compact.

Some other Federal legislation includes the legislation establishing the national forest, park, and wildlife refuge systems, and the public lands managed by the Bureau of Land Management. While directed primarily at Federal land, the definition of both National Park System and National Forest System includes the term "waters." Also, there is one case upholding the authority of the Park Service to regulate activities on waters within the boundaries of a National Park.[4] This decision was based, in part, on the definition of National Park System. In addition, the Park Service has sought legislation (H.R. 11887) that would provide a clear basis in the commerce clause for such regulation. Both the Corps of Engineers (33 U.S.C. § 1) and the Coast Guard (14 U.S.C. § 2) have authority to regulate the use of navigable waters. While this has been primarily exercised where there is commercial boating and a definite need for uniform rules of navigation, the authority extends to all navigable waters. Of related importance are the various authorities possessed by the Federal Power Commission, the Nuclear Regulatory Commission, the Corps of Engineers, the Bureau of Reclamation, and the Soil Conservation Service. These agencies have the authority to license, sponsor, or undertake water resource projects that could convert a free-flowing stream into a reservoir, concrete channel, or cooling tank.

However, as indicated, both the Wilderness Act and the Wild and Scenic Rivers Act contain provisions restricting water resource projects. Two other Acts of some interest are the Federal Water Pollution Control Act, particularly the 1972 amendments, 33 U.S.C. § 1251, and the Endangered Species Act of 1973, 16 U.S.C. § 1531. The former is important because it requires a permit before any discharge from a point source and because of the potential requirements of compliance with best management practices before proceeding with any activity that might result in the runoff of pollutants from a nonpoint source. In addition, EPA is requiring, as a condition for approval of any State plan, an antidegradation policy to preserve waters that are of higher quality than current State standards. Finally, the FWPCA presently provides a significant degree of protection to wetlands under section 404.

The Endangered Species Act provides protection for listed endangered or threatened species of plants or animals. The Act has already been involved in two water cases, the pupfish in *Cappaert* v. *United States* (44 U.S.L.W. 4756, June 7, 1976) and the snail darter in *Hill* v. *TVA* (Tenn., May 25, 1976). The Historical and Archeological Data Act, Pub. L. 93-291, 16 U.S.C. § 469, the National Historic Preservation Act, 16 U.S.C. § 470, and the recent Act (S. 327) amending the Land and Water Conservation Fund Act of 1965, which also established an independent Advisory Council with rulemaking powers, will be important whenever archeological values are involved. The National Environmental Policy Act, 42 U.S.C. § 4321, may also have an impact.

[4]United States *v.* Carter, *339 F. Supp. 1394 (1972).*

Although I cannot discuss individual State laws in this paper, the Federal Acts may be duplicated at the State level, so that within each State, State laws must be consulted because State law does vary between States.

NAVIGABILITY

Before discussing the development of appropriation law, it is important to consider the development of the law on navigable waters, or the extent of the jurisdiction of the United States under the Commerce Clause. A determination of "navigability" is important for two reasons: (1) it affects the ownership of the bed, and (2) it has affected the jurisdiction of the United States. If a river was "navigable" at the time a State was admitted into the Union, then the State has title to the bed. If it was not navigable, then the entity that owns the adjoining shoreline owns to the middle of the riverbed. Since the laws of the United States control the disposition of its property (*U.S.* v. *Oregon*, 295 U.S. 1(1935)), whether a waterway is navigable and title passes to the States is a question of Federal law.

The question of navigability for title is important because although the public has a clear right of recreational use of a "navigable" water, its right of recreational use of nonnavigable waters may vary from State to State. The traditional view, based on English Common Law, is that the owner of the bed of a nonnavigable waterway has the exclusive right of use of the surface of that water. This has been followed in some States, particularly as to lakes.[5] However, the view of most States is that the public has a right to use the surface of all waters, regardless of whether the bed is privately or publicly owned. This rule follows naturally in those States whose constitutions declare all waters to be public waters.[3]

In *Day* v. *Armstrong*, 362 P.2d 137 (Wyo. 1961), the court ruled that the public has a right to float a craft down any stream, even if the banks and bed are privately owned. The court stated that this included the right to disembark and portage, if necessary to floating, but not if that were the primary purpose. This principle should be applied carefully. The existence of this public right does not mean that the public has a right to trespass across private land to get to such waters. Access to such waters, if nonexistent, must be legally acquired. Riparians and appropriators have other rights that must be respected, notwithstanding this public right.

The other reason "navigability" is important is that it determines the jurisdiction of the United States. While States may own the bed of navigable waters, their authority is always subject to the paramount power of the United States under the Commerce Clause. Under the English ebb-and-flow test, the jurisdiction of the United States would extend only to tidal waters. However, the courts in this country adopted the navigability test, which extended the jurisdiction of the United States to all navigable waters.

The courts have used various measures to determine navigability: whether logs have been floated on it, whether a fur trade was conducted on it, whether a light skiff may traverse it once a year, etc. The disparity in tests has led to a disparity in results. For that and other reasons, the courts may in the future utilize navigability to determine the jurisdiction of the United States as a measure less frequently.

The full extent of the jurisdiction of the United States under the Commerce Clause was most recently and significantly exercised in the Federal Water Pollution Control Act amendments of 1972, which refer only to waters of the United States. The Corps of Engineers tried to adopt regulations narrowly construing the statutory definition, but lost a judicial challenge to its regulations. Its subsequent revisions have resulted in congressional efforts to amend Section 404. The important thing in this review of the navigability questions is to recognize that the authority exists and to know the extent to which it has been exercised.

WESTERN WATER LAW

Finally, we get to the problems created by the particular development of western water law. The tremendous variations between the States preclude anything more than a general overview.

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[5]Proctor *v.* Sim, *236 P. 114 (Wash. 1925);* Bolsa Land Co. *v.* Burdick, *90 P. 532 (Cal. 1907);* Hartman *v.* Tresise, *84 P. 685 (Colo. 1905).*

Strict appropriation law provides that a person who diverts a certain amount of water and applies it to a beneficial use acquires a right to use that amount of water and does not recognize any other method for acquiring rights to water. It arose primarily because water was scarce and because appropriators had to be provided with some security that their investment of time and money would be protected in order to encourage development. Nine States (Alaska, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming) have adopted strict appropriation law. Ten others have adopted the so-called "California doctrine," an admixture of riparian and appropriation law (California, Kansas, Mississippi, Nebraska, North Dakota, Oklahoma, Oregon, South Dakota, Texas, and Washington). Most States that follow the appropriation doctrine, in strict or modified form, have also adopted a permit system to regulate the use of water and prevent appropriations in excess of available water. The permit system provides some protection for a river manager in that a notice of application for a permit to withdraw water and an opportunity for public input are usually required. The statutes establishing the permit system usually provide the authorized official with certain preferences between beneficial uses and standards for acting on a permit application. Most provide that a permit application may be denied in the public interest.

Usually, the system under which the river manager operates contains both authorizations and prohibitions. The authorizations might be to protect the fishery; preserve wild, scenic, or other values; or require a certain minimum flow. Prohibitions would include barring the violation of existing rights.

The water already appropriated represents such an existing right, as does the right of private property owners adjoining the river who might be adversely affected by the nature or extent of the recreational use of the river, particularly if it were noisy, excessive, or resulted in unauthorized trespass on this land. The State may be required to regulate use resulting from its developments (*Botton* v. *State*, 420 P.2d 352, Wash. 1966).

The water previously appropriated is part of the existing situation encountered by the river manager. While it does present certain constraints to him, future appropriations, unquantified or excessive appropriations, and appropriations in the form of reservations are more significant for future river management. The effect of the reservation doctrine is discussed in the next section. The effect of overappropriated streams may be mitigated if State of Federal law provides minimum flow requirements, prohibits all appropriation (as the State of Oregon did with the Rogue River), or provides that the creation of the system under which the river manager operates constituted a reservation of those waters. It is important to notice who is appropriating water for what purposes, whether and where that water will be returned. If the appropriation is for municipal water supplies, that may involve restrictions on the use of the waterway.[6]

In States that recognize both riparian and appropriation law, the riparian has no right he can assert that is superior to a prior appropriated use.[7] However, riparian rights will prevail as to a subsequent appropriator. In Washington, the amount of water in excess of that which can be used by a riparian within a reasonable time is subject to appropriation for use on nonriparian land (*Brown* v. *Chase*, 217 P. 23, Wash. 1923). California prohibits waste by either riparians or appropriators. In one case, the California court ruled that the pumping of water for a game preserve to attract wild waterfowl was a nonbeneficial use or waste of water.[8]

THE PROPERTY CLAUSE, THE SUPREMACY CLAUSE, AND APPROPRIATION LAW[2]

Congress clearly has the authority to dispose of waters on the public domain.[9] The first such attempt was the Act of 1866, 43 U.S.C. § 661, which provided that waters on the public domain may be appropriated as determined by local rules or customs. This was followed by the Desert Land Act of 1877,

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[6]Clinton Water District *v.* Island County, *218 P.2d 309 (Wash. 1950).*

[7]Schodde *v.* Twin Falls Land & Water Co., *224 U.S. 107 (1912).*

[8]City of Los Angeles *v.* Aitken, *52 P.2d 585 (Cal. 1935).*

[9]United States *v.* Oregon, *295 U.S. 1 (1935).*

Gutierres *v.* Albuquerque Land & Irrigation Co., *188 U.S. 545 (1903).*

43 U.S.C. § 321, which the Supreme Court interpreted as severing water and land on the public domain.[10] Although the United States has the power to control the disposition of waters on the public domain, it has substantially left determinations of water rights to the States. An exception is where the United States exercises its authority and apportions waters from navigable streams, as in the Boulder Canyon Project Act of 1928, 43 U.S.C. §§ 617-617t, which was interpreted by the Supreme Court in *Arizona* v. *California*, 373 U.S. 546(1963).

The Supreme Court may, in the case of a dispute between two States over interstate waters, exercise its original jurisdiction and apply a doctrine of equitable apportionment, as in *Kansas* v. *Colorado*, 206 U.S. 49 (1907). Perhaps the most important feature insofar as appropriation law is concerned, is the reservation doctrine. First enunciated in *Winters* v. *U.S.*, 207 U.S. 564 (1908) and extended in *Arizona* v. *California, supra,* the essence of this doctrine is that the United States reserves such water from appropriation under State law as is necessary to accomplish the purposes for which the reservation was established. The actual effect of the reservation doctrine is uncertain because the extent is unquantified. The effect is probably greater where Indian reservations are involved because it is not certain what limits exist as to the use to which such water may be put. In Colorado, where the United States is in the process of quantifying its rights, a Master-Referee has adopted the position that the United States may, by establishing a reservation, reserve a certain amount of the instream flows for fish purposes. However, the Master-Referee ruled this was not achieved until the Multiple Use-Sustained Yield Act was enacted in 1960. An Idaho court has rejected the position that the United States reserved the entire flow or even a minimum flow.[11]

In summary, I have attempted to provide a brief overview of the complex legal framework in which the river manager operates. As more laws are enacted, the framework will become more complex. There are some questions I did not discuss, and some that have not been resolved yet. While litigation may be necessary to resolve some questions, I would advise you to avoid litigation whenever possible because it is expensive, inefficient, not always successful or productive, and, perhaps most important, you can lose control over a problem when it becomes a subject of litigation.

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[10]Federal Power Commission *v.* State of Oregon, *349 U.S. 435 (1955).*

[11]Avondale Irrigation District, et al. *v.* North Idaho Properties, Inc. *(Dec. 1, 1975).*

INDUSTRY RESPONDS TO THE EXPLOSION IN RIVER RECREATION

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ABSTRACT.--Describes the response of private enterprise to the growing interest in river recreation--increase in number of outfitters and production of boats and gear as well as how publishers have created a literature of the sport and of the many new services that are provided the river-running public.

More than five times as many people floated the Snake River in Grand Teton National Park in 1975 (83,096) than in 1966 (18,174) (table 1). Only 2,068 people had floated the Colorado River through Grand Canyon before 1966. In 1966, 1,067 people floated it and in 1972 more than 16,000 people (16,428) did so. In Dinosaur National Monument commercial permits increased from 2 in 1967 to 14 in 1976. In the early 1970's, commercial outfitters on the Rogue in Oregon doubled, from 20 to 40.

Statistics on outfitters provide a true picture (table 2). For an outfitter in Ohio, passenger numbers skyrocked--from 100 to 5,000--in three years as he grew from a single-boat operation to one that hired 20 guides and ran 30 boats.

An outfitter on the Chattooga River stateline started his business in 1972 to take advantage of the publicity offered by the movie "Deliverance", which was filmed on the Chattooga. By 1976, he had increased from an original 8 guides to 18, the number of boats he ran had nearly doubled, and his clientele total had tripled.

In Dinosaur National Monument, commercial passenger numbers rose from 6,344 in 1970 to 21,612 in 1975. Several outfitters expanded their carrying capacity by using more boats, running more frequent trips, fuller boats, and, of course, hiring more guides.

The matter of ceilings, allocations, and limitations imposed on outfitters by administering agencies has slowed the trend in many areas. One outfitter writes, "The rate of increase the past few years has been 20 percent due to limiting factors (drought, user day limits, the economy). Our biggest growth year was between 1972 and 1973,"--just when administrative limits were imposed.

A canoeing outfitter, in New Hampshire reports that in 1974 he started his business with only nine canoes. By 1976, his third year of operation, he had 50 canoes to rent. He now rents all kinds of river equipment, has a full outdoor shop relationg to river travel, conducts kayak schools and fully outfits canoe trips. He also runs three canoe and kayak races each year to stimulate business, and he has published three river maps. This outfitter is only one of four that began operating in the same area the same year (only one had served the area previously), and all are doing well.

In the Ozarks, the owner of a country store and gas station has begun renting canoes in the hope of selling more gas, groceries, ice, and beverages to river runners who haunt the area. An outfitter in Tennessee has expanded his services to include boat repair and rebottoming of inflatables. He also sells rafts, canoes, and repair kits. His 3,000 clients, most of whom come from out of State, learn about his services from articles in local or regional newspapers and national magazines.

An outfitter in the Pacific Northwest, who began his career as director of a university outdoors program, started his operation in 1973 with eight raft trips on

Table 1.--*River use increase in Grand Teton National Park (1966-75)*

Year	Commercial users	Private users	Private user using canoe/kayak
			Percent
1966	16,610	1,564	--
1967	23,655	2,476	80 (trip registration data)
1968	21,775	7,848	--
1969	32,623	7,950	--
1970	47,589	[1]3,808	--
1971	62,119	5,917	--
1972	62,867	8,389	57 (trip registration data)
1973	67,912	[2]5,973	49 (trip registration data)
1974	[3]59,632	7,624	58 (actual count)
1975	75,300	7,796	--

[1] High-water year, several drownings on near-by rivers.
[2] High-water year discouraging private use.
[3] Impact of the energy crisis.

Table 2.--*Individual outfitter increases in number of passengers (1970-75), Dinosuar National Monument*

Outfitter	1970	1971	1972	1973	1974	1975
A	3,108	4,366	5,926	5,665	7,300	8,294
B	1,886	2,611	3,550	2,870	3,090	2,626
C	616	1,409	1,425	1,588	3,488	4,779
D	--	1,220	802	751	2,820	3,197
E	346	458	595	674	845	1,478
F	--	133	126	171	435	404
G	34	160	133	144	28	284
H	158	--	--	43	96	173
I	--	92	40	43	220	172
J	--	298	207	175	105	105
K	--	10	15	13	40	50
L	--	--	10	16	48	50
M	196	--	--	--	--	--
N	--	20	--	--	--	--
Totals	6,344	10,777	12,829	12,153	18,515	21,612

the Rogue. In 1974, he added four kayak schools. In 1975 he added two trips each on the Deschutes and the Owyhee. In 1976, he increased his business to 10 raft trips on the Rogue, 12 kayak schools (140 students), and added 2 trips on the Illinois and 6 on the Klamath in addition to the 2 trips each on the Deschutes and Owyhee.

A classical success story concerns two operators each of whom had his own float trip business and his own boat. Both were turning away business. They decided to go into a parternship on a third boat, hiring a guide to run it. In their third year, they entered a full partnership, hired 3 more guides, and carried more than 10,000 passengers.

Their business continued to expand, but boats were scarce. They designed their own, found a manufacturer to make it for them, and helped pioneer boats built specifically for river running. By the early 1970's, they were hiring eight guides a summer. Then they initiated a white-water trip just as white-water boating began booming. In the fifth year of their white-water business, they had 17 guides and had more than 36,000 passengers; for the first time, their white-water trips accounted for more passengers than did their scenic trips.

In the early 1960's, three young men began to run river trips on Pennsylvania's Youghiogheny. Going to school or working at part-time jobs during the winter, they ran commercial float trips during the summer months. They eventually became outfitters.

One of them moved to the New River in West Virginia and developed what has become one of the biggest operations in the East, selling the rubber rafts he designed for the area.

"About 1970-71 the Southeast started coming alive," writes Dave Demaree, who serves as a raft manufacturer's representative in Ohiopyle, Pennsylvania, at the most popular put-in on "The Chattooga, Nantahala, French Broad, Nolichucky, and several other streams started to attract major commercial operations."

Demaree also comments on the ceiling or limitation factor: "Many new outfitters would have started on or moved into the Yough if the State of Pennsylvania had not limited the commercial operation to the four existing outfitters. They each were limited to 3 trips per day of 80 persons each trip (960 persons per day)." The regulations were imposed to save the rivers from the tremendous impact of recreationists.

A sad note comes from Michigan, where they didn't regulate, where people pressures are too great. In a Department of Natural Resources publication called "Michigan Guide to Easy Canoeing", a comment is made that "A few rivers have become so popular that canoe traffic can be called congested, especially on summer weekends. The Au Sable, Pere Marquette, Pine, and Manistee are prime examples."

Use trends, while still growing in most areas, have slowed considerably in areas where administering agencies have imposed limiting factors, but unless those factors are carefully selected the river users will find ways of thwarting the intent if not the letter of the regulations.

Outfitters often see these factors as anti-business, as a means of thwarting the free enterprise system; however, administering State and Federal agencies consider them as protecting resources for future generations. A serious conflict has risen out of these differing points of view, but that conflict lies outside the realm of this paper.

Another way of looking at the response of industry to the growing interest in river recreation is through canoe rentals and sales. Grumman's Rent-A-Canoe Directory indicates an increase of more than 30 percent in canoe liveries between 1973 and 1975 from 426 to 560 (table 3). There is no certain way to differentiate between river and lake use in many cases, but location of the new liveries suggests that the increase is primarily on the rivers. The increase may be due in part to better research on the part of Grumman, but there is no doubt that the trend is upward.

No State had a decrease in number of liveries between 1973 and 1975; 3 new States added liveries, and 10 States remained the same (they are not listed in

table 3). Eight States--Alabama, Hawaii, Idaho, Mississippi, Nevada, New Mexico, Oklahoma, and South Dakota--had no canoe liveries listed in the Grumman Directory.

States having the greatest increase were West Virginia (1 to 4), Texas (7 to 20), and Vermont (3 to 6). In several States the number doubled from 1 to 2 or 2 to 4. However, a number of States having a large number of liveries showed remarkable increases too: Ohio (28 to 38), Pennsylvania (28 to 39), Wisconsin (33 to 44), New York (50 to 64), and Missouri (27 to 34).

Table 3.--*Increase in the number of canoe liveries*[1]

State	1973	1975	Increase
			Percent
Arkansas	3	4	33
California	7	11	57
Colorado	0	1	--
Connecticut	7	8	14
Delaware	2	3	50
Indiana	13	14	8
Iowa	4	6	50
Kentucky	1	2	100
Louisiana	2	4	100
Maine	14	17	21
Maryland	7	8	14
Massachusetts	5	7	40
Michigan	58	59	2
Minnesota	32	37	15
Missouri	27	34	26
New Hampshire	8	13	62
New Jersey	23	26	13
New York	50	64	28
North Carolina	3	5	67
North Dakota	0	2	--
Ohio	28	38	35
Oregon	0	2	--
Pennsylvania	28	39	39
Rhode Island	1	2	100
Tennessee	4	6	50
Texas	7	20	186
Utah	1	2	100
Vermont	3	6	100
Virginia	6	10	67
Washington	5	6	20
West Virginia	1	4	400
Wisconsin	33	44	33
Totals[2]	426	560	31.4

[1]Source: Grumman Rent-A-Canoe Directory
[2]Totals include States not listed that showed no increase

Canoe sales are reflected to some extent by the number of dealers. The number of Old Town Canoe dealers increased from 316 to 346 between December 1974 and June 1976, a 6.3 percent gain. Several interesting trends appear from an analysis of the location of the dealerships. The South and Midwest both show substantial increases; both New England and the West show only moderate increases. However, Maine itself, in which Old Town is located, shows an increase of 8 dealers (from 23 to 31), which means that New England as a whole showed a decrease.

When you consider that the freight rates to ship canoes from Maine to the West are high, it may be that Old Town statistics are not valid in the West. Further, several canoe manufacturers have emerged in the West during the past few years: for example, Easy Rider (Washington), Wilderness Boats (Oregon), and Nona (California). The fact is that canoeing in the West is becoming tremendously popular.

Dave Demaree writes "The canoe and kayak industry didn't get moving until late 1972. With the good TV coverage of the white-water slalom in the '72 Olympics and the film "Deliverance", not to mention a couple thousand people each summer day seeing kayaking boaters on most Eastern raft trips, paddling sales increased greatly." He suggests that the biggest sales are made by backpacking stores in big cities but that "speciality stores are appearing at rivers like pro shops at golf courses".

Demaree claims that there is a surplus product because so many manufacturers have emerged and that "Grumman is now actively seeking dealers for the first time in 30 years". He notes that the canoe business "had been growing at the rate of 25 percent per year" for the four or five years before the oil embargo slowed things in late '73. Grumman is selling between 75,000 and 80,000 canoes annually.

Most canoe companies now produce white-water models. One company (Blue Hole) makes only a product designed for paddling in rapids. It is probable, says Demaree, that "Kayaking has two to four hundred backyard manufacturers actively competing with commercial producers".

The manufacturing of inflatable rafts has had an interesting history. Initially river runners, private and commercial, used the military surplus assault boats and bridge pontoons from World War II, but by the mid-1960's when the business began to explode these crafts were in bad repair and in short supply.

Many outfitters began to design their own boats,and had them produced in West Virginia by Rubber Fabricators. In 1972, B. F. Goodrich bought out this company and dropped boats ("too little sales, too many hassles" says Demaree). The foreign raft producers--Avon and Leyland in England, a number of Taiwan and Japanese manufacturers --began churning out the boats including hypalon rafts marketed by Campways in this country.

Then the Coast Guard stepped in, announcing that they would soon be regulating rafting on navigable rivers and would enforce the Jones Act, which says in part that no foreign-built vessel may be licensed to operate in the United States.

As a result American manufacturers had an incentive to produce boats. Several key management and technical people formerly with Rubber Fabricators left B. F. Goodrich, according to Demaree, to form a new company, Rubber Crafters of West Virginia which is producing "the same quality river rafts they made" before. Another West Virginian long involved in the raft-building business started a similar company called Mountain States Inflatables, Inc. On the West Coast, a company called Maravia recently commenced construction of inflatable boats suitable for white-water purposes.

Personal flotation devices (PFD's) have been a real headache to river runners, commercial or private, especially to kayakers. A dozen companies have mass produced ugly, bulky, uncomfortable jackets for years, largely to fulfill Coast Guard requirements on flat-water powerboats. Few boaters wear them and dozens of people are drowned annually because they refuse to use them.

Stearns Manufacturing Company has put style as well as safety into PFD's. It produces a complete line of vests and jackets.

Several other manufacturers have responded to the need for a comfortable, Coast Guard-approveable PFD that people will wear. One sold only 500 PFD's over a 3-year period, but it sold 8,000 in 1976. Others include Gentex Water Safety's Mariner, marketed for the first time in late 1975, and Maravia's Type V life jacket, which was developed primarily with the commercial outfitter in mind.

Many manufacturers of equipment have been in business for years, sometimes in related fields. For example, Coleman makes all kinds of gear and equipment that might be used on a river trip: stoves, lamps, jugs and coolers, sleeping bags and tents. Not all are specifically related to river running, but it is obvious from the number of Coleman items used on river trips that sales are up. New equipment is being introduced on the market every year.

The R. T. French Company, which sells instant potatoes, packaged gravies and sauce mixes, as well as seasonings, and of course mustard, reports that "we have been interested in the growth of camping and boating activities because so many of our products can be used so easily on outdoor vacations. Our response has been largely public relations oriented. We have developed special recipe booklets, made films for television use, and have engaged special personalities to appear on radio and television for the purpose of passing along camping hints and performing live food demonstrations."

Several freeze-dried food manufacturers cater to the river runner. Mountain House of Albany, Oregon, uses a photograph of a Grumman canoe (as well as one of the Voyageur waterproof bags) in one of their mail-order ads and order forms. Another supplier of lightweight foods--the Grover Company of Tempe, Arizona--recently displayed its goods and gave free samples at a meeting of the Western River Guides Association with good results.

A growing list of boats, books, and other river running accessories appear in the catalogs of mail-order houses: Gerry; Laacke & Joys; Eddie Bauer; Bushnell; The Great World of Ecology Sports; The North Face; Holubar; Frostline; Recreational Equipment, Inc.; Waters, Inc. and L. L. Bean.

L. L. Bean reports "We do sell a full line of canoes and inflatables (with a noticeable increase in sales of inflatable canoes). We also have a variety of valuable accessories such as Handyboy pliers, Supertape, waterproof bags, a canoe chair designed to fit over a keelson in an aluminium canoe, plus a multitude of others."

A few years ago waterproof bags were at a premium. Military surplus ammo cans, delousing bags, and the old reliable "Bag, Waterproof, Special Purpose" that came in several sizes were just about all that were readily available.

The Voyageur Enterprises of Shawnee Mission, Kansas, now offers a line of water waterproof bags made of heavy polyethylene fabric. These bags have seen service on canoe trips and commercial rafting expeditions. Today a number of good waterproof bags are available.

Ann Dwyer is the author of "Canoeing Waters of California". She also is an instructor as well as guide and outfitter. She founded a river running equipment outlet and mail-order firm and a company to manufacture waterproof river bags. She reported: "Five years ago there was one canoe rental in Northern California; now there are three. There are 3 stores in the Bay Area that specialize in canoe and kayak equipment; 5 years ago there were none." The first raft trip on the Stanislaus, was made in 1962; 32,000 people floated it in 1972.

A manufacturer in Southern California was asked by an outlet for river running equipment to develop a pump for the inflatable trade. He has now geared up for mass production of a high-quality low-cost pump.

A number of small family businesses have grown into highly successful ventures. Take Payson Kennedy's Nantahala Outdoor Center, for example. He writes, "I got started as a result of realizing that I was spending all my spare time backpacking, climbing, caving, and especially white-water paddling... I decided it would make sense to try to find a job that would enable me to enjoy these activities."

He and his wife bought a place that included a ten-unit motel, a small restaurant, and a gas station. They began renting boats and the auxiliary equipment that goes with river running, and reports that "about half of our restaurant and gas station business and about 90 percent of our motel business is from river runners." The Center has "the most complete selection of white-water equipment in the Southeast"; and it "has become the focal point of white-water activity and instruction in the Southeast". The white-water schools the Center initiated have simply skyrocketed (table 4), and Payson has contributed a chapter on "Raft Technique" to the book ALL-PURPOSE GUIDE TO PADDLING (Great Lakes Living Press).

In the past five years white-water schools have developed all over the country, some of them associated with colleges but many of them run by outfitters or dealers. The University of California, Berkeley, offered a course during the summer of 1976 called "Flow of

Table 4.--*Growth of business at the Nantahala Outdoor Center, Inc.*[1]

Year	Raft passengers	Canoe students	Kayak students	Boat rentals
1972	1,000 (est.)	50	1,050	75
1973	3,833	250	4,083	300
1974	5,804	600	6,404	765
1975	7,841	900	8,741	1,025
1976	11,000 (est.)	1,425	12,425	1,750

[1]Figures supplied by Payson Kennedy, owner and operator

the River: the theory and practice of river running". This included a weekend run down the American River. The University of Utah offered independent study credit in environmental education for a five-day raft trip down Cateract Canyon on the Green River in Canyonlands National Park.

Articles and features on river recreation have been appearing with greater frequency during the past decade. In 1975, an article in *Smithsonian* featured Martin Litton's Grand Canyon dories. *Southern Living*, *WomenSport*, *Outdoor Life*, and *Colorado* all featured river running articles in 1976, and *Sunset* usually runs a feature on river running in the spring issue. *National Wildlife* magazine highlighted recreational use of several wild rivers with a cover story by Dave Sumner. Many might recall the *National Geographic* article by the Craighead brothers several years ago. A movie made in conjunction with that article is still being rerun on TV.

Two river running magazines emerged in mid-1974, *Oar and Paddle* and *Down River*. The former went under in its first year, but the latter is well and thriving with nearly 10,000 subscribers. Initially published bimonthly, it is now a monthly.

Canoe, the official magazine of the American Canoe Association, and *American White-Water*, the journal of the American White-Water Affiliation, reach thousands of river runners six times a year. Between 1971 and 1976, the number of AWA affiliates nearly doubled from 76 to 146.

Consider the ads in those magazines and in others, the full color brochures that are printed for advertising, the river maps and guide books that have been rolling off the presses. A decade ago only Les Jones was producing river maps. Today there are maps for dozens of rivers and stretches of rivers.

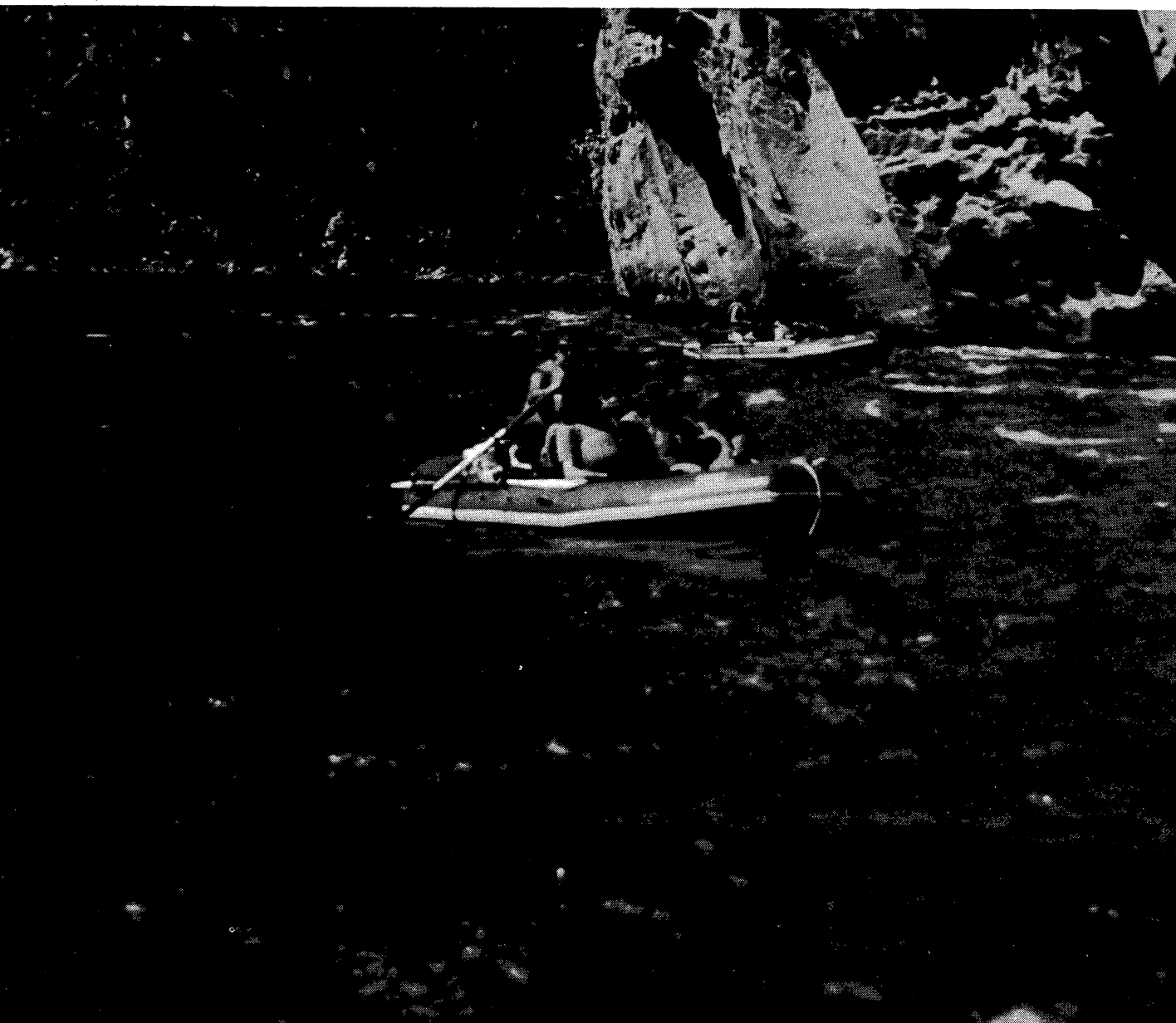
Dr. David W. Lime's "River Recreation Bibliography" (with Earl C. Leatherberry and Dorothy H. Anderson) reflects the amount of the material being published, largely in the past decade. No fewer than four books have been published on the subject since my book *River Running* came out 18 months ago. It sold 5,000 copies in the first 6 months. Bill McGinnis writes that his *Whitewater Rafting* "has sold about 5,000 or 6,000 copies". At least one mail order firm deals only in river running publications. Its list grows annually.

The interest in river recreation continues to grow. No doubt much of that growth has been created by the conscious effort of the outfitters and dealers in river equipment who advertise their services and goods, but word of mouth goes a long ways. So do magazine articles and features on television. The word gets around. No doubt my own books and articles have helped spread the word. I have mixed feelings about the part that I have played. So does long-time Utah outfitter Ken Sleight.

Ken writes philosophically, "I've stayed the same for many years--not much growth, leading my own trips--but my kids are guiding now, and our business has doubled. I can't say I'm happy about the growth of interest, but it had to come and many of us helped it along, sometimes to the detriment of the environment. I feel sad about it and a bit hypocritical. I guess the only thing now is to try to guide the planning and to lessen the impact. But the wilderness is gone--only scenic areas really remain but they are worth working for."

I agree with Ken, but some of the industry's response has had a positive effect: the river trips can teach people to care for the river resource and help lessen the impact. They can give people an appreciation for the river environment that can help save the rivers from other forces.

EVALUATING RIVER RECREATION USE



RIVER LANDSCAPE QUALITY AND ITS ASSESSMENT

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ABSTRACT.--Illustrates the elements of visual assessment of river landscapes: (1) landforms, (2) vegetation patterns, (3) water presence and expression, (4) human use and impacts, (5) other influences. Discusses how to inventory landscapes at large and small scales of application, and with implications of planning and design policies. Points up problems (or dilemmas) of evaluating landscape quality using criteria such as of aesthetics applied to landscape, professional judgment, and perceptual studies.

Recreation quality and river landscape quality presumably go hand in hand. Looking at the whole river landscape and assessing it visually appears to be the best current means of suggesting its quality. Indeed such an overview, accounting for all of a river's connected landscapes, is considerably more practical than implying a measured assessment can be done.

Landscape inventories can summarize the various physical parts seen including landforms, vegetation patterns, stream characteristics, and their relations. Effects, impacts, and artifacts of human use and other influences, such as climate, may be added. A good, general sense of the present scenic resource should emerge from this procedure. It is correct to say we cannot do this now in a quantitative way. If this does become possible, through adequate research, it will be far in the future. Significant baseline information, including qualitative observations on aesthetic character and simple measurements, can, however, be provided. Useful comparisons along one river or between different streams can then be made.

It is not superficial to document the scenic resources of a river. It is an overview that speaks for the integrity or unity of the river landscape. Additionally, the visual landscape record implies, with further research, further linkages to environmental quality and to sociological and psychological perceptions.

ESTHETIC CRITERIA

The landscape is always complex. It is set with variations and details to trap the observer who would make evaluations. Because this paper is based upon an application of esthetic criteria, they are introduced now. A brief review follows, using my interpretations as applied to the landscape (Litton *et al.* 1974).

Basic esthetic criteria are unity, variety, and vividness (Pepper 1937). Each criterion is complex by itself, but when esthetic merit is present, all three are necessarily in evidence. Paradoxically, the criteria are in potential conflict; yet their balance is essential. Unity is that characteristic whereby all parts are joined into a single and harmonious whole. Total, dominant, or an apparent structure is made up of subordinate parts. Variety indicates the complexity of different and numerous parts--"richness" or "diversity" carry the same idea. Mere presence of various parts, however, is no measure of quality. Vividness is the characteristic that gives a strong visual impression. It indicates relations or combinations that are conspicuous. Contrast is a primary expression; another is more subtle: compositional reinforcement from repeated groupings or from somewhat similar aggregations.

Vivid landscapes and those with greater richness are usually equated to higher quality, unity being present. Perhaps these

are only the easiest to recognize. Placid or ordinary landscapes also have levels of quality, expecially important because they are compared to those called vivid. Regional significance and areal unity enter here, such as the unity--beginning to end--of a free flowing river and the amenity it provides to a region.

ELEMENTS OF LANDSCAPE ANALYSIS

Study of water and its attendant landscape pose difficult choices of what to consider, what to omit. It is clear enough, however, that an inventory and assessment of river landscape cannot look at the river alone. The physical landscape and relations readily seen are chosen here as limitations, following principles and restrictions used in WATER AND LANDSCAPE (Litton *et al.* 1974). Focus is also directed to rural rather than urban situations.

The three most tangible parts of the native landscape chosen for analysis are landforms, vegetation patterns, and water presence and expression. Other natural influences need recognition as they assume importance, including visual effects of climate, seasonal change, topographic orientation, and relative elevation. Finally, the evidence of human use and impacts will show, for better or for worse, and is added to the list. Omitted is what, for some, must be the most important part of recreation and the river landscape: animals, birds, and fish occupying their particular niches. The omission recognizes the subject as worthy of consideration in its own right but is also based upon the transitory, fluctuating character of animal-landscape relations. Analytical elements chosen seem, within the bounds of usual human experience, relatively enduring despite recognition that the landscape is indeed dynamic.

Landforms

Landforms, as related to streams, are essentially containers--envelopes of space. I have also called this the "enclosed landscape" (Litton 1968). The degree of enclosure may be marked, as seen in the Yosemite Valley, or subtle, like the flattened saucer made by the Platte wandering over the High Plains. The steeper and higher enclosure makes a more vivid landscape (fig. 1). In comparative analyses, it is comprehensive to think of landform enclosure as a continuum from very steep and high with narrow defile to flattened and low with broad bottom. Simplifying, a set of three landform categories, mountainous, hilly, and flat plain (and plateau) may serve as inventory elements (fig. 2).

A regional inventory interpretation for differing types of landforms with representative streams might reveal that only hill-like enclosures existed. Then a more elaborate set of hill categories would be called for, defining differences of scale, relative height, side slopes, and ridge contours. Linton (1968), for example, in his scenic evaluation of Scotland identifies six landform categories. A somewhat similar study of the Northeastern United States (Res. Planning and Design Assoc., Inc. 1967) identifies 7 categories but with the additional detail of 23 subordinate landform types. And if a detailed inventory of only a small stream is made, landform definitions need to reflect the local variations.

Landforms are the landscapes's backbone, but apart from enclosure, certain parts may also be dominant visual features. Four conditions produce such features, applying both to single or grouped peaks. They are: (1) having isolation, (2) having dominant scale--being materially larger in relative size, (3) having contrasting skyline or silhouette, (4) having contrasting, conspicuous surface pattern. El Capitan is an obvious feature of the extraordinary Yosemite Valley enclosure, but bluffs of the Des Moines River are also significant features of that particular river landscape.

Vegetation Patterns

In the broad view, vegetation patterns emerge from the mixture of general cover types: forest, woodland, scrub/chaparral, grassland, and barren areas. Amounts of different vegetation types, their location relative to one another, position upon the terrain, and linkage to streams play a variety of visual roles in the landscape. Dominance of one kind of cover may be the typical expectation: Appalachian hardwoods, Cascade conifers, Dakotas' grassland, or sage-scrub of the Southwest. This implies a degree of monotony. The whole overlay of plants tends to function as a unifying blanket while at the same time being made up of many and complex individuals (fig. 3). Closer examination of the plant mosaic, especially related to landforms and rivers, will reveal tangible ways it enlivens what we see.

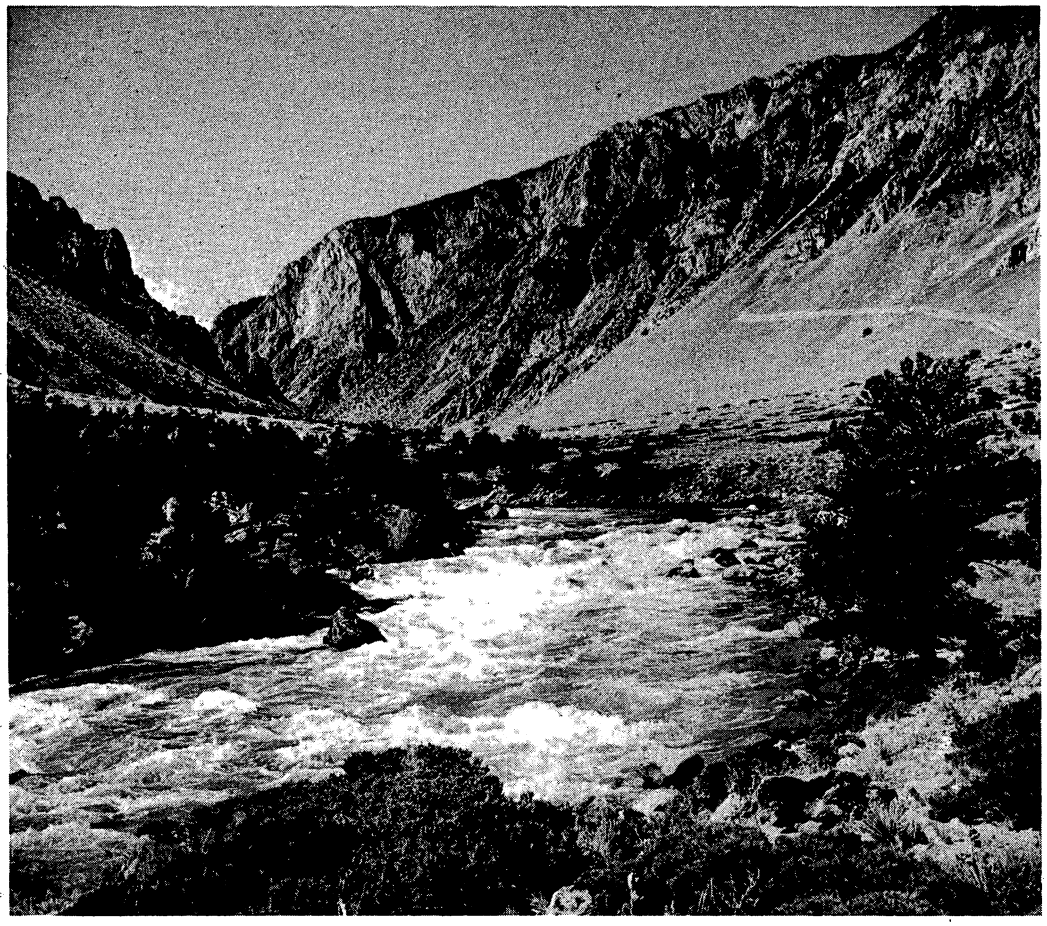

Figure 1.--*White water feature within striking mountainous enclosure with supporting conifers in the riparian zone.*

Looking at a sample of enclosing landforms of the Rocky Mountains, we would expect lodgepole pine or spruce-fir to occupy intermediate slopes, sometimes continuously, sometimes in patches and stringers. Grass will likely make up the patches, and aspen stringers on more moist sites join those of pine. Above, steep barren surfaces or those scant with forbs add an earth color to the greens. In the bottom, a sedge meadow, perhaps with aspen rim and oxbow concentrations of gray willow, add to a vivid yet calm mosaic. Differing amounts and shapes of cover with contrasting textures and colors mix together: light smooth grass, dark upright conifers, intermediate earth tones, and greens of riparian hardwoods.

Although the vegetation patterns of the Rocky Mountains undoubtedly provide strong visual images, some local expression will be apparent wherever we go. The riparian zone, its edges joining the river and margins of vegetation on higher ground, is the special place most apt to contribute distinction. The meandering string of cottonwoods along the Platte provides more enclosure than the land itself and can be more visually dominant than the water it follows. Or birch and granite margins of streams connecting Wisconsin lakes, backed by spruce, are the more conspicuous parts of that plant pattern.

Plants and cover patterns in the river landscape are usually subordinate to the basic landform and water elements they join. Their visual role can, however, be strong and perhaps dominating, occasionally becoming distinct features or functioning to define space. Seasons, too, can give the plant mosiac its time of dominance.

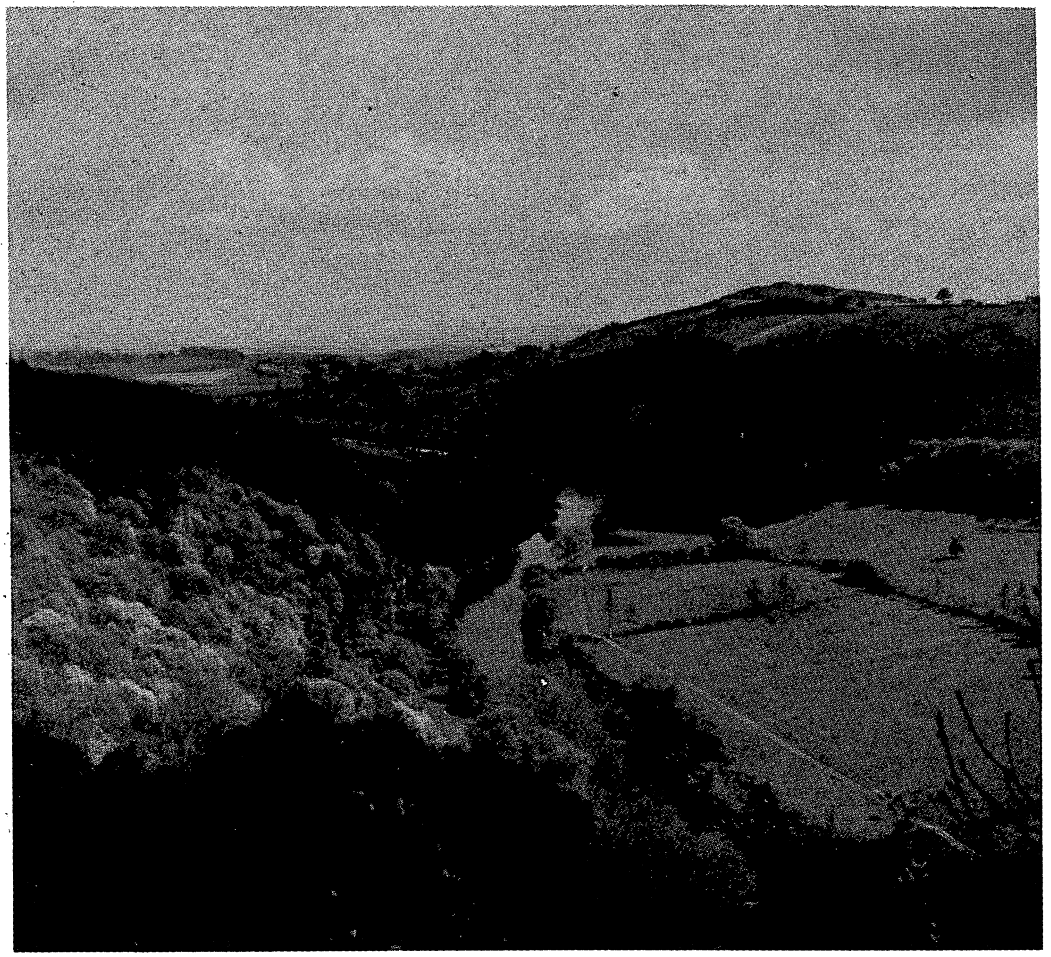

Figure 2.--*Sinuous, quiet stream, visually dominant and continous through junction of contrasting steep hill and flat enclosures, significant farmland pattern.*

Water Presence and Expression

Most people living inland expect their surroundings to be primarily dry land, not water. Rivers are relatively scarce but perhaps clearly so only in arid places. Minnesota calls itself "the Land of Lakes," and Scotland is well known for its lochs. Similar claims do not seem to have been made for places calling themselves "lands of rivers". The presence of rivers does suggest a special source of landscape amenity, even while occupying a proportionally small bit of the whole terrain face. Water in the landscape tends to be dominant because of its visibility, its movement, reflections, and color, its consequent contrasts to adjacent earth surfaces. Loren Eisley (1959) suggests other complex and deep seated values: "If there is magic on this planet, it is contained in water."

River patterns and linear expressions of water, particularly as they may be related to landform enclosures, provide initial and larger scale means of visual analysis. Four patterns, four paths of water across the land, are braids, meanders, sinuous, and straight reaches (Leopold and Wolman 1957). An area or unit of relatively consistent landform enclosure may be accompanied by a single reasonably consistent reach of stream (fig. 3); there can be as readily a combination of dissimilar, contrasting reaches. Leopold (1962) has emphasized the great variability of rivers and their patterns, despite their "--pervasive unity--".

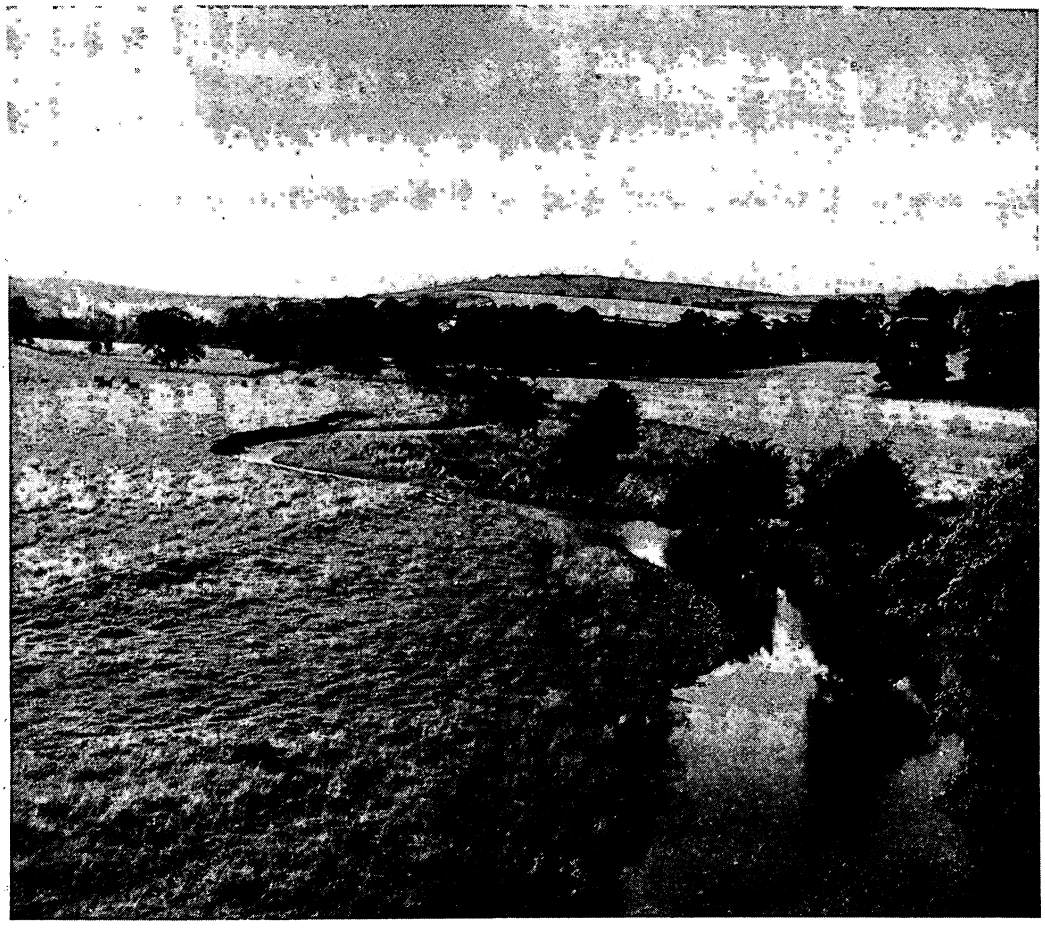

Figure 3.--*Reflective meandering stream in broad grassland bottom, gentle slope enclosure with grass cover and farm woods.*

More detailed visual definitions--secondary patterns--come from a stream's differential movement within path patterns. White water, the roaring, fast expressions of vertical falls and steep gradients, is the most distinctive water element (fig. 1). Quiet, placid, and slow moving water, dark in color, occupies the other end of the landscape expression (fig. 3). Between these extremes are all the other kinds of movement: segments that are swift, boiling, swirling, turbulent, or rapids and riffles. Degrees of disturbance and combinations are infinite, calling for careful observation and astute judgment as to landscape effect.

After path pattern identification, falls, cascades, and rapids can be sorted out as dominant features. A still, deep pool can also be a feature, apparent for contrasts of greater disturbance above and below it. Clean-cut features may be absent. Certain combinations of segments with differing kinds of movement and lengths are, however, specific visual expressions of specific streams. Meander sets, for example, may be joined by riffles or long straight runs by simple curves.

Beyond the river, linking land and water, riparian vegetation can be noted for vividness of contrast or simple continuity and unity. Sinuous or meander stretches are apt to be close crowded by willow or other broadleaf trees. A swift reach can force trees to stand back, tolerating only minor sandbar plants nearby. Each combination adds to or subtracts from the visual image of the water element in the landscape.

Human Use and Impacts

Human use can produce patterns that are comfortable with the river landscape. Agriculture is one use apt to fit this way, whether along the Dee in Scotland or in northeastern Pennsylvania (fig. 2). Opposite effects can result with unfortunate ease, giving visual impacts of variable magnitude. Mining with unreclaimed leavings or poorly designed recreation facilities, especially near water, have high potential for landscape degradation. It is, nonetheless, a mistake to presume that landscapes of higher quality are only related to their degree of naturalness. Human use, reflecting good planning, design, and maintenance, can complement the landscape in desirable, satisfying ways.

Agricultural patterns are primarily from changes in vegetative cover, frequently geometric, frequently more open than what was replaced. Topography is seldom altered other than in minor ways. Because farming depends upon maintenance of plant covers, it tends to fit surrounding vegetation. Occupation of flatter rather than steeper slopes reduces the visibility of change.

Forestry has a wide range of potentials for fitting the landscape as well as periodic disruption (fig. 4). Selection cutting makes subtle visual modifications; clearcutting is--or can be--obvious. Steeper upland slopes are normal sites, places where changes are more conspicuous as compared to flatter ground. Apart from roads, topography is little altered. Geometric patterns are typical, the fit to landscape can be good, bad, or indifferent. Good forestry does aim to maintain full cover on suitable sites; the activity is most apparent when cover is absent.

Mining and quarrying are apt to produce strong visual contrasts and accompanying impacts. Topographic and grading alterations are characteristic. Geometric handling of leavings, with form and color contrasts, are obvious. Vegetation is cleared and replacement may be exceedingly difficult because of inhospitable conditions.

Recreation facilities usually occupy only small parts of the river landscape, but you can be sure that interesting places are involved where people wish to be. Structures about the waters' edge occupy a most vivid part of the landscape, the land-water junction. Back shore areas are less sensitive. Well conceived design of facilities is essential here, following after suitable planning for appropriate uses and locations (Litton *et al.* 1974). Proper maintenance is also critical for such sites.

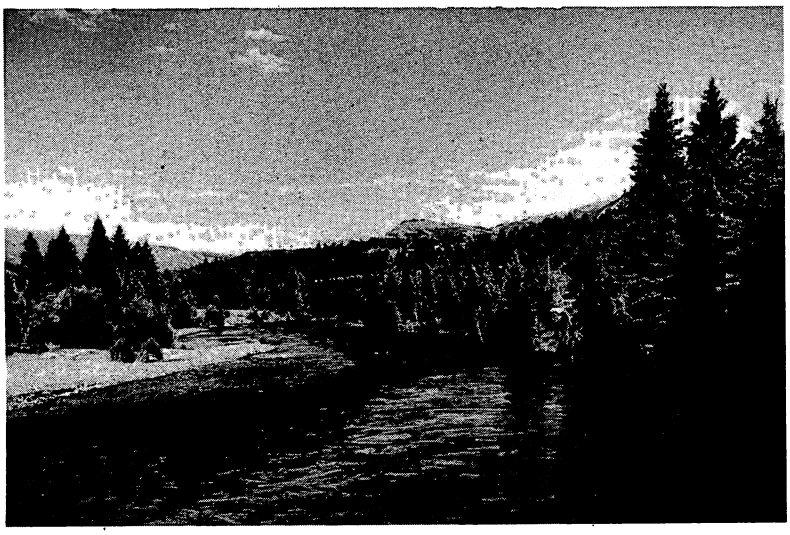

Figure 4.--*Straight, swift stream reach within gentle slope enclosure, landforms visually strengthened by continuous conifer forest.*

This paper cannot address the many ways in which well planned and designed human use may best fit the native landscape. It is possible, however, to summarize certain factors that have to do with the landscapes' visual vulnerability to use impacts (Litton 1974). Skylines and waterlines are highly vulnerable places; areas amid surface slopes are less so. Landscape features and other compositional types are sensitive to change (Litton 1968). Grading and associated soil color contrasts are more obvious than vegetation manipulations. Complex plant mosaics offer more camouflage to alterations than do pure stands of plants. The scale of changes needs to be appropriate to the surroundings. Small changes can be odious, larger ones can actually be more suitable and fitting.

Other Influences

Climate, seasonal change, topographic orientation, and relative elevation are selected examples of other influences affecting landform, vegetation, and water, and the way the landscape will look. Regional considerations will result in rejecting certain influences and substituting others.

Climate, marked by much precipitation or little, can result in frequently encountered perennial streams or their relative rarity. Vegetation follows suit--lushness or sparsity attended by entirely different textures and colors. Within the general climate of a broad area, microclimates are at the heart of landscape variations, particularly through soils and associated plants.

Seasonal changes bring profound changes to some landscapes, little to others. The extensive bright foliage colors of the Appalachian autumn have no counterpart in the West. Or, as with microclimates, local pockets of variation can set visual patterns. Even in places where vegetation seems to respond little to time of year, shifting occupancy of animal and bird life can bring delicate, perhaps elusive, landscape modifications.

Topographic orientations can be associated with several different visual effects. One, in the northern hemisphere, is that southerly slopes have greater visibility than do northerly ones through receiving more direct sunlight and in greater amounts. Another is the response of vegetation, again with climatic linkages. Grass-forest patterns of the West or conifer-hardwood patterns of the East are partially traced to orientation contrasts.

Elevational differences, if sufficient, can be related to many changes of landform, vegetation, and water expression. Tracing the Missouri from Rocky Mountain origins and across the Great Plains is accompanied by overwhelming changes seen in the landscape. Riverscapes within the bounds of single States, say Michigan or Nebraska, demonstrate relative consistency and modest variations.

VISUAL INVENTORIES

The scales at which landscape inventories are made depend upon purpose, whether to serve broad area planning or discrete area design and management. One generalizes, the other provides a desired level of detail. For our purposes, inventories are the base from which river landscape quality comparisons may be made.

Landscape inventory methods depend heavily upon visual kinds of data. These are topographic maps, high altitude imagery, conventional air photos, and field work. For authenticity and tangibility, field observations with resultant documentation are absolutely essential. These include mapping, low-level air and ground photography, and sketches.

Inventory types are Landscape Units, Setting Units, and Waterscape Units (Litton *et al.* 1974). These constitute recognizable visual entities from larger to smaller scale and serve as models adopted here.

Larger Scale Application

The Landscape Unit is based upon regional similarities (or consistencies) of terrain, vegetation, and water elements. Despite internal variations, we have--crudely put--a "homogeneous landscape". Boundary limits occur as consistencies disappear. The Unit is large, never seen all at one time. Memory plays a part. Low-level air observation and photography are vital aids. High altitude imagery (ERTS, Skylab) are appropriate tools as are smaller scale topographic maps at 1:1,000,000 to 1:250,000 scales.

The value of the Landscape Unit is its focus on the broader landscape and an overall sense of regional landscape quality. The evaluation of individual river landscapes and planning for them can be appraised in a regional context.

Smaller Scale Applications

The Setting Unit is essentially defined by its visual corridor--the envelope of space referred to earlier. Its limits may be plotted on a map in the field or by computer graphics (Amidon and Elsner 1968). It is a segment of one river landscape with reasonably consistent or recognizably similar relations of topography, water, and plants. This unit is not necessarily visible all at one time--but it may be. Intermediate in size, contour maps of 1:250,000 to 1:24,000 suit the units' study. Low-level air photography is highly desirable, and ground photography is essential.

Usefulness of the Setting Unit lies in its tangibility. Characterized by middle distance views, a set of these Units provides a means for comparing landscape qualities along a single river. Settings can assure that design and resource management respond to locality.

The Waterscape Unit focuses upon the river, water patterns and expression, and the immediate riparian zone. It can be part of the stream within a Setting Unit but may extend beyond as well as be coincident with the setting. Topographic maps at 1:62,500 to 1:24,000 and larger scale are appropriate. Ground studies and photography are necessary. Design and resource management at site scale and as intimately related to stream character is served by this Unit.

PROBLEMS OF ASSESSMENT

Criteria, semantics, limited research, and resource-management needs pose problems in landscape assessment. Yet, interesting opportunities accompany the problems.

Criteria sweep together a set of dilemmas. There are no universal, complete, or wholly agreed-upon standards of judgment. Probably there never will be. Criteria may be esthetic, physical, psychological, or sociological--or combinations of these. They come from professional studies by geologists, engineers, landscape architects, geographers, and planners as well as from scientific research by economists, geomorphologists, geographers, psychologists, and sociologists. Much research looks for responses and preferences from lay insight. Agencies want and need to know what the public thinks--more sources of judgment. Administrative needs temper criteria and add certain of their own.

Semantics enter landscape evaluation with the mixture of disciplines that work with it. This does, of course, make for thoughtful interchange and brings different professions into contact. There is no standardized vocabulary for landscape definition although recent USDA Forest Service publications move in this direction (USDA Forest Service 1973a, Schwartz *et al.* 1976). Everyday language is the basic tool. Understandings vary and definitions need to be provided. Even so, my definition of "landscape feature" easily goes astray. And the "sensitivity levels" used by the USDA Forest Service and the Bureau of Land Management are different, yet related. The landscape's very complexity must also contribute to the problem of words used in its behalf.

Research in landscape analytics, what little there is of it, is new. Most of it has appeared in the past 10 years. Related recreation and leisure-time research is not particularly tied to identifiable landscape characteristics but may give useful insight to scenic values. Most research is regional. Boster's (1973) study of Arizona ponderosa pine forests and Zube's (1974) study of Connecticut River scenic resources are primarily valid for those areas. Caution does not allow casual interpretations for use elsewhere. Wilderness, agricultural landscapes, and highly variable wildlands are backgrounds for research; it follows that conclusions must vary accordingly. Much remains to be studied.

Resource management has needed landscape evaluation techniques in advance of adequate research. This has at least put research to test and administrative means of application have also been developing. Understandably, administration would like quantitative evaluations of landscapes and potential impacts but must settle now for comparative devices. One result has been the use of arbitrary numbers to represent

judgments about landscape quality or sensitivity to visual change. Such numbers can be no better than the criteria behind them nor the professional application made of them. Federal guidelines for visual landscape management in the USDA Forest Service (USDA Forest Service 1974a) are used in drastically different situations. Regional interpretations are necessary. What is good for Alaska has little to do with New Mexico. It is another task, welcome no doubt, for the landscape architect. Management needs, nonetheless, do suggest a healthy climate for research.

CONCLUSION

Enough unresolved problems and opportunities in landscape assessment research and management exist so that complacency should not be a threat. The procedure given here has emphasized visual documentation of the river landscape's continuity. This is a proper context within which quality may be judged. Evaluation concerned only with high quality segments of landscape misses the essence of the problem. The goal, both of evaluation and later management, needs to be maintenance of the river landscape's integrity.

IMPACTS OF RIVER RECREATION USE ON STREAMBANK SOILS AND VEGETATION — STATE-OF-THE-KNOWLEDGE

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ABSTRACT.--Various means of assessing recreational impacts on streamside soils and vegetation have been employed to provide data to support and implement management decisions. Paired or before-and-after use plots and transects have generally been used to measure changes in the specific composition and density of vegetation, soil compaction, erosion, available moisture, surface soil cover, etc. Changes in the soil and vegetation have generally been related to intensity of use. Past research in this area has usually been confounded by several problems. Among the most critical needs are: (1) selection of sampling points or sites to yield impact data representing an entire riverway; (2) the random location of plots, points, and transects within a selected area; (3) the location of suitable before-and-after or used-and-unused sites for control; (4) the selection and measurement of the most important and most user-sensitive soil and vegetation parameters; and (5) the measurement of visitor use and its correlation with impact data. Management decisions based on this research must be limited by how well the investigator has dealt with these problems.

To agencies charged with providing and maintaining high quality recreational opportunities for ever-increasing numbers of people, the illusive carrying capacity concept is of more than academic interest. Resource managers are increasingly aware of the need to match and even regulate user numbers to coincide with the ability of the natural attraction to hold up under the impact of sustained recreational pressures. Managers can no longer live with the idea that it is their responsibility to provide a steady flow of recreational opportunities of optimum quality for an unlimited public, regardless of the cost. Each site has a level of use beyond which the resource characteristics or the quality of experience are adversely and permanently changed. How many people using a particular site for a set of special purposes over what period of time will finally degrade the resource to a level that is unacceptable to the recreationist?

Research into carrying capacity has generally taken two distinctly different routes depending, it seems, on the training and the bent of the investigators. Most studies have been sociological and have attempted to assess public attitudes toward various levels of use, resource deterioration, or both. This group of studies has attempted to answer the question: what, in general, is the maximum tolerable level beyond which the quality of experiences declines to an unacceptable point? This tolerance level varies among recreationists and, indeed, among managers so that determining just what is unacceptable in each situation becomes difficult. The other research route is more resource-oriented and has attempted to quantify the changes brought about in specific environmental factors by various levels and types of recreational use. In the resource-oriented studies researchers have almost universally directed their attention to the most noticeable changes that generally occur to the

soil and vegetation as a function of visitor traffic and associated activities. Both routes of study can yield useful management information.

The balance of this paper is devoted to a review and discussion of some of this past research, particularly as it applies to river recreation. Research approaches will be outlined and a summary of the principal findings will be presented. Finally, some discussion will be devoted to the interpretation and application of the results of these studies.

RESEARCH OBJECTIVE AND METHODS

There are basically three approaches to measuring recreation-induced changes in the soil and vegetation. By far, the most desirable is the before-after method; i.e., obtain soil and vegetation data prior to opening up an area and then inventory the area after some period of use. A convenient alternative to this method is to establish a set of sampling plots and transects in the used areas and locate a similar but undisturbed area nearby for an identical set of control plots. Third, recreation areas may be surveyed, without employing controls, to obtain impact camparisons between different types and intensities of use, frequently on areas exhibiting different native soil and vegetation characteristics. There have been variations. Each approach yields useful information if the results are properly interpreted.

Soils

Soil compaction from visitor traffic has been the most frequently inventoried variable. La Page (1967), Magill (1970), McCool (1969), and Merriam and Smith (1974) used penetrometers while Frissell and Duncan (1965), Meinecke (1928) and Ripley (1962) used infiltration or hydraulic conductivity measurements as an estimate of this variable. Dotzenko *et al.* (1967), Lutz (1945), and Settergren and Cole (1970) employed gravimetric techniques. Settergren and Cole (1970), and Sutton[1] used a portable nuclear gauge to determine compaction.

Changes in other soil characteristics have also been investigated. Root exposure and soil profile truncation that are direct results of the removal of ground cover vegetation, soil compaction, and sheet erosion, were studied by Cole[2] and James and Ripley (1963a). Organic matter, bulk density, moisture content, and other common soil parameters have been measured by Dotzenko *et al.* (1967), Merriam and Smith (1974), and Settergren and Cole (1970). Hansen (1975) studied the extent and cause of streambank erosion along the Pine River, a heavily canoed stream in Michigan.

Vegetation

A number of studies have examined changes occurring in the native tree and ground cover vegetation as a result of recreational use. The common approach has been to employ a system of plots of varying size and configuration for inventorying the tree cover. Point sampling transects and quadrats have been used to sample ground cover and the lesser vegetation. Where research objectives permitted a longer study duration, permanent plots and transects have been established to periodically monitor the seasonal changes and, frequently, intensity of use.

Cole[2], de Vos and Bailey (1970), Echelberger (1971), Frissell and Duncan (1965), Herrington and Beardsley (1970), Hinds (1976), Magill (1970), Magill and Nord (1963), Ripley (1962), and Sutton[1] have investigated various aspects of tree mortality (sometimes by species and age class) and decline in apparent vigor resulting from mechanical injury, heavy user traffic, soil compaction, and root kill.

The impact of concentrated recreational activity on the ground cover, and ground cover vegetation density and species composition has been studied by Cole,[2] de Vos and Bailey (1970), Frissell and Duncan (1965), Herrington and Beardsley (1970), La Page (1967), Magill and Nord (1963), and Ripley (1962).

Finally, Beardsley and Wagar (1971)

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[1]*Sutton, Steven W. The impact of floaters on the Ozark National Scenic Riverways. Unpublished Master's Thesis. 152 p. School of Forestry, Fisheries, and Wildlife, University of Missouri, Columbia.*

[2]*Cole, Dennis Michael. Recreational impact on forest sites in the Missouri Ozarks. Unpublished Master's Thesis. 103 p. School of Forestry, Fisheries, and Wildlife, University of Missouri, Columbia.*

related amounts of herbaceous ground cover and the growth rates of trees to various combinations of three cultural treatments (watering, fertilizing, seeding to grass and clover), to visitor use, and to selected site factors. Thus, they test vegetation management as a means to maintain site quality.

SELECTED RESEARCH RESULTS

The impact of concentrated recreational activity on the various soil and vegetation parameters examined has varied with: (1) the type, intensity, and duration of use; (2) the nature of the existing environmental factors; and (3) the type of vegetation management. Some of the general trends are enumerated below. Where a study has provided information specifically on river recreation impacts or results that may be directly applied to the management of our riparian zones for recreation, some expanded coverage is given.

Changes in Soil Characteristics

The most common recreational impacts on the soil include the following:

1. Surface compaction and bulk density increased. The finer-textured soils display the greatest degree of compaction. Sutton[1], working along the Current River in Missouri, noted that it was virtually impossible to alter the density and structure of the gravel and sandbar soils at stopover points along the river frequently used by floaters. He further observed that, with the possible exception of occasional mechanical injury done to the young willow vegetation by visitors, these sites appeared to be indestructible.

2. The greatest degree of soil compaction occurs immediately following the opening of a new area. Thereafter, surface soil density stabilizes.

3. With surface soil compaction and the reduction in protective ground cover vegetation (noted below), sheet erosion, soil profile truncation, and root exposure often result. Neither Hansen (1975) nor Sutton[1] could attribute streambank erosion simply to canoe traffic on the riverways studied. The erosion that was measured was usually linked to some nonfloating activity. On the Current River in Missouri it was the free vehicle access to the water's edge that frequently led to serious erosion problems.

4. Infiltration and hydraulic conductivity are reduced.

5. Soil organic matter is reduced.

6. Because of the effect of compaction on infiltration and soil storage, soil-moisture content and availability may be seasonally low.

7. A few scientists, including La Page (1962) and Meinecke (1928), found that frost action during the winter months, when there is little or no recreational use, loosened the compacted surface soil aggregates to some extent.

Vegetational Deterioration and Adjustment

The response of the native vegetation to concentrated recreational use may result from direct physical or mechanical injury or may reflect physiologic and morphologic adjustments made by the plants to soil compaction, lower soil moisture, etc. Among the more commonly reported observations are:

1. Mechanical injury to most trees on heavily used areas is common. Although disease in wounded trees is a frequent byproduct, mortality--except in extreme cases and with certain particularly susceptible species--is seldom inevitable.

2. Total elimination of trees in the younger age classes, i.e., the seedlings and young saplings, may result from seedbed compaction and mechanical injury.

3. A decline in tree vigor frequently signaled by "stagheading" may be associated with soil compaction and root dieback.

4. One of the first environmental indicators of heavy recreational impact is a reduction in the native ground cover both in amount and the number of species represented.

5. A number of investigators have observed that, following the first few seasons where the ground cover is reduced by recreation traffic to some low point, there is a recovery or adjustment in the vegeta-

tion (de Vos and Bailey 1970, Frissell and Duncan 1965, La Page 1967, Magill 1970, and Sutton[1]). There is a shift, according to La Page (1967) and Sutton[1] toward more recreation-tolerant species. However, the total number of species is reduced. Bluegrass (*Poa pratensis*) and path rush (*Juncus tennis*) were the most commonly found species on heavily used areas along the Current and Jacks Fork Rivers in the Ozark National Scenic Riverways by Sutton.[1] The rush is often an early indicator of heavy traffic along pathways. The grasses generally appear to be more resistant to trampling than the other, more herbaceous, ground cover species.

6. Beardsley and Wagar (1971) demonstrated that, with new areas, careful site selection and campground design coupled with reinforcement of heavy-use areas can substantially reduce or eliminate deterioration of ground cover vegetation. They also found that, under certain conditions, watering, fertilizing, and seeding to durable species can effectively increase ground cover on recreation sites.

DISCUSSION

There is little question that research has demonstrated that concentrated recreation will alter the soil and vegetation to some degree and that directed management can aid in counteracting adverse impacts. However, recognizing these effects is only a beginning. Correctly interpreting the research, i.e., placing things in the proper perspective; relating these results to some assessment of the intensity of use; and applying this information in a field situation require considerable additional management expertise.

INTERPRETING IMPACT RESEARCH

Recreationists do not "use" the entire site uniformly. Generally, they tend to congregate at and move along specific sites and routes; i.e., picnic benches, barbeques, boat launches, sanitary facilities, scenic attractions, and the straight-line paths between. The impact of use on the soil and vegetation is greatest, if not exclusively, on these sites of concentration. Researchers tend to sample use-related soil and vegetation changes on these obviously impacted locations. Research results tend to answer the question, "What is the magnitude of change or alteration on impacted sites?" This tends to generate data that will almost certainly indicate that recreational use adversely alters the soil and natural vegetation. This approach frequently avoids the question of how much of the *total* soil and vegetation resource is adversely impacted. Moreover, with river recreation, these impacted areas may be sparsely scattered along many miles of waterway.

Changes in the streamside soils and vegetation could be easily documented in a study of a number of sites along the Current and Jacks Fork Rivers in the Ozark National Scenic Riverways.[1] All sites selected for study initially displayed some signs of use. In relation to the entire 140 miles of rivers in the system, the impacted areas, the developed landings and access points, campgrounds, convenient gravel bars, caves, springs, and other attractions, represented only a very small percentage of the total resource.

It is the agency manager's responsibility to place things in perspective. He must evaluate localized adverse impact in terms of the total area. Furthermore, the importance he assigns to problems of site deterioration rests not only on how much but also on where specifically the impacts are occurring.

Relating Recreational Impact to Use

Since recreation management agencies must consider the cause as well as the effect of these impacts, they must attempt to relate changes in the various soil and vegetation parameters to the number of visitors and the type of use. Only a limited amount of research has been done on this aspect. La Page (1967) computed the regression relation between percent cover loss and camper days. Merriam and Smith (1974) calculated impact stage values from inventory data that included measures of bare soil, loss of ground vegetation, soil compaction, dead trees or trees with exposed roots, and increase in site size. The inventory data were obtained from newly developed campsites in the Boundary Waters Canoe Area. They related the impact stage values to visitor days, again by way of regression analysis. Some researchers have found that, following an initial change in the soil and vegetation, very little additional impact results with increased use (Frissel and Duncan 1965).

More studies incorporating an assessment of the cause, (a quantification and classification of users) as well as the effect, (a measurement of the changes in the natural environment) are needed to provide the tools for the resource manager to fully understand and cope with the problem. If use regulation or, possibly, rationing are to be used as management tools to protect the soil and vegetation resources, this relation must be well established.

Application

Applying impact research goes beyond the documentation of adverse soil and vegetation changes. Recreation managers must also consider how the public perceives the deterioration in terms of the total resource. As pointed out, impact may be concentrated at a relatively few locations scattered along the riverway. Visitors will probably continue to concentrate on these same areas for one reason or another and bypass the zones between. The bulk of the shoreline is seen from the river and never touched and, for many, the quality of the whole experience will remain high. For others the soil and vegetation deterioration will leave the greatest lasting impression. It is important that sociological considerations such as visitor perception be taken into account in assessing the importance of impact and apportioning the management dollar.

CONCLUSIONS

Concentrated recreational activity along our riverways, as in other natural outdoor settings, frequently produces adverse changes in the soil and vegetation. Considerable expertise is needed in the interpretation and application of impact research in a management situation. Both ecological and sociological considerations must be taken into account in evaluating the carrying capacity of a riverway for recreation.

ECONOMIC EVALUATION OF ALTERNATIVE USES OF RIVERS

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ABSTRACT.--Reviews the benefit-cost analysis decision criterion and the concept of opportunity cost. Outlines how to measure recreational benefits using the Hotelling-Clawson-Knetsch model. Discusses data and research needs for using benefit-cost analysis as a tool for making recreational river management decisions. Concludes that the ability to use benefit-cost analysis in river management exists and should be exercised.

The management of rivers and river segments requires allocative decisions regarding the uses to be made of them. Because these are primarily public decisions, benefit-cost analysis is the appropriate economic tool to guide the manager in making them. The purpose of this paper is to argue that benefit-cost analysis is also a useful tool for making river management decisions.

Conceptually, benefit-cost analysis is concerned primarily with economic efficiency and not with income distribution questions. As a social decision-making concept, then, it is incomplete and should be considered as just one element in the public decision-making process, albeit a very useful and important element.

Empirical benefit-cost analyses have been widely criticized. The primary criticisms have resulted from improper application of the economic model and incomplete accounting of costs and benefits. Improper application of the economic model can be avoided by education of analysts and by public vigilance to assure the economic validity of analyses. Incomplete accounting of costs and benefits may occur because of a desire to sell a project, negligence, or the inability to measure all costs and benefits in commensurable units.

Although benefit-cost analysis techniques may not be perfect, they are good and getting better. When Maurice Chevalier was asked how he viewed old age he replied: "Well, there is quite a lot wrong with it, but it isn't so bad when you consider the alternative".

The alternative to using benefit-cost analysis in public recreation planning is to continue as we have. That is, justifying decisions and budget requests on the grounds that recreation is "good" (and more is always better) and/or the rates of activity and area participation are increasing. Budget decision-makers will not settle for such justifications, nor should they. Benefit-cost analysis forces the definition of objectives and alternatives and the weighing of relative merit that budget decision-makers need and are looking for.

The inability to measure benefits is the most frequent criticism of benefit-cost analysis as a decision-making tool for efficiently allocating recreational resources. But our ability to make such measurements has increased substantially, and we should start making use of that increased ability. The measurement techniques, however, require data that are usually not available without undertaking a site specific study. The question is whether the decisions are important

enough to bear the expense of such studies. This symposium is evidence in support of the position that they are. Furthermore, the data requirements do not appear to be particularly burdensome when compared to existing and proposed studies of wild, scenic, and recreational rivers (Lime 1975a).

SOME ECONOMIC CONCEPTS

Benefit-cost analysis is a technique that can be used to aid resource allocation decision-making. Because the concern is with public decisions, the appropriate criterion for choosing among alternatives is the maximization of net social benefits (Herfindahl and Kneese 1974). The analysis, ignoring complicating factors, is one of objectively examining the costs and benefits of each alternative and choosing the alternative with the largest present net benefits. The decision criterion determines the appropriate measure of benefits and the concept of opportunity cost defines the costs that should be included.

Decision Criterion

The net benefits of an alternative will be maximized at the scale for which marginal benefits equal marginal costs. The demand function for the use of a natural environment expresses the marginal benefits of various amounts of use. The areas under the demand function for various quantities measure the total benefits of each quantity of use (fig. 1). Similarly, areas under the marginal cost curve measure the total costs of varying amounts of use (fig. 2). That level of use at which marginal benefits equal marginal costs will be the level that maximizes the difference between total benefits and total costs, net benefits (fig. 3). The maximum net benefits of each alternative are then compared and the alternative with the largest net benefits is chosen (Herfindahl and Kneese 1974).

The approach outlined is equivalent to maximizing the sum of all consumers' surpluses and all producers' surpluses (Kelso 1966). Further, the resulting allocation is equivalent to that which would result in a competitive market (Herfindahl and Kneese 1974).

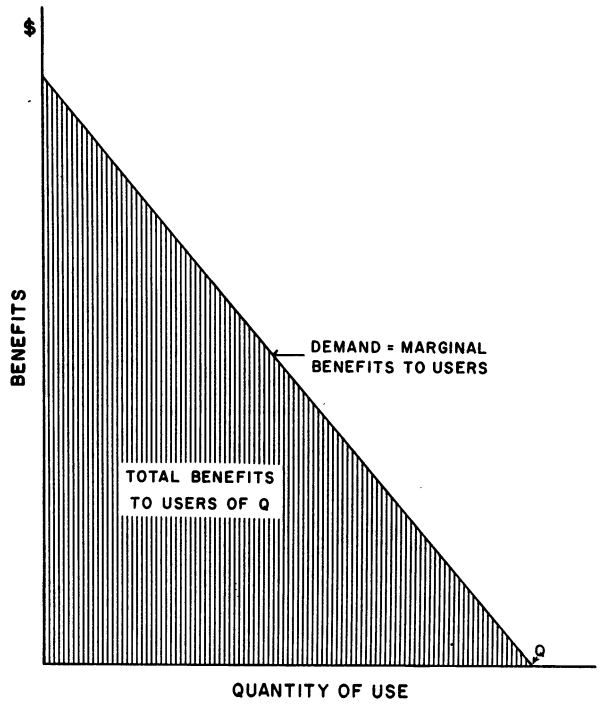

Figure 1.--*Demand function for use of a public natural environment.*

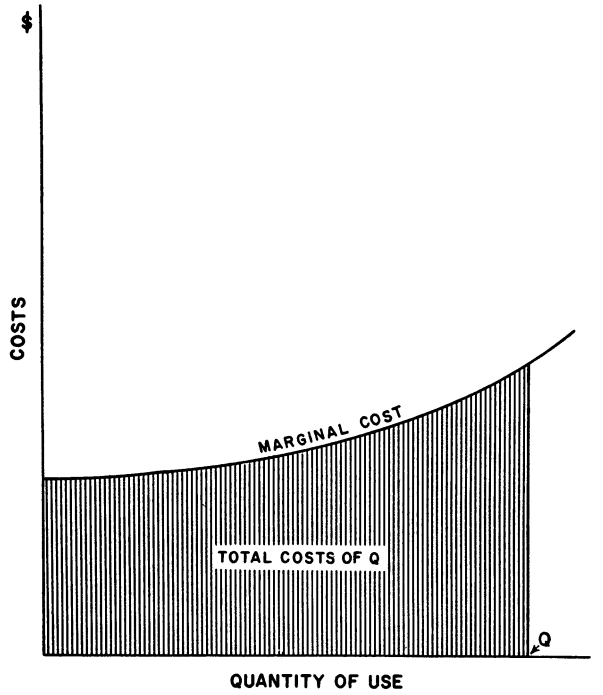

Figure 2.--*Marginal cost function for provision of use of a public natural environment.*

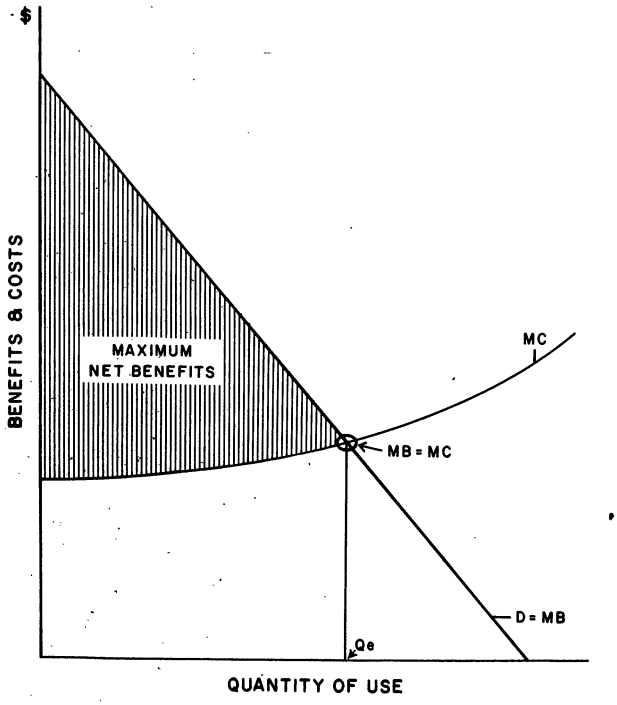

Figure 3.--*Level of use that maximizes net benefits.*

Costs and benefits occur over time and their magnitudes may vary at different times. The specific criterion of choice, then, is to choose that alternative that has the largest present net benefits. To calculate present net benefits, the flows of benefits and costs must be discounted to the present. The rate at which to discount them has been the subject of much discussion. Space does not allow a review of this discussion and the reader is referred to Krutilla and Fisher (1975).

Opportunity Cost

When one or more of the alternatives involves nonmarket benefits, costs may seem to be more easily measured than benefits. This mistaken impression arises from a limited concept of cost.

One of the basic concepts of the economic theory of production is that of opportunity cost. The opportunity cost of implementing an alternative is what must be given up because the alternative is implemented. For the marketed goods and services that may be required, money outlays are used as measures of their opportunity costs. The rationale is that these goods and services would be employed in other productive pursuits if they were not employed in the given alternative, and that their values, as reflected in their prices are derived from the values to society of these other pursuits.

The specific opportunity costs of an alternative depend on the nature of the situation. Herfindahl and Kneese (1974) pointed out: if you own an automobile and are considering using it or public transportation to make a trip, the relevant costs of using the automobile are the variable operating costs including gasoline, oil, tires, and wear and tear costs associated with the particular trip. These are not all of the costs of owning and operating the car, but are more than the out-of-pocket costs required for the trip.

On the other hand, if you do not own a car and are trying to decide between driving to work or taking a bus, then additional costs must be considered. In this situation you must also consider the costs associated with buying a car, such as annual depreciation, insurance, license, and interest on the investment. These costs are a part of the opportunity costs in this situation because they could be avoided by using the bus; whereas they cannot be avoided in the former situation in which the automobile was already owned.

But not all opportunity costs can be measured using market values. For example, building a dam on a river would mean that the benefits arising from primitive river travel would be given up. The loss of these benefits is an opportunity cost of the dam project and should be brought into the cost accounting. Furthermore, some project costs may be subsidized and the subsidies should be added into the costs.

So what we find is that benefits and costs are two sides of the same coin, but like the two sides of a coin, they are not identical. Hence, costs may be as difficult to measure as benefits.

BENEFIT MEASUREMENT

Over the past few years a bit of jargon has developed that categorizes the uses of natural environments as either commodity or amenity uses. A concern about this jargon is that the two words seem to convey a value judgment: commodity uses are more valuable than amenity uses because they are "productive" as compared to the "unproductive" amenity uses. But the terms are now imbedded in the literature, and we (or at least I) must learn to live with them.

Commodity Values

Commodity values are the benefits arising from the use of natural environments for mineral, timber, livestock, agricultural, water, and energy production. In older economic jargon these are producers' goods: inputs to subsequent production processes that eventually result in final consumer goods. The values of commodity uses derive from the values of the final consumer goods to which they contribute.

With the exception of timber, the real prices of these commodities have been decreasing over time (Potter and Christy 1962 , Barnett and Morse 1963). This means that the economic scarcity of these commodities has been decreasing relative to other goods and services. Technological advance has lowered production costs and increased substitution possibilities to the extent that their real prices have declined in the face of increasing demand for them.

Amenity Values

Amenity values arise from the direct uses of natural environments by final consumers, consumers' goods in the old jargon. These uses enter directly into the individual's consumption pattern with little or no intervening production technology. Therefore, technology has much less of an impact on the costs of or provision of substitutes for these uses as compared to commodity uses. User and option values are two types of amenity values.

Estimating User Values

User values are the benefits users of natural environments obtain through on-site activity of one sort or another. We have well-developed models for estimating the economic values of these benefits. The basic model is the travel cost model referred to as the Hotelling-Clawson-Knetsch (H-C-K) model (Clawson and Knetsch 1966). Two stages are involved in the estimation of value with the model. First, the demand function for the recreational experience in the given natural environment is estimated using travel costs as a price proxy. Then, in the second stage, a demand function for the natural environment is derived.

The demand function for the environment is the marginal benefit function of the users of the environment. The total benefits to them are estimated by finding the area under the demand function as was shown in figure 1. This quantity is referred to as total willingness-to-pay.

Value measured in this way is constrained by users' incomes because the users are considered as buyers rather than sellers. However, the effect of income on the demand for a good depends on the proportion of the consumer's budget spent on it. Typically, expenditures on an outdoor recreation activity at a specific site are a small proportion of a user's total budget so the income effect is small. If the users are considered as sellers, then a higher value is estimated because income is not a constraint. How much higher it is depends on the importance of income in the demand for the area. Therefore, the total willingness-to-pay value estimated using the H-C-K model is the lower bound value of an area in recreational use.

The H-C-K model has been extended and given more econometric sophistication to account for possible income effects, other demand shifting variables, and substitution effects (Smith 1975 , Gum and Martin 1975). More work needs to be done in refining the way in which substitution effects are handled. In one study, total or average expenditures on all other recreational experiences were used to account for substitution (Gum and Martin 1975). Recreational

experiences, however, combine activities and environments. The relations leading to the combinations are not well known. We need to know more about the characteristics of environments as they relate to the characteristics of activities in producing the characteristics of recreational experiences that form the basis for preferences and, hence, for substitution relations.

The H-C-K, or travel-cost model, uses observations of actual behavior to estimate the demand for the recreational experience. This is its greatest strength. With the improvements that have been made in its application, the model is extremely robust and can be used with confidence.

Appreciation of Benefits

The H-C-K model provides estimates of current annual benefits. There is a strong argument that these benefits will increase over time (Krutilla and Fisher 1975). The argument is based on two propositions. The first is that all natural environments, to some extent, are gifts of nature and not producible by man. Admittedly there is a continuum of environments from wilderness to KOA campgrounds over which the natural component varies in intensity. But to whatever extent an alternative use destroys whatever natural component an environment has, that component cannot be reproduced at a later date. Thus, natural environments are fixed in supply, and technology cannot ease this supply fixity through provision of substitute environments. On the other hand, continued technological advance will continue to relieve commodity supply restrictions by increasing materials substitution possibilities.

The second proposition is that demand for amenity uses of natural environments will increase over time as a result of increasing per capita demand and population growth. Technological advance contributes to increased per capita demand by increasing per capita real income. The result is a growing scarcity of the amenity services of natural environments relative to the commodity uses of such environments.

Evidence that the demand for and value of amenity services will grow over time is convincing, therefore, the appreciation of these benefits should be brought into benefit-cost analyses. Krutilla and Fisher (1975) present a simulation technique for estimating the rate of appreciation for linear demand functions. Based on the argument for benefit appreciation, the model simulates a situation in which the demand for amenity services shifts outward over time while supply remains fixed, imposing a carrying capacity constraint at some point.

The model breaks the shift in demand into a vertical component and a horizontal component. The vertical shift represents increasing willingness to pay for given quantities of the service and is assumed to be constant over time. The horizontal shift represents increasing quantities being demanded at given prices. The rate of horizontal shift is assumed to be constant to the time at which the capacity constraint is reached, after which it decreases to the rate of population growth. For many recreational activities, the rate of growth in participation has been greater than the population growth rate. This means per capita demand has been growing and more and more of the population is being exposed to these activities. Common sense tells us there is an upper bound to growth in participation, the rate of population growth.

The simulation model to estimate the rate of appreciation in recreational benefits is simple in that it abstracts greatly from the real world and, therefore, has a small number of parameters. These are the rate of vertical shift in demand, the rate of the horizontal shift, the year the area reaches capacity, the rate at which the horizontal shift decreases to the population growth rate after the year capacity is reached, and the year the horizontal growth rate equals the population growth rate. Data are not commonly available to estimate these parameters. Enough evidence exists, however, for choosing alternative values for the parameters so that the sensitivity of the results to the alternative values can be tested.

Option Values

Option values remain largely unmeasura-

ble in economic terms. These values include the value to individuals of having the opportunity to visit an area in the future. The conclusion that this kind of option value is additional to total willingness-to-pay has been worked out, but no empirical method for estimating it has been developed (Cicchetti and Freeman 1971). Scientific values are also option values. These arise from our desires to pursue ecological research in undisturbed areas, preserve genetic information, and preserve potential sources of medicine. Also included among the option values are the vicarious benefits people gain from simply knowing such natural areas exist (Krutilla and Fisher 1975).

DATA AND RESEARCH NEEDS

To apply benefit-cost analysis, data are needed to estimate those benefits and costs we have the ability to measure. With regard to amenity uses of wild, scenic, and recreational rivers, these are the user benefits and some of the costs of providing the opportunities for recreational uses.

User Benefits

The H-C-K model is site specific and studies specific to individual rivers must be made to estimate user benefits. Although site specific, they need not be on-site studies.

The model uses travel costs as the price proxy in the estimation of the demand for the recreational experience. Thus, actual travel cost data or indirect data, from which travel costs may be calculated, must be obtained.

Some investigators have used trips and some have used visitor-days as the quantity variable. The variable that should be used in a particular situation depends on the amount of variation in trip lengths. When trips are used, it is useful to distinguish day trips, weekend outings, and vacations, estimating demand functions for each.

The observational unit is open to a choice among the individual, group, or household. The choice depends on the nature of the river and the activity.

In addition to the price and quantity variables, variables that may shift demand must be considered. These include income, travel time, socioeconomic, and substitution variables. When users have been aggregated by origins, multicollinearity between travel cost and travel time has resulted. The solution has been to drop travel time from the statistical demand functions, resulting in an incomplete specification of demand. The disaggregate approach, in which the individual user is taken as the analytical unit, avoids the multicollinearity problem and makes possible the inclusion of both travel costs and travel time in the estimated demand functions (Gum and Martin 1975).

The use of total or average expenditures on all other recreational experiences to account for substitution effects is not entirely satisfactory. More research is needed to identify the variables that express the nature of the substitution relations.

In most studies of the recreational users of an area, data on socioeconomic variables are collected. The additional variables required for benefit estimation may be income, travel cost, and substitution variables. Income and travel cost are straightforward variables and easily measured at little additional cost. The substitution variables eventually identified should also be of a straightforward nature.

The H-C-K model derives part of its strength from the fact it is based on observations of actual behavior. When considering potential uses of a river, however, there is no actual behavior to observe. One solution is to estimate benefits for similar rivers receiving such uses and apply them to the river being studied. This approach, called the representative site approach, was used in an Arizona study (Sublette and Martin 1975). Research of the kind being reported at this symposium by Chubb will provide a basis for identifying "similar" rivers.

Costs

Little attention has been paid to the costs of providing and maintaining recreational opportunities relative to

the attention given demand and value. Perhaps cost studies have been considered less challenging than demand studies.

Estimates of the costs of facility construction and maintenance and the costs of maintaining the natural and social components of recreational environments are needed. Facility cost estimates are most easily obtained. To estimate the costs of maintaining the natural and social components of these environments, however, is more difficult. The papers presented at this symposium by Settergren and by Heberlein relate to this issue. It certainly is not lacking in challenge. Nevertheless, once the alternative recreational experiences have been defined for a river, reasonable judgment estimates of such costs could be made.

SUMMARY

The state-of-the-knowledge regarding measurement of recreational user benefits is such that it is now possible to measure them with confidence. The total willingness-to-pay measure of value, the area under the demand curve for the environment, is the relevant measure given maximization of net social benefits as the decision criterion. This measure of value is constrained by income and is, therefore, a lower bound value.

Option values are still unmeasurable. They have been shown, however, to be additional to user benefits.

An argument that the demand for and value of amenity uses of natural environments will increase in the future is convincing. A simulation model for estimating the rate of appreciation in benefits has been developed. The model applies only to linear demand functions and requires parameter estimates not easily obtained.

On the cost side, facility construction and maintenance costs can be easily measured. Costs of maintaining the natural and social components of natural environments are less easily measured. However, it should be possible to make reasonable judgment estimates of these costs given definition of the potential recreational experiences to be considered for a river.

While all of the problems of cost and benefit measurement have not been solved, the state-of-the-knowledge has reached a level at which it is possible to begin using benefit-cost analysis as a decision-making tool in the management of wild, scenic, and recreational rivers.

DENSITY, CROWDING, AND SATISFACTION: SOCIOLOGICAL STUDIES FOR DETERMINING CARRYING CAPACITIES

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ABSTRACT.--Four types of carrying capacity are identified: physical, ecological, facilities, and social. The importance of both levels of technology and value judgments are noted for determining any of these capacities. The satisfaction model based on an explicit or implicit adoption of ecomonic theory by both researchers and managers for determining social carrying capacity is found wanting and an alternative model based on a determination of social norms is proposed. This model is discussed both in terms of recent social psychological studies of crowding as well as prior assessments of recreation carrying capacity. Finally, some practical suggestions for adopting this model are noted.

The recreation carrying capacity of wilderness has received the attention of social scientists for over a decade, beginning perhaps with the thoughtful analysis by Wagar published in 1964 and complemented by the pioneering empirical work of Lucas (1964c) in the Quetico-Superior. Since then the work has been advanced by continued studies in the Quetico by Lime (1970) and in other areas by Stankey (1973). The complexity of carrying capacity determination has been spelled out and progress has been made at sorting out the components of capacity (Lime and Stankey 1971 , Frissel and Stankey 1972 , and Bury 1976). In doing so, researchers are telling managers that no single number exists but rather combinations of factors including management objectives, the physical and biological nature of the resource, the preferences and tolerances of the users must be considered together in selecting a capacity for a given area. Carrying capacity is thus a dynamic concept (Stankey 1974) and is difficult to pin down to a specific number.

A major stumbling block to these efforts to establish a carrying capacity is that they have been based on an economic model. This approach is either explicit as seen in the work of Alldredge (1972), Fisher and Krutilla (1972), Cicchetti and Smith (1973) or implicit in the Forest Service research (Stankey 1971 , Lime and Stankey 1971). No one can argue with the elegance and internal consistency of these models. However, any model must simplify the world, and in doing so, some untested assumptions must be made. Unfortunately, the primary simplifying assumption of the economic model does not square well with a social-psychological model of human behavior. Data necessary to test this assumption come from a recently completed study of crowding on the Colorado River in the Grand Canyon (Shelby 1976). Further, data I have collected on the Bois Brule River in Wisconsin essentially replicate and consequently extend the findings from the canyon to other rivers. In addition to these new data, social-psychological research has begun to extend biological work on crowding to humans. The thrust of this work complements sociological research on river visitors, and these two bodies of literature will be discussed in this paper as a means of both giving a sociological direction to carrying capacity research and integrating prior work on crowding and carrying capacity.

PHYSICAL CAPACITY AND ECOLOGICAL CAPACITY

Theorists have usually discussed carrying capacity under two rubrics: those dealing with natural features and those dealing with human components (e.g., Lucas and Stankey 1973 , Lime and Stankey 1971 , Bury 1976 , Fisher and Krutilla 1972). I have found it useful to further differentiate these into four related categories: physical, ecological, facilities, and social, which may be used in roughly a descending order to establish capacities.

The upper limit of capacity is the amount of physical space available for humans. In the Grand Canyon, this might be the number of spaces available along the Colorado River for visitors to camp and sleep in the evenings. Allocating all of the available beach spaces into cooking and sleeping areas large enough to accommodate an adult human would yield a carrying capacity far in excess of current visitor limits.

A second and the most widely recognized and discussed capacity has to do with human impact on the ecosystem. Clearly if the physical capacity of the Canyon or any river bank or lake shore were reached every night of the season, dramatic impacts on animal and plant life would result. Ecological capacity is difficult to establish, for *any human use will have an impact.* The critical question is how much impact is tolerable.

Value Judgments Necessary

To establish a carrying capacity once impacts have been measured someone must say, "This much is enough". This means that selecting a carrying capacity implies some kind of value judgment, even in the case of physical capacity. Under one set of values, physical capacity in the canyon is reached when there is one party on the beach. Under another set, when there is one person for every 3-by-7-foot sleeping location in the canyon. The question of the appropriate mix of expert, scientific, and public judgment is at the heart of carrying capacity controversies.

Managers would like to think carrying capacity can be determined solely by scientific and technical information, and thus avoid the apparent arbitrariness of value judgments. The only time that such data alone appear to make carrying capacities determinations, is when the value premise is widely shared.

For decades biological studies have been used to establish carrying capacities, particularly for deer, elk, and livestock. These studies have helped managers make decisions because the value premise is explicit and widely shared (production should be at a maximum without impairing the range). When, however, there is wide disagreement about what is valued, no decision can be reached. When ranchers cry out for zero predators and environmentalists demand wolves and coyotes be preserved, biological studies cannot in themselves establish a carrying capacity.

Lucas and Stankey (1974) note that the concept of carrying capacity may be useful for range management but is ill-suited for recreation management. (They go on to use it, however, because of its wide circulation). Recreation researchers have recognized the importance of shared values in their selection of sites for the study of carrying capability. Such studies have tended to focus on wilderness recreation rather than crowding in campgrounds, zoos, or picnic areas because there tends to be a greater value consensus about the nature of a quality wilderness experience. Of course, wilderness recreation should be the most sensitive to minor changes in visitor density.

Level of Technology Necessary

Just as a value premise is necessary to establish carrying capacity, any carrying capacity must be based on a specific level of technology. If visitors to the Grand Canyon were to sleep in boats as well as on beaches, the physical capacity of the canyon could be increased. The introduction of new technologies including "porta potties" in the Grand Canyon have reduced human impact on the biology of the inner canyon, and consequently have raised ecology capacity.

The addition of technology into a given recreation activity is a two-edged sword. While on the one hand it may be used to reduce impact and increase carrying capacity, in the case of river running itself, the introduction of rubber rafts and

tubes has led to crowding problems on rivers all over the nation. On the Colorado River, the introduction of new technology (Glen Canyon Dam and the regulation of water levels on the Grand Canyon) has dramatically affected use in the last decade.

FACILITIES CAPACITY

To handle visitors physical and organizational facilities, such as parking lots or boat ramps, are needed. When parking lots are full or boat ramps covered with rafts loading, the carrying capacity of the facilities has been reached. In the long run, facilities capacity is not a serious problem, although it may be fixed for a single season. While physical or ecological capacity can be manipulated by the introduction of new technologies, facilities capacity can be greatly enlarged by the application of dollars. Parking lots may be built, boat ramps expanded, and more personnel hired, for where there is demand, the income needed to expand facilities capacity is at least potentially available.

SOCIAL CARRYING CAPACITY

Throughout the literature is the notion that there is some visitor density that reduces the quality of the recreation experience (Lime and Stankey 1971 , Frissel and Stankey 1972 , Stankey 1972 , Lucas and Stankey 1974 , Fisher and Krutilla 1972 , Stankey 1974 , Bury 1976). We might call this social carrying capacity. How many visitors can be put into an area before the quality of their experience is significantly reduced? Social carrying capacity also requires a value judgment. How much human interaction is too much? When is the experience significantly reduced? However, the problem is even more difficult in the case of social carrying capacity, because there is even less value consensus about the nature of a recreational experience than there is about a preferred ecosystem. Moreover, recreation research is far behind the theoretical development of the biological sciences. Consequently, among scientists there is little shared agreement about what variables to measure and how to measure them. Social scientists are hard pressed to gather the appropriate data to determine the impact of humans on the recreational experience of others.

The utility of these four kinds of carrying capacity may be illustrated for river recreation in the Grand Canyon. Currently in the Grand Canyon, use is nowhere near *physical capacity*. *Ecological capacity*, with the introduction of porta potties (although further study is needed), is probably far above current use limits. In any case, even extreme human recreation impact is probably trivial compared with the dramatic impact of the Glenn Canyon Dam on the river ecosystem. *Facilities capacity* is alleged to be 150 persons per day at the Lee's Ferry put-in point. However, Park Service records show this was exceeded 20 days out of the 1974 season (Shelby and Nielsen 1975a). In any case, more staff, parking and loading zones could easily alleviate that problem.

The real limiting factor in the Grand Canyon may be *social carrying capacity* where the number of people influences the nature of the experience. I suspect this is true for much back country recreation. On the other hand, in certain areas, ecological limits will be the first to be exceeded. Facilities limits will in other cases be reached before other capacities have been exceeded. Physical carrying capacity is unlikely to be reached in any area. However, it serves as a starting point from which the issue of carrying capacity may be considered.

Although managers are implicitly concerned about social carrying capacity and providing a visitor with a particular kind of recreational experience, they are uncomfortable at limiting use on the basis of such criteria. Some of this reluctance is due to the diversity of opinion as to what a high quality recreational experience is. Because there is more likely to be consensus about biological impact or facilities capacity, managers may select such limits even though they are actually managing for a particular kind of recreation experience. Managers seem more comfortable saying, "The parking lot isn't big enough so you can't come in," rather than saying "You can't come in because too many people will reduce the quality of the experience for others." Facilities carrying capacity may be a useful way to limit numbers once ecological or human carrying capacity has been reached. However, as a

fixed limit in itself in the face of rising demand, it is not generally defensible.

Resource managers, as Hendee and Stankey (1973) have pointed out, by reason of training and personal values, tend to over-emphasize biological capacity. Numbers are often limited on the basis of demonstrable but trivial biological impact. Or numbers are allowed to exceed the point where the important components of the recreation experience are lost (e.g., solitude) because no biological impact can be documented. There are no doubt biological limits and carrying capacities, but these should not be used to avoid hard decisions about another sort of capacity.

The subterfuge of using facilities or biological capacity, although convenient for the manager, may be an inefficient and ineffective means of both establishing or regulating social carrying capacity. However, in the absence of more adequate standards for social carrying capacity, the manager can hardly be faulted for using other criteria. The theoretical basis for establishing social carrying capacity is weak, and current methodologies illsuited for making such a determination. The remainder of this paper is devoted explicitly to that problem.

SATISFACTION AS THE BASIS OF SOCIAL CARRYING CAPACITY

Social carrying capacity has been defined largely in terms of visitor satisfaction. Bury (1976) states, "The objective of recreation management is to maximize user satisfaction within the specific constraints of budget or physical resources or agency policy". Lucas and Stankey (1973) indicate within constraints "...we assume the goal of recreation carrying capacity is to maximize user satisfaction". Lime and Stankey (1971) define carrying capacity in terms of that level which can be supported without "...excessive damage to either the environment or the experience of the visitor". The emphasis on satisfaction is always couched in terms of constraints (such as management objectives). I will try to show that it is those constraints, rather than satisfaction, which are really the important parameters is establishing social carrying capacity.

This notion of satisfaction is also important in the perception of managers. Within ecological and budget constraints, managers say they wish to provide for as many satisfied visitors as possible. Dissatisfied visitors are a problem for managers; so is turning away other visitors who might be satisfied with the experience. Managers generally view their role, after protecting the resource, as providing an experience that will please visitors.

Theoretical Basis of the Satisfaction Model

While the satisfaction model is at the basis of theorizing about carrying capacity and is also implicit in management, it has reached its full flower under an economic analysis of carrying capacity. Alldredge (1972) spelled out the basics of the model in simple terms easily grasped by managers and sociologists alike. The Resources for the Future Investigators (Cicchetti and Smith 1973 , and Fisher and Krutilla 1972) stated it in quantitative and operational terms.

Briefly stated, when a person enters a wilderness area alone, he has some amount of satisfaction (called enjoyills, by Alldredge, and operationalized by Cicchetti and Smith and Fisher and Krutilla as willingness to pay). This is alleged to decrease for the first individual as subsequent visitors enter the area. However, because it does not immediately drop to zero, aggregate satisfaction across visitors continues to increase. When the amount of satisfaction of the nth visitor does not equal the drop in satisfaction of the remaining visitors and the aggregate satisfaction begins to decline, social carrying capacity is reached.

This is a conceptually consistent notion of social carrying capacity that fits well with a management objective of what might be called satisfaction management, and generally follows Stankey's analysis of carrying capacity (Fisher and Krutilla 1972). Moreover, it can readily lead to selection of a number at least in the theoretical descriptions of the model.

Problems With the Satisfaction Model

The satisfaction model so oversimplifies the nature of a complex, real-world

process to achieve a social carrying capacity estimate that it loses touch with the process itself. Two studies (Stankey 1973 , and Cicchetti and Smith 1973) have shown that wilderness visitors will show lower levels of satisfaction or a reduced willingness to pay when asked their reaction to *hypothetical* encounters in wilderness areas. This supports the basic premise of the satisfaction model, "...the satisfaction or ability gained from the wilderness experience tends to be inversely related to the number of parties he meets on a wilderness outing" (Fisher and Krutilla 1972).

However, until recently no one ever looked to see if this premise held in an actual recreational setting. *Are wilderness visitors who encounter many parties really less satisfied than those who see few?* For two summers, observers who counted the number of encounters, were placed in boats on the Colorado River in the Grand Canyon. Visitor contact at attraction sites, the length of contact on the river, and the number of people seen in those encounters were also noted. These data were then related to satisfaction scores of visitors on the trips.

During the 1974 season, 213 visitors on 11 trips filled out questionnaires (Shelby and Nielsen 1975) and *the correlations between satsifaction and the density measures were not significantly different than zero.* In 1975, the study was replicated with a representative sample of trips (Shelby 1976). Here, 1,009 visitors completed questionnaires (a 96 percent response rate) on 46 trips. Even with this large sample, only the correlation between length of time in sight of people on the river and satisfaction was statistically different from zero (r=0.10). However, this correlation accounts for only 1 percent of the variation in satisfaction, hardly enough to be an important issue in satisfaction management. The other variables, such as number of contacts and number of people seen, were not related to satisfaction.

It may be argued that the Grand Canyon is such a unique resource that it overpowers any effect of density on satisfaction. However, I am currently analyzing data that appear to support the Grand Canyon findings.

During August 1975, nearly 3,000 canoeists, tubers, and fishermen on the Brule River in Wisconsin were interviewed. The correlation between daily use as measured by electric eye counts up river and satisfaction was 0.009 (NS) indicating again that visitor number plays no role in the overall satisfaction of the visitors present on this recreational river. These studies should be replicated in other wilderness areas, but cast substantial doubt on the basic premise of the satisfaction model.

Why Doesn't Satisfaction Relate to Density?

Satisfaction is a complex concept and there are likely to be many things other than the number of encounters, or length of encounters that affect satisfaction. Freedman (1975) argues in his discussion of density-intensity theory that in many circumstances people are simply not attending to density, and it simply may not be a factor in their experience. For example, while those few who experienced the Grand Canyon before 1960 may be appalled by 1970 use levels and contact their congressmen, most visitors may not notice.

Grand Canyon visitors are not only very satisfied but 31 percent of the variance in satisfaction is explained by the social aspects of the trip (e.g., subjective quality of group experience), personal benefits, the wilderness character of the trip (e.g., being in wilderness an important reason for the trip) and weather (Shelby 1976). Perceived crowding accounted for only an additional 2.5 percent of the variance and 6 additional density variables added another 2.5 percent, bringing the total explained variance in satisfaction to 36 percent. Wagar (1964) anticipates these findings in his discussion of the multiple satisfactions that may be derived from a particular recreation experience.

It may be argued that density in the Grand Canyon was simply not high enough to show any effect on satisfaction, that surely as physical capacity is approached satisfaction must go down. Shelby and I, responding to a note by Greist (1976), don't believe this would inevitably be the case.

Users choose activities that are in

accord with their own idea of a "good time." Those who don't like the anticipated crowds in Grand Canyon will (as some have already done) not return but move on to less crowded areas, thus being "displaced" by those more tolerant to higher densities. Crowding norms, then, change due to alterations in group composition. The result is that aggregate satisfaction continues to climb with increasing use, and carrying capacity (the point at which satisfaction declines) is never reached. This may be especially likely in the Grand Canyon where 90 percent of the visitors are making their first (and for most, only) trip. Most of these visitors say that they had *no* expectations about how many other groups they would meet on the river (Shelby 1976). Individuals are susceptible to viewing what they see as appropriate where they have no prior expectations. This would tend to mitigate against any effects of density increases.

Further, increasing densities may cause a change in the definition of the experience. Increased use alters the character of the experience form, for example "zero contact wilderness", to "moderate contact semi-wilderness". Use levels that began to approach physical capacity in the Grand Canyon would move to the "excursion" experience, where one expects to see others viewing the same resource. As this happens, people probably change their normative definition of appropriate contact levels. Changes in the experience, then, cause individual normative changes, and satisfaction remains high. This subtle "product shift" would again mean that aggregate satisfaction continues to climb as use increases.[1]

A management policy aimed at maximizing aggregate satisfaction leads to some interesting possibilities. For example, a Grand Canyon Parkway along the Colorado River would certainly increase the number of satisfied Canyon visitors. Dissatisfied seekers of wilderness might go elsewhere. The influx of people more tolerant of crowding would cause contact norms to change, and the new product (the Grand Canyon by automobile) would be defined in terms of higher contact rates.

[1]*Personal communication with Stankey, 1976.*

Satisfaction Alone is not Suitable Criterion for Management

Neither the USDA Forest Service researchers nor the economists have proposed satisfaction as the *sole* criterion for establishing carrying capacities. Lucas and Stankey (1974), Lime and Stankey (1971), and Frissel and Stankey (1972) have carefully limited the notion of carrying capacity to those numbers that could be satisfied within management objectives. The economists have likewise discussed satisfaction within the context of a certain product--"a wilderness experience" (Fisher and Krutilla 1972). Hence, satisfaction itself is not as suitable criterion for defining these limits. *It is likely that for a wilderness experience, the number of visitors may reach the point where the experience is no longer provided even though there may not be a noticeable reduction in satisfaction of the visitors present.* Consequently, if certain types of recreational experiences are to be provided in the face of increased user demand, *some criterion other than satisfaction must be used to establish social carrying capacity.* The remainder of this paper is devoted to some notions which may help select these capacities. The first step in developing an operational approach to establishing carrying capacity is to focus our discussion on the concept of crowding.

SOCIAL PSYCHOLOGICAL MODELS

Since 1970, social psychologists have begun to build on the work of sociologists (e.g., Winsborough 1965 , Galle *et al.* 1972) and biologists (e.g., Christian *et al.* 1960) regarding crowding. The notion of crowding is really central to the determination of social carrying capacity. Social carrying capacity for an activity has been reached when the participants regard the setting as crowded. Crowding is more than just the number of people present. Most theorists (Altman 1975 , Stokols 1972a and 1972b, Desor 1972 , Lawrence 1974 , Rappaport 1975) distinguish between density and crowding. Density refers to the number of individuals in a particular setting and their distribution. Crowding is the negative evaluation of a density that exceeds a certain point. In our focus on the negative aspects of excessive density, it is important

to remember that density may be too low as well as too high. Frequently mentioned examples include too few people at a football game or a cocktail party. The language lacks a term such as crowding to describe the absence of sufficient numbers, although terms such as over and under manning (Wicker 1973) may serve in the technical literature.

The Return Potential Model

The distinction between density and crowding implies that the appropriate level of human density in a particular situation is essentially a normative concept. There may be too few, just right, or too many. Jackson (1965) proposed a model that may be helpful for considering carrying capacity. This model is called a "return potential curve" and works like this:

Individuals are asked how they would feel about seeing 1, 2, 3, 4...n other people in a particular setting. By plotting the mean responses on a graph where the favorableness or unfavorableness of the evaluation is plotted on the x axis and numbers are plotted on the y axis, one establishes a return potential curve.

Figure 1 shows three hypothetical return potential curves for three different activities: a wilderness experience, a cocktail party in a small room, and a city sidewalk. For a wilderness experience, reaction to numbers is most favorable at zero and crosses into the negative values at four, when respondents began to evaluate density unfavorably. The range of appropriate numbers is narrow, ranging from zero to four. A cocktail party, on the other hand, has two regions of rejection, both when there are too few participants, and when finally there become too many in the room to converse, obtain drinks, etc. The latitude of acceptance is broader for a cocktail party than for a

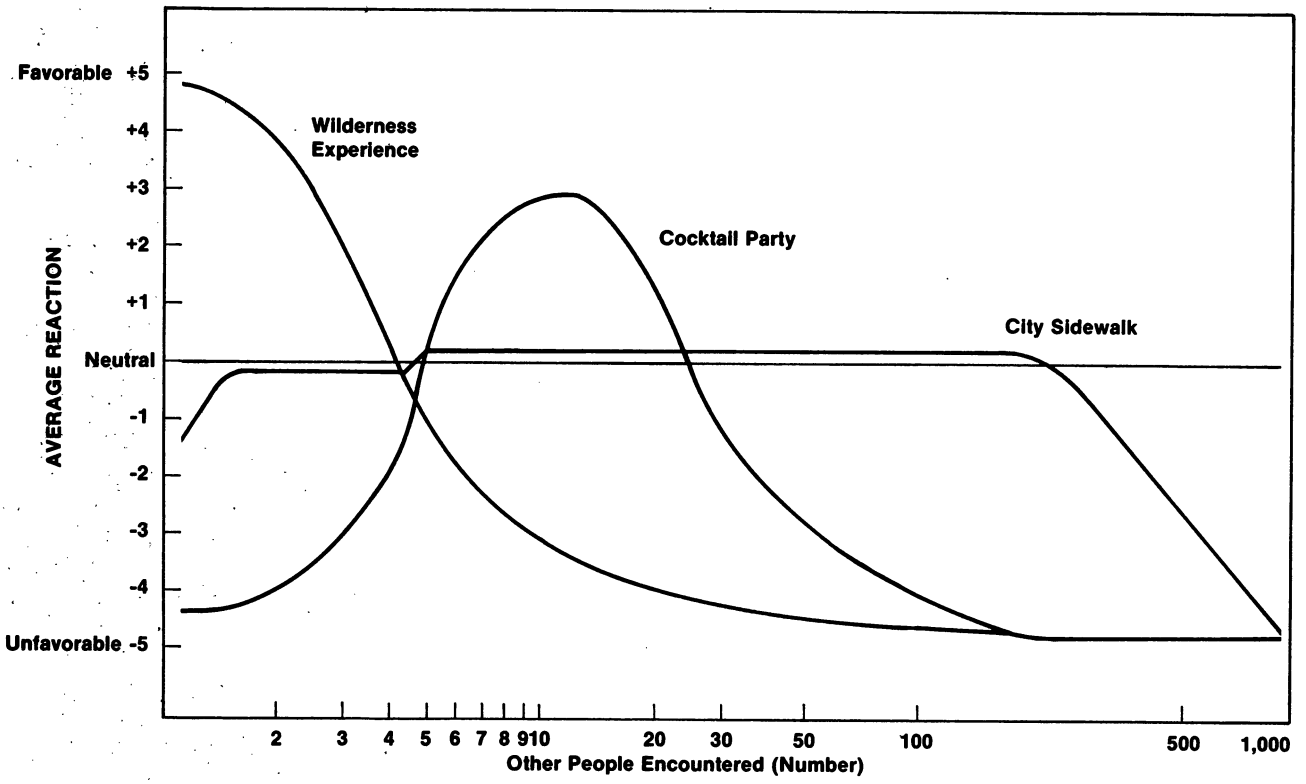

Figure 1.--*Return potential curves for three activities.*

wilderness experience, ranging from 5 to 25. The latitude of acceptance for a city sidewalk is broader still, ranging from 11 to 400, but drops off substantially when one can no longer negotiate from the sidewalk. Such return potential curves show the strength of the social norm by the height of the modal point: higher the mode, the stronger the norm. The norms about contacts in wilderness areas are more strongly crystalized than the norm for cocktail party interaction. Sidewalk contacts are generally unguided by norms except for empty or impassable sidewalks.

These return potential curves illustrate the relation between density and crowding. Seven people (a constant density level) is a crowd in wilderness areas, but not a crowd at a cocktail party or on a stroll down the sidewalk. When the density level exceeds this range of tolerable contact, the effects of crowding should be observable both psychologically and behaviorally.

Normative Explanations in Crowding Research

Recent social psychological literature illustrates some of the points raised in this discussion. Cohen *et al.* (1975) showed that college students are influenced by both the setting and the activity in the number of individuals they would place in a room "...until they felt that the addition of one more figure would create a crowded situation". More people were acceptable in the same size room for recreation (a party or social hour) than for work (working on a group project or a business meeting). Desor (1972) corroborated this. These studies suggest that different activities have different return potential curves.

Normative Explanations Help Reconcile Inconsistent Findings in the Crowding Studies

It has been widely assumed that increase in density in the social world such as cities, apartments, and urban life in general would cause negative pathological effects (Freedman 1975). However, large scale studies investigating this phenomenon have shown either no such effect or no effect beyond social class differences (e.g., Winsborough 1965 , Mitchell 1971 , Freedman 1975).

This lack of density impact in the sociological studies has been largely replicated in the early social psychological laboratory studies. In these studies, placing more and more college students on chairs in a room had no effect on performance of individual mental tests (Freedman *et al.* 1971). Freedman *et al.* (1972) also found that room size had no effect on the aggressiveness of decisions made by mock juries.

However, recent studies have begun to show density effects on task performance. Paulus *et al.* (1976) argue that the lack of crowding effects in prior work may have been due to the insensitivity of the tasks used by Freedman and his associates. Using a maze task, they found that more errors were made under crowded conditions. One interpretation of this is that the two activities have different return potential curves. Density may not have reached the subjective crowding level sufficient to influence performance in Freedman's experiments because people were sitting on chairs in a room as they filled out paper and pencil tests. No matter how close the chairs, the normative character of the setting had not been changed. However, just as the student approaching a pin ball machine says "stand back", indicating a preference for a given amount of space, performance on the maze task could have been influenced by the close proximity of others doing the same task. In short, there are probably different return potential curves for test taking and game playing (or maze running in this case). The density level in Freedman's work did not violate the test taking norm, but the density level did violate the game playing norm in the work by Paulus and his associates.

Findings presented by Worchel and Teddlie (1976) are also consistent with the normative interpretation. They had college students work on two group projects (as opposed to the individual tasks used by Freedman and his associates) at various densities. Crowding distorted time perception, but had no effect on task performance. However, interaction density was also varied. When chairs were close together (touching in a circle), performance went down and subjects became more punitive in their group reaction to a hypothetical juvenile delinquent. Subjects in the high

interactional density conditions also attributed more aggressiveness and nervousness to the group members. *It appears that there is a different norm for group communication.* Here, when chairs touch, people both feel crowded and show a performance and psychological reaction, while for individual cognitive tasks, touching chairs does not violate the norm.

NORMATIVE EXPLANATIONS IN CARRYING CAPACITY RESEARCH

In the struggle to solve carrying capacity problems, recreation researchers have used normative kinds of approaches in three ways. First, Hendee and his associates (1968) developed a measure of wilderness purism that has been refined and used by other investigators (Heberlein 1973 , Stankey 1972 , and 1973 , Shelby 1976) to identify a particular group of wilderness visitors who are supposed to have more sensitive responses to a wilderness experience. Restated in terms of norms, this group is seen as having different expectations and norms about appropriate behavior in wilderness areas than the typical visitor. Hendee *et al.* (1968) and Stankey (1972) argued that wilderness management should be consistent with these norms, because there are fewer substitutes available for this group than for the general visitor.

Second, Stankey (1973) has gone beyond this approach to develop preference curves, much like the return potential curves described above for the number of contacts and the type of party encountered. His curves are similar to those presented in the hypothetical figure in this paper. They specify essentially the range of latitude for contacts before a wilderness type experience would be lost. The curves drop sharply from one to three and level off after five. Such graphs tell managers that one to five contacts are enough. As expected from a normative perspective, wilderness purists show steeper curves than the general visitor.

Carrying capacity research and management have been influenced by a normative perspective in a third way. It has been widely demonstrated that the phenomenon of asymetrical antipathy exists in wilderness type recreation (Lucas 1964a, Stankey 1973 , Lucas and Stankey 1973). For example, the paddling canoeist tends to dislike the motor boater, but not the other way around. This appears to also hold for hikers and horse parties, cross country skiers and snowmobilers, and rowers and motor boaters in the Grand Canyon as well. The groups essentially hold different norms about what is an appropriate behavior in a wilderness area. The motor boater, horse packer, snowmobiler, appear to believe that a wider variety of behaviors are appropriate than do the canoeists, hikers, and skiers. Management, which tries to isolate the uses from each other, is being implicitly influenced by a normative model.

Problems in Application

There are at least three difficulties in using norms for establishing carrying capacities. One just alluded to is that various users may have different norms. For example, appropriate density is different for tubing than for canoeing and fishing. This problem may be avoided by zoning activities to different segments of a river or to different times on the same river segment.

A second and more difficult problem is that visitors may have no expectations or no norms that apply to new situations and consequently cannot evaluate crowding consistently (Shelby 1976).

An allied problem involves norm formulation itself. How does one develop norms or expectations about appropriate numbers for a particular setting and recreational activity? Generally, it is done on the basis of past experience. Consequently, even though the character of an experience may gradually deteriorate as new users are introduced into the activity and density increases, each new generation may become more tolerant of increasing numbers. Today a wilderness experience may come complete with wide, groomed trails and signs at junctions indicating mileage to the next point of interest--a far cry from a frontiersman's notion of wilderness.

CONCLUSIONS--HOW TO ESTABLISH SOCIAL CARRYING CAPACITY

It is not possible, on the basis of satisfaction alone, to establish a social carrying capacity. Repeated surveys of

visitors will continue to show high satisfaction levels even as the character of the experience changes. How then does a manager establish a carrying capacity?

Specific Management Objectives

Although it is agreed that carrying capacity can only be established within the context of management objectives (Wagar 1964 , Lime and Stankey 1971 , Lucas and Stankey 1973 , Heberlein and Shelby 1976), no one talks much about these objectives. To be effective, the objectives must define specifically what type of recreational experience is to be provided, e.g., a chance to see a particular site, to have a particular experience. Where there are more than one of these (and there usually will be), they should be ranked. Management objectives should also indicate for whom the experience is to be provided. Management objectives such as "protect the resource", and "provide satisfying experiences" are not specific enough to help determine carrying capacity.

Visitor Assessment

The next step is to determine what actually happens. How often are people in contact with each other? Where do they camp and stop? What adjustments are made by visitors to reduce crowding? Although most such data are behavioral, study of perceived crowding preferences may be a useful part of visitor assessment. This is routinely done as in the case of ecological impact, but is rarely done for social impact.

Normative Assessment

Having specific management objectives and knowledge of the social impact, the manager is in a position to assess norms to determine if contact is excessive. Essentially this process would be to generate the return potential curves such as those described in figure 1. In practice, it need not be so formal. By going to various groups and asking if the contacts are too few or too many, the manager can get a rough idea of the described curves. It is *very* important, however, that a variety of potential users and nonusers (such as managers) be consulted. It is also necessary that this input be presented according to the various groups rather than just adding them all together in a "vote". This will give the manager a sense of the variety of norms that exist for visitor density in a particular setting, for a particular activity.

Determining social carrying capacity will never be an easy decision, yet if it is based on such information, it will be more defensible than the kind of arbitrary number picking currently practiced.

METHODS FOR COUNTING RIVER RECREATION USERS

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ABSTRACT.--Counting and classifying recreation users on the nation's rivers is a new technical endeavor. Procedures for documenting river use are reviewed and the merits and limitations of various approaches are discussed.

The commitment of public agencies to intensive management of rivers for recreation creates the need for information in a broad range of disciplines. One of the most basic kinds of information sought by managers is an account of the varied uses occurring on the Nation's rivers. Use statistics are often prerequisite to a meaningful interpretation of other kinds of data. Conclusions about resource impacts and user perceptions, for example, can be defined more precisely when the character and intensity of use occurring on a river is known. It may also be desirable to monitor river recreation to assess the effectiveness of management actions.

In many instances recreation managers may only be concerned with documenting the volume, distribution, and kinds of uses occurring on a river. More demanding situations may require information addressing such things as separation of river traffic in both space and time, access use, origin-destination patterns, watercraft ownership, etc.

River recreation is usually not distributed uniformly either in time or space. Peak hours and days typically characterize the use regimen, especially in situations where day-use activities such as swimming predominate. Some types of recreation, such as fishing, tend to be concentrated at selected locations, while other activities, such as canoeing, may be highly mobile and occur over extended portions of a river corridor. River traffic may also be two-way and comprise many different classes of watercraft and user groups.

For these reasons it should be recognized that a *precise* measure of all types of river recreation may be impractical to attempt on many rivers. If serious impediments to sampling exist, managers may have to limit their focus to the most important recreation uses. This does not necessarily mean that only the dominant or most visible activities should be measured. River uses such as night fishing could be minor occurrences yet still be important from a management viewpoint.

This paper examines methods and procedures currently used for gathering and interpreting river-use data. Because the focus is on the quantitative dimension of river recreation, methods used to obtain sociological and demographic data are considered only if a particular method can be used for both purposes.

Overlaps and ambiguities exist in some of the terminology used to describe use-estimation procedures. The intent here is to *characterize* selected methods, not to rigidly *categorize* them.

The task of securing quantitative river-use information is examined in the following sections from two perspectives: (1) the basic approach or rationale adopted for compiling and interpreting the data, and (2) specific techniques that may be applied to acquire the data.

APPROACHES TO MEASURING RIVER-USE

Total Accounting Approach

Under ideal circumstances it is possible to account for all use occurring on a river. Relatively simple situations having limited access, uncomplicated jurisdictions, and essentially homogeneous uses lend themselves best to this approach.

A total accounting of river use is feasible when the opportunity exists for use statistics to be generated as the by-product of an existing program involving use allocation. Otherwise there must be strong justification for the effort and expense that will be required to obtain complete use data. Often it is unnecessary to attempt a complete inventory of all uses on recreation sites (James 1971).

On rivers where managing agencies have instituted trip permit or floater registration systems, excellent opportunities exist for a total accounting of use. An advantage of this arrangement is that demographic data can be obtained simultaneously and participation in activities associated with the principle uses can often be measured. The gathering of river-use statistics by permit systems is usually practical only where formal controls have been imposed for other administrative purposes. The acquisition of use data is in itself a weak justification for regulatory measures unless the data is critically needed for management decision making.

Continuous counts can also be made of river activities, principally floater type uses, by electronic and optical recording devices. Opportunities to obtain complete use data over extended stretches of river may be limited, however, by cost and logistic constraints, and by the complexity of use patterns. It may be necessary, for example, to obtain supplemental origin-destination data to resolve the problem of duplicate counts of watercraft made by recording devices at several locations on large rivers.

Use Estimation

Sampling methods can often provide acceptably accurate estimates of outdoor recreation uses at a reasonable cost. On rivers, as anywhere else, the development of a valid sampling design requires some prior familiarity with prevailing use patterns. Statistical estimates derived from sample observations can only be as valid as the rationale and assumptions that underlie the sampling procedures. Especially important is the need to identify important variables in use patterns and to stratify the sampling design to assure that these factors are accommodated in the estimate.

Direct Sampling

Direct sampling is taken here to mean the recording of selected objects or events at predetermined intervals to establish a basis for estimating the total number of occurrences in a given area during a specified period of time. The essential feature of this approach is that the object or activity being measured is *directly* recorded during the sampling procedure. Passive enumeration techniques, including human observation and remote sensing technologies, are applicable to this approach.

The chief shortcoming of direct sampling is that only the *number* of users (or vessels) is estimated. Supplemental information is required to produce a quantitative measure of many related parameters important to river managers. To illustrate, consider the task of estimating raft use on a river. Periodic sample counts of rafts can produce a reliable estimate of the number of rafts operating on a river during a given period. Perhaps this information is sufficient to meet the needs of management. However, if the concern is to document raft use in terms of user days, it becomes necessary to obtain supplemental data providing a measure of average trip duration and the usual number of occupants per raft. If additional information is desired, a compound sampling approach is necessary.

Compound Sampling

Compound sampling involves the coordinated use of two or more sampling techniques. One application requires the establishment of a statistical correlation between some *indirect* use parameter,

which can be easily measured, and the recreation activity of concern. After a proper calibration is made, measurement of the indicator can be used as a basis for projecting an estimate of the recreation activity being studied. The widely acclaimed double sampling method by James and Ripley (1963a), and used extensively by the USDA Forest Service for estimating recreation uses on forest lands, is perhaps the best known application of this approach. Axle counts, parking lot attendance, metering of utilities, and other indicators have been used as a basis for the procedure (Elsner 1970, James 1970, James and Tyre 1967). To apply the method it is necessary to establish a strong correlation between the parameter being measured and the number of participants in the activity being studied. Unless this is done, a reliable estimate is not possible. James *et al.* (1971a) noted, for example, that counts of parked cars were not a reliable indicator of fishing use on a small trout stream because vehicles owned by nonfishermen were present in unpredictable numbers. Several studies (Lucas 1964a, Gibbs 1973, Chubb and Baker (article in these proceedings)) utilized a double sampling approach to estimate use on rivers or in riverlike areas.

In contrast with dispersed-use situations often encountered in terrestrial environments, rivers lend themselves, at least theoretically, to direct measurement or estimation of recreational uses. This advantage can often be exploited through another type of compound sampling scheme to yield quantitative data on several important parameters associated with river use. The strategy is to correlate the estimated amount of river use with selected activities *directly* associated with this use. The rationale is similar to that used by fisheries managers in quantitative creel censuses. Suppose, for example, that the number of rafts operating on a river is estimated by direct sampling. Interviews made concurrently among a representative sample of raft users could produce data for correlation with the estimated level of raft use to provide a measure of overnight floater camping, stops at points of interest, and other activities directly associated with rafting. Compound sampling has great potential for estimating visitor participation in a wide range of river recreation uses.

TECHNIQUES FOR ACQUIRING RIVER-USE DATA

Reporting Systems

Mandatory floater registration requirements and trip permit systems afford the ultimate opportunity for gathering and compiling complete use statistics. Several State and Federal agencies have instituted such programs on portions of the Colorado, Green, Salmon, Allagash, and Youghiogheny Rivers, to mention a few. Permit systems are administered on some rivers in cooperation with commercial outfitters or concession operators, an arrangement that can substantially reduce cost and administrative burdens on the managing agency. On the Allagash Wilderness Waterway in Maine, a user fee was recently incorporated into the registration system to partially defray administrative and maintenance costs (Cieslinski 1976).

The potential for comprehensive use data to be obtained through mandatory permit systems is perhaps best illustrated by Lime and Buchman (1973) who developed recreation-use statistics for the Boundary Waters Canoe Area in Minnesota. By analyzing travel permits issued to recreationists entering the area, the authors developed 64 tables and figures presenting information on group sizes, time and place of entry, camping trends, watercraft use, etc. Back Country Use Permits have similarly been used to document both terrestrial and river recreation on portions of the Rio Grande River (Ditton *et al.* 1976). Noncompliance with permit requirements has not been a major problem on rivers where the managing agencies have been able to maintain effective access control. However, methods have been devised for measuring noncompliance and adjusting use estimates where necessary (Lime and Lorence 1974).

Voluntary registrations have been used only to a minor extent for documentating use on rivers. The main difficulty with this method is that incomplete responses hamper the development of reliable use statistics. Hayden (1974) was able to verify an approximate 50 percent

response to a voluntary registration among private floaters on the Snake River in Grand Teton National Park, hence, a projection could be made for this category of users. Self-registrations have worked satisfactorily for estimating visitor use at developed sites on forest lands (Wagar 1969). Thus, voluntary registrations may have potential for wider application to river-use estimation if accurate calibrations can be established between recreation uses and registration responses.

Survey Techniques

Survey techniques have been widely used to secure data about river users and their participation in selected recreation activities. Included in this category are ground and aerial observation techniques, interviews, and survey questionnaires. Survey methods can be applied as the exclusive means for obtaining information, or they may be used in combination with counting devices.

Human observation, perhaps the most fundamental means for obtaining basic use data, has been relied upon in several studies. Hayden (1974) placed observers at two access points to record floater use on one heavily used portion of the Snake River. In a recent study on the American River Parkway in California, observations of recreation users were recorded by clerks walking or riding bicycles at 14 selected locations (U. S. Army Corps of Engineers 1976). This study relied on a Latin-square sampling design to inventory 12 categories of recreation use along 23 miles of river.

Recreation investigators have also relied heavily on visitor interviews as a means for obtaining quantitative river-use information. In many instances this has been done in conjunction with other data-gathering techniques. Interviews were used in combination with mechanical axle counters by Lucas (1964a) to estimate canoe use on the Quetico-Superior Wilderness, and by Chubb and Baker (article in these proceedings) during their investigation of recreational uses of the Pine River in Michigan. In other river-use studies, interviewing techniques have been supplemented with observations made from fixed-wing aircraft (Seitz and Dahlgren 1975, U. S. Army Corps of Engineers 1976). Similar techniques have been used to estimate recreation activities on reservoirs (James *et al.* 1971b). Aerial observations have also been recorded with the aid of photographic techniques (Kreig 1969). Some excellent work involving interview techniques has been done by Fleener (1971, 1975, 1976) to estimate recreational uses on portions of the Platte, Grand, and Mississippi Rivers. Fleener's use of a probability sampling scheme illustrates how interviewing techniques can be applied to measure diverse uses on complex river systems. Interviewing techniques were also used in a recent study of recreation uses on the Atchafalaya River Basin Floodway in Louisiana (Soileau *et al.* 1975), where more than 90,000 persons exiting through survey stations were contacted during the 3-year study.

Voluntary questionnaires have been used with modest success to obtain quantitative river-use data. James *et al.* (1971a) obtained an impressive 77 percent return of questionnaires placed on the windshields of cars belonging to trout fishermen along a small stream in South Carolina. This response was obtained with the aid of a questionnaire return box located nearby.

Remote Sensing Technologies

Much interest is developing in the application of remote sensing techniques for measuring river use. Mechanical, optical, and electronic devices are particularly effective for inventorying floater types of recreation. That is, automated systems seem best suited for recording traffic at specific points along river corridors.

A comprehensive review of remote sensing technologies and their applications in outdoor recreation research was made by Schell and Taft (1972). They concluded that aerial sensors, such as satellite systems and high altitude instrumentation, show little promise for providing data useful to recreation managers, the principal shortcomings being poor image quality and sampling disruptions caused by unpredictable weather. Ground sensors were believed to have potential for recreation data gathering, but high cost was cited as an obstacle to wide-

spread use of sophisticated electronic sensing systems. Hogans (1976) has made an excellent review of the current literature on remote sensing applications in outdoor recreation research, particularly photographic techniques.

Electric-eye devices have been used experimentally for counting watercraft or their occupants on several rivers, including portions of the Brule[1] and Upper St. Croix Rivers[2] in Wisconsin. Although the USDA Forest Service has successfully used electric-eye devices to count canoeists on several Michigan Streams[3] such devices have generally been plagued with problems of reliability and false counts. Several investigators reported equipment failures during operation or complained of inaccuracies caused when vessels running abreast were not counted.

For several years the Bureau of Land Management has used a commercially manufactured system relying on an electric-eye sensor to activate a movie camera. The device has been used to monitor river traffic on portions of the Green River in Utah.[4]

Time-lapse cameras have been used successfully to record recreational use on several rivers. Excellent results were reported by Marnell (1975) in the application of a modified super-8 mm movie system to record floater traffic on portions of the Current and Jacks Fork Rivers in Missouri. Similar results have been achieved by the USDA Forest Service on sections of the Eleven Point, Piney, and North Fork Rivers in Missouri.[5] A time-lapse camera system has also been used experimentally on the Buffalo National River in Arkansas (Babcock 1976). Sohn (1968a, b) and Haugen and Lenning (1970) utilized 8-mm time-lapse photography to record recreation activities on selected Iowa Lakes. Several studies of recreational and commercial vehicle activities on forest lands have also involved the use of time-lapse camera systems (Besse *et al.* 1974, Hogans 1976, Murphy 1973).

A sophisticated playback system for interpreting data recorded on super-8 films was recently described by Gasvoda and Besse (1975). Their automated traffic classifier consisted of a coded keyboard for tallying up to 10 categories of commercial and recreation vehicles projected on 8-mm film. Development of a similar system for use by river investigators could substantially increase the utility of time-lapse systems for counting and classifying traffic on rivers, especially those receiving intensive watercraft use.

Time-lapse camera systems offer several distinct advantages. The equipment is compact, relatively inexpensive, and can be located a sufficient distance from rivers to provide reasonable security. Traffic can be counted and classified, and watercraft moving upstream can be tallied separately from those going downstream. Another useful feature is that a time display can be incorporated into camera systems to show the distribution of traffic in time. With available films, 8-mm camera systems are useful only during daylight hours. However, this is not a serious limitation in most situations because rivers are used mainly during daylight hours. Possible invasion of privacy by photographic surveillance techniques has concerned some agencies (Marnell 1975). Hogans (1976) argues that such concerns are largely unwarranted as long as reasonable discretion is used in the application of camera technologies.

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[1] *Personal communication with Dr. Thomas A. Heberlein, Department of Rural Sociology, Univ. of Wisconsin, Madison, September 17, 1976.*

[2] *Personal communication with Mr. Henry Hughlett, National Park Service, St. Croix National Scenic Riverway, St. Croix Falls, Wisconsin, September 13, 1976.*

[3] *Personal communication with Mr. Dave Foster, USDA Forest Service, Huron-Manistee National Forest, Cadillac, Michigan, August 3, 1976.*

[4] *Personal communication with Mr. Don Duff, Bureau of Land Management, Salt Lake City, Utah, September 13, 1976.*

[5] *Personal communication with Mr. Marsh Lefler, USDA Forest Service, Mark Twain National Forest, Rolla, Missouri, September 10, 1976.*

Super-8 time-lapse photography has demonstrated considerable potential for river-use studies and further development of this technology appears well justified.

CONCLUSIONS

Recreation-use monitoring on rivers is a new endeavor. Because river corridors are physically diverse and varied in terms of the recreation they support, it is inappropriate to generalize about the application of use-measurement techniques. Specific methods must be evaluated individually in the context of their applicability and effectiveness under a given set of conditions. Rivers characterized by uncontrolled access, fragmented jurisdictions, and diverse recreation uses clearly require more sophisticated procedures for acquiring use data and impose correspondingly greater cost and logistic burdens than simple well controlled rivers.

Significant gains have been made in river recreation monitoring, but much room remains for improvement, particularly in reducing cost. Greater precision is needed for estimating use in complex river settings. This matter warrants high priority because many rivers designated or proposed for State river systems are extremely complex in terms of ownership, access, recreation patterns, and other factors that make use monitoring difficult. Improved sampling designs are needed to cope with a host of complications, including uneven distributions of use in time and space, complex activity patterns, and multidirectional traffic situations. Activities incidental to primary recreational uses are also becoming important management considerations that require data.

There is a need to improve automated counting devices for broader application in river environments, particularly time-lapse photo-surveillance systems. The potential usefulness of camera technologies is grossly underdeveloped. One caveat, however, is that remote sensing technologies should be used discretely. Unfavorable public reaction could eliminate a useful strategy for obtaining river-use data.

Finally, it is important for investigators to disseminate information concerning the application of new techniques for measuring river use. Developments in remote sensing technologies and advancements in sampling design especially should be reported.

RIVER RECREATION POTENTIAL ASSESSMENT: A PROGRESS REPORT

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ABSTRACT.--In the past, most river recreation was managed from the viewpoint of rectangular land areas rather than complete river systems. Managing from a river-oriented viewpoint gained momentum with the passage of the federal Wild and Scenic Rivers Act but no widely adopted method of assessing river recreation potential has yet been developed. Several approaches to potential assessment are summarized. The RIVERS Method, which is being developed by Michigan State University in cooperation with the North Central Forest Experiment Station, involves assessing 67 variables for each mile of river and evaluating the potential for 16 recreational activities.

APPROACHES TO PLANNING THE RECREATIONAL USE OF RIVERS

Society has recognized the recreation potential of rivers for many years. Public parks, private estates, summer homes, and a variety of commercial enterprises have been located on rivers in order to take advantage of the various psychological and active recreation amenities inherent in river environments. However, until recently, most individuals and agencies approached the recreational use of rivers in terms of limited rectangular land areas rather than river systems. Even today, there are many instances where river recreation is planned, developed, and managed with little or no thought for consequent downstream problems or upstream situations that may affect such use. Many planners and land managers still tend to think only in terms of a particular campground, park, or ranger district. Some recreation potential assessment procedures, such as the USDA Forest Service's recreation inventory, evaluate river potential by administrative unit. Unfortunately, the development of even one facility such as a launching ramp or logging road by one adminsitrative unit can drastically affect the recreational use of the river at other locations. Similarly, policies regarding the types and amounts of recreational use permitted on one stretch of river often influence the recreational environment on other stretches. The rectangular viewpoint, therefore, can easily lead to user conflicts and unwise use of resources especially as participation increases.

River recreation planning and management based on a river-oriented viewpoint is generally much more satisfactory than planning or management founded on the traditional rectangular approach. River-oriented methods treat the river as a system rather than focusing on a particular tract or administrative unit. Individuals and sportsmen's clubs owning salmon or trout streams have long recognized the importance of controlling water quality and flow by watershed management. More recently, recreation values have been investigated on a watershed basis in the planning and management procedures of such organizations as the Tennessee Valley Authority, the U.S. Soil Conservation Service, and Ontario's river valley conservation authorities. However, in most of these cases, water control was the primary objective and recreation was considered a secondary benefit. Then, in the late 1960's, came the first large-scale attempts to preserve and manage rivers as

units because of their scientific and recreational values. Congress passed the Wild and Scenic Rivers Act in 1968 authorizing a national river protection program and many States followed with legislation that permitted protection of rivers with State-wide significance. River-oriented planning and management of waterways for recreation was receiving recognition at last.

RIVER RECREATION POTENTIAL ASSESSMENT METHODS

Although some agencies started to plan and manage river recreation from a river-oriented viewpoint more than 25 years ago, river recreation potential assessment is still in its infancy. Most evaluations have been for a particular site (such as a river-based State park site), for a specific administrative unit (such as a ranger district), or for one or two recreation activities (such as canoeing and camping). No large scale quantitative assessments involving a full spectrum of activities have taken place. This is unfortunate considering the great potential offered by rivers because of their wide distribution, the extensive range of water-dependent and water-related recreational activities that they can support, and the high carrying capacity of the water-land interfaces involved.

Techniques for objectively and quantitatively assessing their recreation potential are particularly desirable today when so many national, State, and provincial agencies are attempting to classify rivers. If many sizable river systems have to be classified, some type of numerical evaluation procedure is the only satisfactory approach. In this age of cost-benefit analysis and zero-based budgeting, planners and land managers can scarcely expect to defend plans for classifying and managing rivers on the basis of qualitative generalities; they need comprehensive quantitative support for their selections and priorities. It is no longer sufficient to announce in public hearings, environmental impact statements, and budget documents that a particular river is beautiful and should be preserved! Legislators, administrators, and citizens are expecting more these days and are unlikely to support classifications, rankings, and management plans that are not adequately supported by careful numerical analyses.

However, the absence of any widely recognized numerical evaluation technique is a problem. Most river evaluations are still being made on the basis of visits to selected sites or floating down and making brief qualitative notes on what is seen. This situation is rather like the early days of timber buying in the Great Lakes area when the "land lookers" or "timber walkers" travelled through the forest gathering visual impressions and then advised their bosses what to buy. Just as forestry found it necessary to develop more reliable forest inventory procedures, so modern recreation planning and management needs systematic quantitative appraisal of complex recreation resources. During the past decade considerable progress has been made in developing such techniques for river recreation potential assessment.

The Craighead's Assessment Method

Probably the earliest systematic quantitative approach was developed by Frank and John Craighead in the early 1960's. Their evaluation system considered the potential for three activities: boating, hunting, and fishing. Ratings were based on scores for 12 variables for boating and hunting and 13 variables for fishing (Craighead and Craighead 1962). The scores possible for each variable were from 0 to a maximum of 3, 4, or 5 depending on the variable. Scores were then summed for each activity and the totals used to indicate a river's comparative suitability for that type of recreation. No weighting of one variable relative to others was employed other than the weighting inherent in establishing the scoring criteria and in setting maximum values at 3, 4, or 5.

The Leopold Assessment Method

Luna B. Leopold's method was designed to quantitatively evaluate and compare the esthetic quality of rivers in order to justify the designation of unique sections that deserve preservation (Leopold and Marchand 1968 , Leopold 1969b). He did not make evaluations for individual recreation activities but considered his esthetic evaluations were an indication of recreation potential.

Three groups of factors were considered in the Leopold method. One group was physical factors including valley topography,

river width, and water velocity. Another group consisted of biological factors such as surrounding vegetation, animals in the area, and the flora and fauna of the river itself. Leopold's third group was called human use and interest factors and included such items as land use, accessibility, and historical sites. He felt that unique landscapes were of greater significance to society than common landscapes so he used his evaluation scores to produce a uniqueness ratio based on how infrequently such conditions existed. This method has been criticized for not considering more factors, for employing an unnecessarily complex calculation procedure, and for producing unrealistic uniqueness values (Hamill 1974 , 1975). However, Leopold's work was used as a starting point in many subsequent studies such as Juurand's (1972b) work on classifying Canadian wild rivers and Libby's (1975) examination of the recreation potential of certain New Brunswick rivers.

The Dearinger Assessment Method

Both the Craighead and Leopold methods were developed for use on remote rivers in mountainous areas of the West. The first significant study in a more developed eastern environment was Dearinger's (1968 , 1971) investigation of the recreation and esthetic potential of small streams in Kentucky. He made his evaluation in two steps. First, the stream was rated for 92 natural and cultural variables and second, these ratings were used to develop scores for each of 16 recreational activities. Only the rating values for appropriate variables were used in developing each activity score, each rating value being multiplied by a weight based on the relative significance of the variable to the activity. The comparative suitability of each stream for an activity was then calculated by expressing the total score as a percent of the total possible score.

The Morisawa Assessment Method

A comparative study involving both eastern and western rivers was done by Morisawa (1971). She made extensive field observations including detailed transects of the main stream and main tributaries, and a reconnaissance survey of the entire watershed while rating a river for its recreational and esthetic quality. In order to reduce the number of activities, she grouped them into three classes: active outdoor recreation, active water recreation, and nature observation and interpretation. Each transect was classified for each group of activities into one of four categories--(1) most or all activities in the group possible year round, (2) most or all possible seasonally, (3) some activities in the group possible year round, and (4) some possible seasonally. Esthetic quality was measured by rating such features as vegetation, relief, water appearance, pollution, and litter on a 5-point scale. In a subsidiary project, an attempt was made to develop empirically based values for esthetically important features by showing 45 color slides of river scenes to 500 individuals and asking them to evaluate their beauty on a 6-point scale.

MacConnell and Stoll Assessment Method

A very different approach was used by MacConnell and Stoll (1969). They assessed the recreation potential of the Connecticut River by mapping land use from aerial photographs. The uses classified were 9 types of agricultural land or open space, 6 types of mining land, 12 urban types, 14 recreation facility types, and 26 riverbank and rivershore types. They also considered accessibility, picnic and camping areas, scenic overlook sites, aquatic vegetation, physical obstacles in the water, and other factors affecting recreation participation.

Other Assessment Methods

The studies outlined above are those that we found of greatest relevance in developing an approach to river recreation potential assessment. However, there are many other studies and planning procedures that include useful ideas such as the USDA Forest Service technique for making forest-wide inventories of recreation potential (U.S. Department of Agriculture 1972), the Northern Region's method of using portions of valleys as "recreation experience units" when assessing recreation opportunities in the Rocky Mountain area (U.S. Department of Agriculture 1974b), and Olson's (1969) use of aerial photographs to estimate boating, swimming, and camping potential on township-sized areas.

The experiences of some of the States and Provinces in developing classification systems are also relevant. More than 25 now have classification systems and 9 use numerical scoring methods. However, most systems are simple techniques based on general esthetic appeal and impressions concerning suitability for canoeing. The Bureau of Outdoor Recreation is developing a method of evaluating rivers for inclusion in the national Wild and Scenic Rivers system but it, too, is based more on the esthetic and heritage values of rivers than on detailed analysis of potential for a variety of recreational activities. In Ontario, the Ministry of Natural Resources is developing a technique for assessing river corridors as possible sites for a new type of provincial park called a waterway park (Ontario Ministry of Natural Resources 1976). It involves rating a possible location for 17 variables on a 5-point scale. These variables include the time it takes to canoe the proposed stretch, navigability, diversity of conditions, carrying capacity, water quality, and conflicting activities. Further discussion of relevant methods is contained in a thesis by Bauman (1976).

DEVELOPMENT OF A DESIRABLE METHOD FOR THE USDA FOREST SERVICE

In 1975, the Department of Geography, Michigan State University, began a study of river recreation potential assessment methods for the North Central Forest Experiment Station. The basic goal was to develop a method that could be used to objectively classify rivers and plan their recreational use over large geographic areas such as a national forest or State. The technique selected would therefore have to be applicable to a wide range of rivers from wild rivers in remote mountain regions to placid rivers in agricultural and urban areas. After careful examination of previous methods, discussions with a number of agency personnel, and some preliminary field work, we developed an approach called the RIVERS Method (*R*iver *I*nventory and *V*ariable *E*valuation for *R*ecreation *S*uitability). This technique was then given a limited field test on four sections of three different rivers in Michigan during the summer of 1975. We are now planning a much more extensive field test of a modified RIVERS Method. These tests will involve practical application of the technique by agency personnel at a number of locations in the United States and Canada.

BASIC FEATURES OF THE RIVERS METHOD

The method has five basic features that, in combination, distinguish it from previous techniques: (1) it evaluates river environments for 16 different recreational activities, (2) this evaluation involves a broad range of pertinent natural and cultural variables, (3) it is applicable to rivers of all types from precipitous torrents in remote wilderness regions to slow-flowing rivers in highly urbanized areas, (4) it uses computer programs to facilitate computations, and (5) it permits quantitative comparisons between rivers of various types or between segments of the same river or different rivers.

Office Inventory

The first step in the RIVERS procedure is to gather all available pertinent information regarding the river to be studied. A key item is a set of suitable aerial photographs. Good quality color-infrared photographs at a scale of 1:36,000 or larger is desirable but conventional panchromatic black and white or infrared black and white are acceptable. The river is then marked off in 1-mile long segments measuring down the center line of the river. As much data as possible is then compiled on a separate inventory form for each segment. The variables included on the inventory form are as follows:

Basic Physical Features
- width of river
- site development potential
- apparent stream velocity
- floatability
- flow fluctuation
- seasonality
- stream bed materials
- dominant river pattern
- water surface pattern
- bank erosion

Special Physical Features
- ponds
- sandy beaches
- oxbow lakes
- immediate bank height
- bayous
- islands
- navigational obstructions

General Water Quality
- turbidity
- temperature
- bottom solids
- floating solids
- bacteriological condition
- chemical pollutants
- pesticides
- odor

General Soils Limitations for Recreational Use
- conditions that limit dryland activities such as camping

Biological Features
- algae
- water plants
- fish
- waterfowl
- land flora
- game animals
- other animals
- other birds

Land Use
- general land use
- historic sites
- public ownership

Esthetic Features
- scenic variety
- general beauty
- unique features
- remoteness
- trash
- detrimental structures

Accessibility
- roads, trails, ownership, and other aspects of accessibility

More details concerning variable specifications and a copy of the inventory form are part of our final report to the Forest Service (Chubb and Bauman 1977). Most of the data are concerned with features within the "river corridor"--an area we defined as extending ¼ mile on either side of the center line of the river. Most of the variables are scored on a 5-point scale with the higher numbers assigned to conditions favorable to recreational use. Some variables can be rated in the office by stereoscopic interpretation of the photographs. Others such as water quality and ownership can be rated from agency reports and maps.

Field Inventory

The second step is to float the river and complete the inventory by field observation. An ideal arrangement for small- and medium-sized rivers is a three-man party. The observer uses the air photographs and topographic maps to establish their position and checks the inventory sheet as they proceed down each segment.

Data Analysis and Evaluation

When all the data have been recorded on the inventory forms and carefully checked, the field crew turns in the forms for the analysis and evaluation phase. The information is punched on data processing cards and used as an in-put to our RIVERS computer program. At present, the program is designed to make simple arithmetic calculations for each of the following 16 recreational activities:

- Bank fishing
- Boat fishing
- Canoe camping
- Driving for pleasure
- Hiking
- Hunting
- Nature study
- Picnicking
- Power boating (10 h.p. or more)
- Small craft boating (under 10 h.p.)
- Social canoeing
- Swimming
- Trail camping
- Vehicle camping
- Waterskiing
- Wilderness canoeing

First, it selects the variables that are appropriate for evaluation of the river's potential for a particular recreation activity; for example, only 41 of the 67 variables for which a rating is recorded are used in assessing the potential for hunting. Values for the selected variables are then "transformed" depending on whether or not a variable has a positive or negative correlation with the activity concerned; for example, rapids are generally regarded as positive for wilderness canoeing but negative for boating with large boats. In the next step the transformed values are multiplied by numbers (termed "weights") that reflect the importance of each transformed variable in determining the feasibility of each activity.

Finally, the program sums the weighted scores for each variable and expresses the total as a percent of the maximum possible. The percents are then compiled into a matrix by activity and river segment and plotted

on a map. At present, we are using manual mapping procedures but, when further field tests of the inventory technique have been completed, a computer mapping routine will be developed. Eventually, when a number of typical rivers in various classifications have been evaluated, the computer program will be extended to include classification of the river as a whole and by major sections, and the calculation of a ranking in relation to other rivers in the same class.

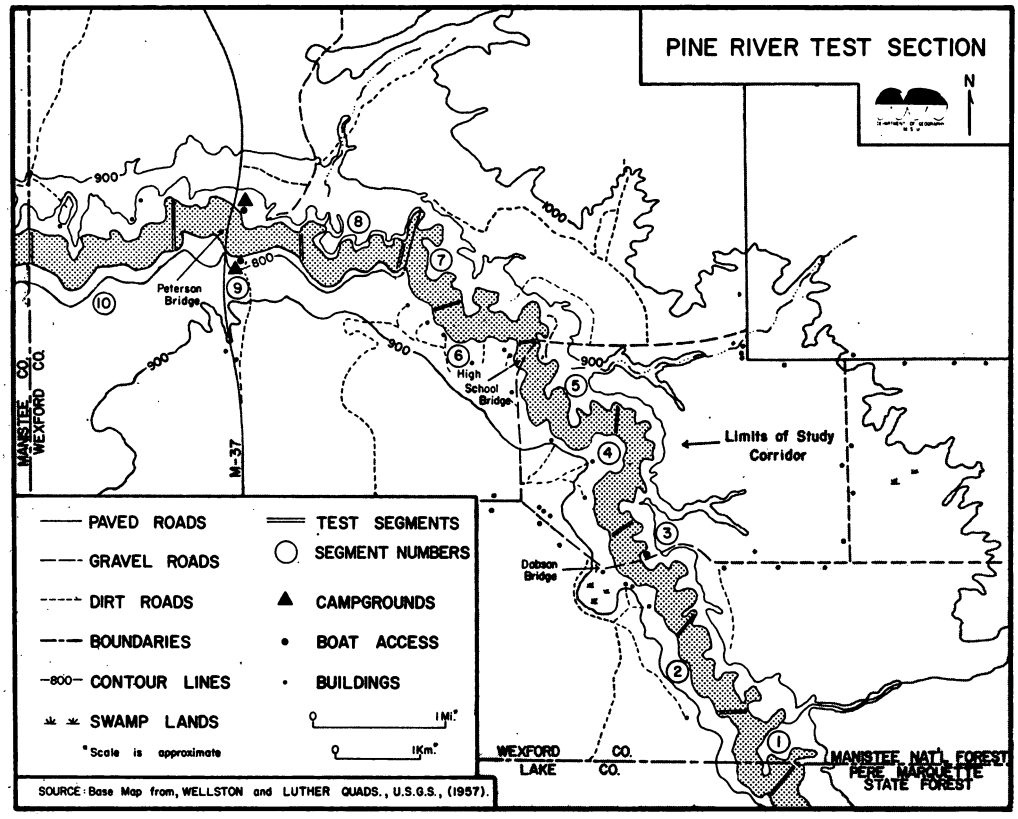
Test Rivers

We made an initial test of the RIVERS Method by gathering and analyzing data for four sections of three Michigan rivers. One 10-mile test section was on the Pine River near Cadillac in Wexford County (fig. 1). Two 11-mile sections were on the nearby Manistee River. Both the Pine and the Manistee Rivers run through the Manistee National Forest and are well-known canoeing rivers. However, we were looking for a variety of conditions so a section of the Manistee that is severely affected by water discharge from a power station and a relatively flat section near the mouth were selected. The fourth test section on the Looking Glass River was 10 miles long; it flows through agricultural land with considerable streambank housing development and is within 10 miles of the Lansing-East Lansing metropolitan area.

CONCLUSIONS CONCERNING A DESIRABLE METHOD

From our experiences in developing and testing the RIVERS Method we came to the following conclusions regarding the features that are necessary for a technique to be effective in classifying and planning the recreational use of a large number of rivers.

Figure 1.--*Diagrammatic map of the Pine River test section showing the river corridor and 10 segments*



Number of Recreational Activities Considered

After careful examination of previous methods and experimentation with several groupings of activities, we concluded that the only practical approach was to treat all the principal uses of rivers as separate activities. One of the problems of managing popular rivers like the Pine River is the conflicts between the resource needs and behavior patterns of the various user groups. For example, on such rivers the canoeists conflict with the fishermen. Omitting either of these activities is certainly not appropriate and combining them into a group hides the conflicts and suggests there are no differences in resource needs. Similar problems occur with other types of rivers and activities if omissions or groupings are attempted.

Number of Variables Included in Inventory

Although one instinctively wishes to reduce the number of variables included in the inventory, our experiences did not indicate that the elimination of one or more is practical at this stage. The variables are numerous and complex but so are the recreational uses of rivers and the interrelations between the resources and user behavior. When more rivers have been assessed, it may be possible to empirically determine the relations between river features and recreational use. Behavioral studies may also assist in establishing these relations if they are sufficiently comprehensive. In the meantime, rivers are being classified, planned, managed, and, in some cases, abused so the use of intuitively developed inventory variables is the only solution.

Scoring and Weighting Procedures

The five point scoring system worked satisfactorily in the field; little difficulty was experienced in deciding which score should be assigned for a particular variable. However, the scoring and weighting procedures were developed intuitively and will also benefit from further experience with the method and data from comprehensive behavioral studies. We found, for example, that in some cases the negative effects of low-lying poorly drained soils did not reduce the scores for river bank activities as much as conditions warranted. Accessibility and navigational obstructions also did not have as strong an influence as desirable. Another problem was an apparent lack of differentiation between the potential for some activities on high quality rivers compared to low quality rivers. We plan to include evaluation of sample stretches of lower quality urban rivers in future field assessments in order to determine what alterations in the scoring or weighting are appropriate.

Assessment of Entire River and Segment Length

We found that the use of transects or sample segments is not satisfactory. For example, canoeing and boating are greatly affected or even eliminated by river obstructions; if a small river runs through heavily wooded terrain, it is often difficult or impossible to assess river navigability from aerial photographs because of the foliage or deep shadows. If only certain parts of the river are assessed by field inspection, it may be over-rated for navigability.

We found that the mile-long segments worked well. Although longer segments would reduce the number of inventory forms and simplify all phases of the analysis, retention of visual impressions and agreement on assessment scores often became difficult if segments were longer than 1 mile. On the other hand, use of shorter segments slowed down the assessment process and greatly increased the duration and cost of analysis without adding significantly to the apparent validity of the ratings.

Quantitative Significance

We have no illusions about the quantitative significance of assessment scores obtained by the RIVERS Method. We found it difficult not to include complex and precise measurements such as averaging a series of rangefinder readings to obtain channel width or using a secchi disc to measure water turbidity. However, the objective is to evaluate many rivers in a short time and any method that meets these specifications is bound to involve

numerous approximations. The final evaluation scores, therefore, are not precise values. Rather, they are quantitative generalizations of the type made in classifying climates or calculating site indices. The reliability of the method is thus primarily a matter of how consistently different observers arrive at approximately the same scores for a particular river segment. This will be tested more extensively in the future but fieldwork to date leads us to believe that the method produces reasonably consistent scores.

Applications

In addition to facilitating decisions regarding the recreational use of rivers flowing through forest lands and the classification of rivers under National, State, and Provincial programs, numerical assessments such as the RIVERS Method have a number of other potential uses. They would be helpful in preparing environmental impact statements for projects involving river land such as the building of dams, channel improvements, or riverside highways. In such cases, it may prove possible to stimulate what would take place if an inventory was performed following completion of such projects and produce anticipated final recreation potential scores. Comparison of the latter with the current scores would give a quantitative impression of the probable impact. Another possible use would be to demonstrate the effects of decreasing water pollution or the changes resulting from improved urban river environments. In any event, use of such quantitative evaluations will draw attention to the recreation potential of rivers and should result in more careful allocation of these valuable recreation resources.

FURTHER DEVELOPMENT

During the next phase of developing the RIVERS Method, we plan to address the problems mentioned above and also include some other secondary investigations. A limited experiment on the Pine River indicated that 35 mm color photography from a light aircraft may be useful especially where no other suitable air photographs are available; this will be investigated further. We also plan to study the possibility of including more extensive consideration of carrying capacity in the inventory and analysis procedures. However, field testing the method on a number of different kinds of rivers will be the main objective of future work.

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ALTERNATIVE STRATEGIES FOR STUDYING RIVER RECREATIONISTS

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ABSTRACT.--Recreation researchers have a variety of social research tools available to them. Often, however, the application of alternative tools in studying recreation issues is inconsistent with the relative strengths and weaknesses of the procedures. Alternative research strategies are discussed in terms of their ability to provide information to answer basic questions about recreationists and recreation problems. Implications for planners, managers, and policymakers are addressed.

Understanding recreational problems and the motives, preferences, values, and behavior patterns of recreationists is an important concern for recreation managers and researchers. Such understanding is essential for identifying the consequences of alternative recreation management strategies.

Recreation researchers have a variety of social research tools available. Often, however, the application of alternative tools in studying recreationists and recreation problems is inconsistent with the relative strengths and weaknesses of the procedures. The need for accurate, unbiased information is essential for the development of effective recreation policies and management schemes. Therefore, recreation planners, managers, and policymakers should be as concerned as researchers that appropriate research procedures are followed.

The purpose of this paper is to describe alternatives to the traditional cross-sectional survey and present a framework for selecting *when* a specific data collection strategy may be appropriate or inappropriate. The framework allows the researcher to examine the alternatives in terms of the information they can and cannot provide. Such a framework should also prove useful to planners, managers, and policymakers because it gives a basis for evaluating whether the data developed in a study answer specific questions about recreation phenomena.

My discussion focuses on providing a general overview of when and why each approach may be best. These comments are as applicable to the study of river recreation (the subject of this symposium) as they are to any other setting. Readers interested in more detail are referred to the readily available social research methods textbooks and papers, only a few of which are referenced in this paper.

BASIC RESEARCH QUESTIONS ABOUT RECREATION BEHAVIOR

Two fundamental types of questions that researchers and policymakers might ask about recreation behavior are: (1) questions requiring description and (2) questions requiring explanation.

Good description is the key to understanding and is often neglected in social science research. Three basic descriptive questions for which researchers or policymakers might seek information are:

1. *Description of the event: What is happening, when, where, and how much?* Answering this question involves a basic description of the event being studied. For example, the researcher may want to know how extensive river use is and how

it varies from location to location or by time or season.

2. *Description of the participants: Who is involved?* Describing the social, physical, and psychological characteristics of the persons involved in the event under investigation will answer this question. For example, who rafts? The young? The old? The highly educated? Groups or individuals?

3. *Description of preferences: What do people prefer?* Most people make a variety of choices daily in keeping with their personal values and goals. Describing the various preferences for types of recreation--for example, desirable developments, acceptable management procedures--is central to both understanding and providing for recreation opportunities.

After a phenomenon has been adequately described, the next step is to explain why it occurs. Two general questions relating to the explanation of a phenomenon are:

4. *Explanation of an event: Why is it happening?* This involves an explanation of the phenomenon in terms of either participant motivation or various components of the environment. For example, can visits to a specific river be explained by the user's desire to be there, or by the fact that few alternatives exist for that kind of experience? Why do people choose one area over another? Why do they continually violate well-posted rules?

5. *Explanation of change: How can behaviors be modified or changed?* Answers to this question are often necessary for producing desirable results in recreation areas as well as other areas. Changing (or maintaining) a certain behavior is often the desire of the resource manager who may be faced with problems of overuse, litter, vandalism, sanitation, conflicting uses, or intolerable resource damage. Information provided in answer to earlier questions is often essential in preparing a study to answer this final question. Examples include: How can littering or vandalism be prevented along rivers, and what procedures will effectively disperse users along popular stretches of streams?

RESEARCH DESIGNS AND DATA COLLECTION STRATEGIES

In preparing a study to answer one or more of the above questions, the researcher must choose from a variety of research designs and measurement strategies. A research design is the basic framework within which data are collected; that is, are the data about the same population collected only once (cross-sectional design) or more than once (longitudinal design)? Or does the investigator attempt to determine "cause and effect" relations through some control procedure (experimental design)? Measurement strategies are the various procedures by which data are collected. Does the researcher look for himself (observation) or are subjects asked to speak for themselves (self reports)? Any study is a combination of a research design and measurement strategy; for example, a cross-sectional survey, a longitudinal observation study, or an experimental design using direct observation as a measurement strategy.

Research Designs

1. *Cross-sectional.*--This design is characterized by one measurement of the phenomena in question across a segment of the target population. It allows for intersubject comparisons on the characteristics or behaviors measured.

2. *Longitudinal.*--This design allows for measurement of attributes or behaviors within a target population two or more times (also known as panel or time-series studies). It allows for intrasubject as well as intersubject comparisons over time.

3. *Experimental.*--This design is characterized by some sort of manipulation or control procedure by the investigator and an evaluation of its effect on the phenomenon in question--did the manipulation result in any change in attitudes or behavior?

Measurement Strategies

1. *Observation.*--Observation refers to systematic techniques for observing, recording, and evaluating behavior. Such observation follows specific procedures and is much more exhaustive and objective than casual observation done in the

course of normal events by both managers and participants. There are three methods for observation: direct observation of events as they occur, observation of traces of behavior, and participant observation.

2. *Self reports from subjects.*--The subjects under study can be asked to report the desired information to the investigator. Essentially, this requires the subjects to "observe" their own characteristics, behavior, or feelings about what they do or events that go on about them. The tools used in this approach are surveys (interviews or questionnaires) and diaries.

ADVANTAGES AND DISADVANTAGES OF ALTERNATIVE RESEARCH DESIGNS AND MEASUREMENT STRATEGIES

From the researcher's perspective, answers to all five basic research questions are important for an understanding of a particular recreation phenomenon. Practically, however, some questions may be more important than others. Managers, for example, are often concerned with maintaining or modifying certain behaviors (question 5). Unfortunately, no single combination of a research design and measurement strategy will provide data to answer these questions. The method of study must be selected with two criteria in mind: (1) Will it provide reliable and valid information to *directly* answer the questions? (2) Will it provide the information efficiently?

Table 1 summarizes the relation between the basic questions and alternative research designs and measurement strategies. The basic assumption is that the design and measurement strategy is acceptable *only* if it can provide valid and reliable data to answer the question directly. Therefore, conjecture and inferences based on data collected to answer other questions may not be appropriate for judging the utility of the method under consideration, particularly if there is a better alternative.

Readers should refer to table 1 during the following discussion about the advantages and disadvantages of alternative research approaches.

Alternatives for Questions of Description

The Cross-Sectional Survey

The cross-sectional survey is the standard social science tool used in most recreation research. Indeed, it is the most common method used in all social science research. The pros and cons of using this method are presented first to serve as a baseline for comparing the other methods.

Three kinds of information are typically sought in a survey: (1) Respondents are asked to recall their past behavior (or to predict future behavior); e.g., how many trips they've taken to a certain river. (2) They are asked to report descriptive characteristics such as income, education,

Table 1.--*Relation of research designs and measurement strategies to basic questions about recreation behavior*

Basic questions about recreationists and recreation behavior	Research designs			Measurement (data collection) strategies						
				Observation			Self reports			
				Systematic			Surveys			
	Cross-sectional	Longitudinal	Experimental	Direct	Trace	Participant observation	Behavior recall	Report of characteristics	Report of attitudes, beliefs, etc.	Diary (log)
Description:										
1. What is happening--when, where, how much?	X	X		X	X	X	(X)			X
2. Who is involved?	X	X		X	(X)	X		X		X
3. What is preferred?	X	X	X	(X)	(X)	X	(X)		X	(X)
Explanation:										
4. Why is it happening?	(X)	(X)	X	X[1]	X[1]	X			X	X
5. How can it be maintained or modified?			X	X[1]	X[1]	X[1]	(X)[1]			(X)[1]

[1] Appropriate within an experimental design.
X = Acceptable alternative--provides data to directly answer the question.
(X)= Acceptable under limited conditions.

age, sex, place of residence, and similar items. (3) They are asked to report individual psychological states, attitudes, preferences, and beliefs about such things as wilderness, rivers, recreation, and society. Items like "I believe there is a crowding problem along the river; I prefer solitude at my campsite; or I think people should pick up the litter of a friend"; are examples of such measures. Each of these types is examined below.

1. *Behavior recall.*--Behavior recall is often used in surveys to answer the questions, "What is happening?" and "What is preferred?" Because of the serious shortcoming of this approach, behavior recall is a poor substitute for other methods. Behaviors recalled on a questionnaire or interview are likely to be an inaccurate measure of actual behavior. In studies of littering, for example, more than 50 percent of people observed littering said they had not (Heberlein 1971). Several factors probably account for the discrepancies observed. A common human frailty is our inability to objectively record our own behavior even under the best conditions (Mead 1964), and particularly the motivations behind it. People may simply not know or may forget what they did or when they did it. They may think events happened more recently than they actually did. Definitional problems also may operate--asked how many times one has visited rivers in wilderness areas, a person may count trips to areas which really aren't wilderness. And, as in the case of not reporting littering behavior, people are reluctant to admit illegal or inappropriate behavior and deliberately mislead the investigator.

2. *Reported characteristics.*--Asking subjects to report various personal or group characteristics is straightforward and is usually a part of most surveys. Requesting this information is usually secondary to asking about their behavior or attitudes. Many personal characteristics, although not reported without error, are sufficiently accurate for most purposes, especially when the high cost of determining such information by other means is considered.

Reported characteristics included in a questionnaire or interview give a description of many unobservable as well as observable variables related to individuals and groups ("Who is involved?"). Whether or not this measure of "who" is appropriate depends on how involvement in the event under study was determined. If involvement is based on self-reported behavior recall data, then relations between "who" and "what" may be questionable. If, however, the investigator has some prior knowledge about actual involvement in an activity (direct observation, use registers, licenses, etc.), the sample can be restricted to those known to be involved in the event of interest. Such a description of "who is involved" is more likely to be accurate than the former. Generally, the results of broad surveys directed at an unidentified population must be viewed with caution.

3. *Reported attitudes, preferences, and beliefs.*--The focus of most surveys is on respondents' attitudes, preferences, and beliefs. This approach is not without serious problems as has been well documented in the social science literature (Heberlein 1973). Attitudes are conceptually complex and difficult to measure. An attitude survey often appears easy to carry out but in fact requires a great deal of skill in conceptualization, measurement, and analysis (Potter *et al.* 1972).

Further, it sometimes appears that attitude studies are done when people are really interested in behavior and the implicit assumption has been made that attitudes closely approximate real behavior. But, there is little evidence of a direct effect of attitudes on behavior (Deutscher 1966, Hancock 1973, Heberlein 1973, Wicker 1969). Wicker's (1969) study showed that attitudes predicted real behavior only 10 percent of the time.

A basic question for which attitude studies are appropriate is, "What do people say they prefer?" From a carefully conducted attitude survey of the appropriate population, a manager may accurately assess what people say they prefer. Stankey (1973) showed how wilderness purists prefer different wilderness management policies than nonpurists do. He argued that such preferences should be taken into account in wilderness management.

Attitude studies allow people to assess and consider hypothetical alternatives which do not exist. However, this hypothetical nature of the alternatives

presents its own difficulties. We may be developing and managing recreation areas on the basis of hypothetical answers to attitude questions not representative of the real world.

Alternatives to the Cross-Sectional Survey

Alternative measurement strategies: self reports--diaries.--This self-report procedure requires that participants record their own behavior, feelings, etc., as close to the time they occur as possible. As the name implies, diaries are kept over an extended time period, such as a float trip down a river. Respondents may be asked to record their motives for doing things as well as what they did. Diaries are particularly useful for gathering information about people while they are traveling to remote locations such as along rivers or when their travel prevents easy observation. The reduced time lag, compared with that of surveys, compensates to some extent for the inaccuracy of behavior recall described earlier.

The diary approach has many of the faults of other self-reporting procedures. For example, only normative behavior is likely to be recorded completely and accurately. Inconvenience also may prompt incomplete entries. Even with its faults, the diary is a procedure that must be considered when information over a period of time is wanted. With proper instructions to the respondent, many of its shortcomings can be reduced.

Diaries can be useful for determining "what is happening". Diaries have been successfully used by State fish and game departments to study fishing and hunting activities and by researchers to study wilderness travel (Lime and Lorence 1974). Diaries should include appropriate instruction for what to record, how to enter information, and when to log the entries. Diaries are best used when the investigator can specify things he wants documented; for example, "When and where did you camp along the river?" "Who were you with?" "What did you do in the evening?" "How many other boating parties did you encounter?" Requesting that "everything you do" be recorded, over even a short period of time, is usually unworkable and puts an unnecessary burden on the respondent.

Diaries can yield accurate information about "who is involved" in an event. This information about "who" is similar to that provided on questionnaires and interviews, except that the information is recorded presumably as the events occur rather than recalled later.

Alternative measurement strategies: observation methods.--(a) *Systematic observation of events as they occur.* For this form of observation, the specific events or objects under study must be well defined and directly observable. This method can be conducted by an observer who tallies specific events or notes certain objects by some prearranged coding schedule. Or it can be done by artificial surveillance such as remote cameras and other automatic recording devices. Examples of events susceptible to this approach include various human behaviors such as the amount and type of use a facility, area, trail, or river receives.

Systematic observation of actual behavior in recreation settings has several problems. First, the measure may be reactive; that is, the presence of an observer may affect the behavior under study. For example, measuring littering behavior by placing observers along a trail is likely to reduce the incidence of the behavior, because people tend to litter more when they are alone (Heberlein 1971). Therefore, even if observations of behavior are reliable, they may be invalid because of the reactive distortion caused by the measurement process itself.

A second and more serious problem for the outdoor recreation researcher is that systematic observation of actual behavior may be inefficient and expensive because some behavior is difficult to observe or seldom occurs. In remote settings it may take many hours to record a few observations because of infrequent and scattered use.

A third area of concern regarding systematic observation is observer reliability (Burch 1974). Without specific training for the observer, pretested recording schedules and instructions and continual reliability checks, a serious distortion of actual events can result. Indeed, the observer is both the strength and the weakness of this approach (Kerlinger 1973).

When events are well defined and directly observable, systematic observation will produce reliable, valid, and accurate results about "what is happening"--if the problem of reactivity can be overcome. A definite advantage of this procedure is that with proper sampling, generalizations can be made about specific individual and collective behaviors.

Systematic observation of events can also describe "who was involved". Variables such as the subject's sex, race, age, etc., can easily be recorded at the time the event is observed. The only criterion is that "who" be clearly identifiable.

Systematic observations of events as they occur can sometimes provide data to answer the question, "What do people prefer?" For example, observation focusing on where people choose to camp along a certain river may reveal a preference for locations far from other sites. However, the correlation between the presence of other sites and actual preference may be spurious. Perhaps the locations were selected because of some other quality, such as availability of sunlight or nearness to a good landing. Some other procedure (such as a survey or diary) will be necessary to clearly establish the reason for the choice.

(b) *Systematic observation of behavioral traces.* Observing the effects of previous behavior may be appropriate in some cases. Observation of traces is one way to reduce costs of direct observation and to obtain nonreactive measures because the subjects under study need not be present when data are collected. Webb *et al.* (1966) described a wide array of such unobtrusive measures.

Accretion of or buildup in environmental factors caused by human behavior are a good measure of such behavior. For example, how much litter accumulates at sites along a river? Although these measures may be unreliable because of weather factors, they are valid and relatively inexpensive. Measures of the degradation or erosion of the environment are also useful. The rates at which trails are wearing down or firewood and foliage are disappearing are measures of the amount of use an area receives. A wide array of such traces may be regularly recorded in and around a recreation area by the creative investigator.

An important difference between traces and other measures of behavior is that traces usually indicate aggregate behavior rather than individual behavior. This limits the generalizations that may be made from the resulting data. From actual observation of rafting behavior and sex of the rafters, the investigator can correlate the subjects' sex and rafting activities. Such a correlation cannot be made from traces.

When individual events need not be or cannot be observed directly to determine "what is happening", measuring their traces may be useful. By systematically observing the accretion or degradation of a variety of factors that occur as a result of recreational behavior, a measure of its impact can be determined. Such aggregate data may be sufficient for planning and policy purposes.

Trace observation can yield information about "who was involved", although validity and reliability must be seriously questioned. The presence of discarded fish bait containers and fishing gear wrappers suggests that fishermen were in the area; the presence of horse droppings or feed hay at campsites suggests that horse users were there. The precision with which such data can be measured, however, may limit its usefulness. And, because traces are a measure of aggregate rather than individual behavior, the investigator cannot determine from the above example if fishermen or horse users were the only people in the area, nor if the fishermen came on horseback. Interpreting and generalizing such data are difficult, but for some purposes, the knowledge that fishermen or horses were in the area may be enough.

Use of traces to determine "what is preferred" suffers from all the shortcomings of direct observation, plus those inherent in measurements of accretion and degradation as reflectors of previous events. This method should be used only when alternatives have been ruled out.

(c) *Participant observation.* As Campbell (1970) points out, participant observation is more than a single method of data collection and may include a variety of techniques for gathering quantitative

and qualitative data. This method is unobtrusive and relatively inexpensive. Some writers include systematic observation as a participant observer's role (Campbell 1970, Gold 1958). For the purposes of this paper, discussion of this procedure is limited to roles involving interaction with participants. That is the essence of participant observation which distinguishes it from the other forms of observation.

The method is difficult to define simply, but it generally involves the investigator directly taking part in the activity he wishes to study. The observer is able to observe his own reactions to events taking place as well as reactions of others. Through this interaction with participants and continual data processing and evaluation, the investigator can reformulate the problems as the study proceeds and look for new information (Dean *et al.* 1969).

Major disadvantages of participant observation include the possible lack of objectivity and reliability of the observer, the possibility of becoming overwhelmed with large amounts of information, reactivity if the identity of the observer is known or suspected, and insufficient information collected for generalizing because it is often subjective and incomplete. Systematic theory testing requires more rigid procedures.

Participant observation is often useful as a prelude to surveys or more systematic counting of objects, specific events, or behavioral traces. Operating as both observer and participant, the investigator can gain insights that might not otherwise be apparent. Participant observation is an excellent and efficient tool for defining the dimensions of a problem because a great deal of diverse information can be quickly generated.

In the early stages of a study, participant observation is useful for determining "what is happening" at a broad level--the range of events, type of participants, activities, problems, etc. A major advantage of this method is that the observer is often able to gain access to events, because he is involved in them and does not pose a threat to people being observed.

Participant observation gives a clear picture of "who is involved" in events that the observer sees. Finding out who was engaged in events not observed is also possible by talking with others. The participant observer often has access to information about "who is involved" because he is more readily accepted as a member of the group than a formal observer or authority. Thus, data on "who" result from what is seen and what is learned from others.

Participant observation should also be considered an important alternative in the study of "what is preferred"--particularly in the early stages of an investigation. The observer learns about preferences by several methods--his own and other people's choices (for example, where to camp along a river) and informal talks with them to determine what they prefer. Initially, participant observation may help determine the range of preferences, but a more systematic process would best determine their relative importance.

Alternative research designs :
1. *longitudinal design.*--In addition to the problems with the survey measurement strategy, the cross-sectional design of many studies limits the generalizations that can be made from the data. With events measured only once, intersubject comparisons can be made across the population at that time only. With a longitudinal design (measurements of the same population two or more times), both intersubject and intrasubject comparisons are possible over time, and descriptive questions can be more readily answered. As an alternative to the cross-sectional design, longitudinal design of studies can clearly identify trends over time, if disadvantages of the measurement procedure are considered. Longitudinal designs, however, impose greater burdens on both researcher and subject because data are collected more than once (Crider *et al.* 1973).

Alternative research designs :
2. *experimental design.*--In essence, an experimental analysis is a longitudinal design with some manipulation occurring between measurements. Data are collected by observation or a self-reporting procedure. The element of manipulation and before and after measurements make this process unique.

Although few experiments are reported

in the literature on recreational behavior, many experiments are actually done but without sufficient documentation to determine effectiveness. In day-to-day decisions, managers and policymakers initiate changes in recreation environments which may have some effect on people. For example, they may provide trash cans along a river, build a new road for boat launching, develop more campsites, add convenience facilities, or restrict access. The manipulation or change is essentially the guts of an experiment. The impact of the change needs to be evaluated so that the desired results will be attained. More attention should be paid to documenting cause-effect relations implicit in most management actions to ensure that undesirable consequences do not occur. For example, as Clark *et al.* (1971) illustrate, the process of "creeping campground development" in response to increasing use may have serious effects on the types of users attracted to certain areas.

An experimental design may be useful for providing data on "what is preferred". Direct observation, and to some extent self-reports (even if done within a longitudinal design), will provide partial answers on how people behave or their stated preferences. However, these approaches may have serious errors. To determine exactly which factors influence choice implies some sort of experimental design. By systematically controlling or manipulating characteristics of river campsites, for example, and measuring the effect, researchers and managers could identify important factors related to site preference and, more important, their use.

Alternatives for Questions of Explanation

The Cross-Sectional Survey

The cross-sectional survey may be best suited to answer the question of "Why things are happening", particularly when the answer may require a social-psychological explanation. A carefully conducted survey of attitudes can explain why the phenomenon occurred in terms of the social psychology of the action and the mediating decision process. To do a study of attitudes presumes that one knows a great deal about the process itself, but many attitude studies seeking to learn why something is occurring don't seem to have this understanding. Such studies are noted by a wide variety of unrelated questions, the lack of clear research hypotheses prior to data collection, and the general sterility of results. Further, when trying to explain why a behavior is occurring or how to control it, an attitude study may be inappropriate because situational or environmental factors may be largely responsible, and these are generally ignored in most surveys.

The cross-sectional survey is inappropriate for determining "how a behavior can be modified or maintained". Research on litter control by Keep America Beautiful, Inc. (1968) presents a good example. Respondents to a survey identified two classes of reasons for littering. The first type was individual attributes--laziness, indifference, carelessness, etc. But this description doesn't really tell us why littering occurs because these data say nothing about the process linking such attitudes to littering behavior. The second class of reasons relates to situational factors--trash facilities, litterbags, etc. The problem here is that littering itself was not under study. Respondents were asked to give reasons why they think littering occurs or how it can be controlled. Whether or not facilities, laws, litterbags, and education had anything to do with the respondents' past, present, or future littering behavior cannot be ascertained from this type of study. Indeed, other research (Clark *et al.* 1972a, Heberlein 1971) suggests that laws, educational campaigns, and trash facilities have little impact on littering. And all these studies focused directly on the problem--littering and litter.

Alternatives to the Cross-Sectional Survey

Alternative measurement strategies: 1. self report--diaries.--Diary studies can provide information on "why a behavior is occurring" if respondents describe why they did what they did. For example, when boaters choose among streams in an area and locate their movement on a map, the investigator may want to know why they made their decisions. Reasons may include "this way was shorter", "too many people the other way", etc. This approach however, has all the weaknesses described in use of diaries to answer descriptive questions.

Alternative measurement strategies: 2. participant observation.--Participant observation can answer the question of "why a behavior occurs" both from the point of view of the observer, who may engage in the event and record his own reactions to it, and from the perspective of those he observes; the observer interacts with them and is often able to learn "why" through conversation. Measurement of "why" with participant observation procedures is most useful in the early stages of a study; it can help the researcher ask the right questions later on. Participant observation is often necessary for a good attitude survey. It should be noted, however, that although participant observation may be necessary for an attitude study, it is not a sufficient replacement for such a study. Participant observation provides hypothesis, but only the carefully conducted attitude study, with its systematic sample and rigorous measurement, provides strong support for hypotheses dealing with social-psychological explanations of "why".

Alternative research designs: 1. longitudinal design.--When the investigator wishes to determine if the reasons "why an event is happening" change over time, then a longitudinal design may be appropriate. This is a particularly useful approach when combined with a survey aimed at determining social-psychological reasons.

Alternative research designs: 2. experimental design.--If the factors controlling a behavior are situational, experimental analysis can yield data about "why it is happening". For example, use of campsites along a river may be related to access, visibility, proximity to other sites, etc. Experiments can isolate the relative impacts of the various factors.

Experimental analysis is the only method that allows the researcher to determine directly "how a behavior can be modified or maintained". Although simple observation of behavior and cognitive explanations of why it occurs may provide insight into possible control procedures, any testing of effectiveness of controls implies an experiment. Research on litter control in recreation is an example of how experimental analysis can be used to determine effective control procedures (Clark 1976, Clark *et al.* 1972a, Heberlein 1971). A carefully conducted experiment is the key to determining the effectiveness of management actions because the relative impacts of each approach can be clearly substantiated.

RELATED ISSUES

I have discussed a variety of research designs and measurement strategies and have presented a simple framework for determining which may be appropriate for providing information about several questions concerning recreation behavior. The decisions that must be made about appropriate strategies are more complex than the framework implies. In this section, several important issues that the investigator should consider in designing a study are discussed.

A Variety of Procedures Is Necessary

When used alone, none of the strategies described can produce data to directly answer the five basic questions about recreation behavior. Consequently, researchers interested in all the questions must be able to use a variety of research designs and data-collection strategies to get the best results.

Rarely will one of the five questions be studied alone. Usually, a study will combine several. This makes it particularly important for the researcher to understand the limitations of the alternative procedures and to select the appropriate combination to satisfy the study objectives.

Strategy Depends on State-of-the-Art

The appropriate research strategy may depend on what is known about the events of interest to the researcher or manager. Studying a phenomenon about which little is known may require a different approach than if specific variables have been identified.

Participant observation is particularly useful in early stages of an investigation and can be used to focus data on four of the five basic questions. More information is required to use the other strategies; systematic observation re-

quires identification and definition of important variables; self reports require the right questions for pertinent responses; and experimental analysis requires identification of target behaviors and possible controls.

An effective overall approach is to focus initial data collection efforts on participant observation to identify variables that can be more accurately measured by systematic procedures. By considering what is known and which of the five basic questions should be studied, the researcher can determine the most appropriate research strategy.

Practical vs. Scientific Importance

An important concern, particularly to data users, is whether the information to be collected will have any practical importance. Consequently, both the researcher and practitioner must understand the implications that the data collection strategy has for potential application. Does the researcher want to study questions of most importance to the manager? If so, the choice of strategies is limited to those best suited to producing valid and reliable data that will directly answer questions of interest.

CONCLUSION: THE EMPHASIS NEEDS TO BE CHANGED

Attitude studies (primarily cross-sectional surveys), if done carefully, can play an important role in answering major questions about recreation and recreationists. They are particularly useful in explaining why certain events are observed. They also give the most systematic information about what people say they prefer (although experiments may give a wider range of choice and tell more about what people actually prefer in certain settings). Attitude studies, however, seem to be done to the exclusion of both observational studies and experiments. Such a strong reliance on these techniques limits the ability to increase our knowledge about a variety of recreational phenomena.

There are several possible explanations for the strong reliance on cross-sectional surveys. First, many investigators incorrectly feel they have a good idea about what is actually happening when beginning a study. Hence, there is a tendency to neglect the basic descriptive questions and move to research that will explain the phenomena. Or investigators may inappropriately think that the behavior-recall data from survey methods will adequately describe what is happening and who is involved.

Another important reason why many investigators focus on attitude surveys is that they believe attitude studies really tell how behavior can be changed. I strongly disagree with this. It is experimental analysis focusing directly on behavior (or attitudes if that is what one wants to change) that can do this. This problem, coupled with the poor relation between attitudes and specific behavior, indicates that more time should be spent in direct observation of or experimentation with the behaviors in question.

Finally, most social scientists conducting research on recreation are trained in survey methodology and often are not familiar with other alternatives. Consequently, this strategy is often used when other procedures would be more appropriate. All recreation researchers, regardless of academic background, need a thorough understanding of the alternative procedures available to them.

Regardless of the reasons, it seems clear that social science efforts in studying recreation, regardless of the setting, need to be refocused. The consequences of not doing so are great, particularly when the data have policy implications. Determining the best strategy for collecting data depends on a variety of factors discussed in this paper. Individual researchers need a basic understanding of *all* the strengths and weaknesses of each strategy.

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MANAGING RIVER RECREATION USE

MANAGEMENT RESPONSE TO GROWING PRESSURES IN WESTERN WHITE-WATER RIVERS — THE ART OF THE POSSIBLE

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ABSTRACT.--Describes agency responses to the increasing demand for white-water recreation, development of management plans, and why planning and public involvement are needed. An example of conflicting interests and resulting political pressure is given.

In the late 1960's and early 1970's, boating use on western white-water rivers began to grow very rapidly. Use on the Colorado River in Grand Canyon in 1972 alone was more than had occurred in the 100 years from 1870 (Powell Expedition) to 1969. Use on the Green and Colorado Rivers in Utah, Colorado, and Wyoming increased similarly. For example, use on Desolation-Gray Canyon of the Green River in Utah in 1975 was more than six times the amount in 1971. Boating use on the Rogue has more than doubled since 1973. The Middle Fork and Main Salmon Rivers, and Snake in Idaho; the John Day and Deschutes in Oregon; the Stanislaus, Tuolomne, and Merced in California were all undergoing the same dramatic increases.

The basic reasons for these increases were: (1) River running was simply undergoing a rapid growth in popularity similar to the growth in downhill skiing of the 1960's; (2) As limits began to be placed on use of the better known and more popular rivers, commercial and private runners began looking around for and using other less well known and less popular rivers; (3) As more and more people acquired the skill to run wild rivers, more boatmen began to respond to growing demand by starting new companies of their own; and (4) River equipment in the past few years has become more available.

As these use pressures grew, public land managers were seeing problems develop at the same time. Trash, litter, and human waste were accumulating along beaches and camp areas. Trails to various attraction sites began to proliferate. Firewood at popular beach areas became depleted; live trees, brush, and standing, picturesque, gnarled, dead trees were being cut for the campfire. Beaches and campsites became blackened by charcoal and ashes. Fires along beaches and river bottoms increased. Crowding at attractions, major rapids, and campsites became problems and people started filing complaints about too many other people. Safety became a problem both on the water and on the beaches. Historic and archaeologic resources were lost.

There are three phases in agencies' responses to these problems. The first is a decision to take action, after they look for direction, search for authorities, and recognize their limitations and possible dependence upon others. Second is the formulation of an operational plan--often after the fact. The plan is affected by public input, funding, research needs, and manpower allocations. Third, the plan will be tested in a crucible of public opinion, pressure groups, and the power of representative government.

Once we accept the fact that river management will for the foreseeable future react to quantifiable problems rather than potential ones, we will spend less time criticizing the decisions made by "management explorers" and look toward a contemporary methodology for the solution of white-water dilemmas based upon the present situation.

If we cannot--and it seems we cannot--compete for dollars and man-years needed to plan, program, and budget future river problems, how can we escape falling into the same traps time after time, given the certainty that the problem will be there before the plan?

An action plan unfortunately begins with a budding problem and the following conditions that vary remarkably little between rivers: (1) Quite without warning that beautiful stretch of water is host to a remarkable array of boating equipment and people and has sustained some environmental deterioration--it doesn't look "nice" anymore; (2) The opportunity to implement nonregulating alternatives is past; (3) Government agencies with river-related responsibilities will disagree about the need for positive action, depending on their enabling legislation or mandate, usually--but not always--along Federal-State lines; and (4) there will be one or more organized vociferous groups set to battle management decisions, and many ancillary special interests.

Happy is the manager responsible for a nonnavigable white-water river in a remote area predominately in one ownership with no more than 28 active commercial outfitters. For those less fortunate, we recommend a strategy and response designed to avoid certain pitfalls and an early retirement.

ACTION TO TAKE

First, examine the land ownership pattern through which your river flows, including political subdivisions. How many (1) Federal agencies are involved? (2) administrative subdivisions (districts, forests, areas) within any one agency? (3) States and State agencies? (4) counties? (5) Indian reservations? or (6) private lands?

The manager must identify those authorized to control put-in and take-out points as well as camping locations. The manager must know if the river has been declared to be navigable, and if so, by whom. If this question is not settled, it must be faced squarely during the discussion of management agreements. What State agency regulates boat licensing and safety; operator licensing and game laws? Are the Coast Guard, Corps of Engineers, or U.S. Fish and Wildlife Service involved?

He must not underestimate the great importance of considering the river's proximity to population centers. Local interests are potentially antipodal to regional and national interests. The manager must weigh the local sentiment about his program if he is to avoid almost certain conflict. Sometimes, unfortunately, conflict is unavoidable.

A conscious effort must be made to define and evaluate authorities exercised by your agency and all others. Are there agencies with seemingly conflicting directions; i.e., mineral and mining development; large irrigation districts; high density recreation? Must you rely on others for enforcing regulations?

Not to be overlooked are the political realities. Who are the congressional delegations and State representatives? If the power structures are understood at the beginning, a more realistic assessment may be made of the programs attainable as opposed to those desirable.

When the initiating manager is aware of the number and orientation of agencies with direct and immediate responsibilities on *his* river, the next step is to describe the problem and need for action to his immediate supervisor and to the highest ranking field official, or officials, within his organization who are responsible for the entire river segment. The report must include operation recommendations to the field official regarding the next steps to be taken. When accepted, the plan should not return to the operational level until workable agreements or acceptable compromises have been reached with all agencies at the highest field level--it usually proves fruitless for one agency to attempt regulation without the cooperation of all.

We do not mean to say that a detailed program must now have complete agreement. That may never happen. The agreement must, however, concern the *need* to take action, any action, now, and the rationale must at least

be understood by all involved. This in itself is probably the biggest job of all.

The concerned agencies must decide, at the highest level possible, upon a management arrangement to administer a river program. Will a lead agency be named to plan and implement regulations, or will Federal and State agencies name members to an interagency managing group? For obvious reasons, the lead agency approach is the best. If an interagency management team must be formed, the fewer the members the better.

A written cooperative agreement may issue, or simply an agreement to agree. Whatever happens, all must propose a beginning action--a study, draft regulations, moratorium on use, or a combination, or whatever; a journey of a thousand miles begins with the first step.

The major point to be made is that top level agreement or understanding must be reached by all responsible bodies before serious steps are considered to regulate use. The natural reaction for a manager is to take those actions within his authority and then request assistance from others.

DEVELOPING AN OPERATIONAL PLAN

Once the administrative machinery is properly balanced and functioning well, we can begin developing an operational plan based upon clearly understood goals and objectives. To bridge the gap between general concepts and identifiable, measurable results, standards must be set up for each objective that can be measured and analyzed.

In the past, agencies have not always been able to respond to the river-running craze with an orderly step-by-step program. The following discussion describes the experiences of a manager with experience at Grand Canyon and areas in Utah.

Many land managers responded to visitor use pressure problems in a strikingly similar manner. This was before the Interagency Whitewater Committee was set up. Their basic response was to: (1) set up interim limits and requirements, (2) initiate research and study programs, (3) gather public input, (4) develop more complete management plans on the basis of number two and three within the basic authority granted by Congress to the managing agency for a specific river or river segment.

Most managers did not have basic data from which sound decisions could be made. It is generally recognized that there are three major limiting factors that form a basis for carrying capacity determinations in river running: (1) *Physical capacity*--actual numbers of people that can be physically accommodated at launch sites, campgrounds, etc.; (2) *Sociological capacity*--the number of people that can be on a river at any one time without interacting to the point of degrading each other's experience; and (3) *Ecological capacity*--the number of people that a river system can accommodate without impairment to components of the various indigenous ecosystems.

Most interim management plans, while having some differences, have included the following:

A. *Use Limitations*

(1) An overall limit of use, either in numbers of people, number of parties (groups), or passenger days. (Passenger day is one person for one day or any part of a day.) Most overall use limits have been based on a recent actual use figure for the given river segment. In essence, use and allocation were frozen at the existing level at the time limits and related management requirements were established.

(2) Allocation of use between user groups, i.e., between commercial and noncommercial, and on one or two rivers, a third category of educational allotments was added.

(3) Maximum group size per trip.

(4) Maximum number of days per trip.

(5) A limit on the number of people or trips launched per day.

B. *Resource Protection and Sanitation*

(1) Use of portable toilets or installation of permanent toilets at campsites.

(2) Litter and trash prevention requirements.

(3) Use of fire pans for open fires and charcoal. Fires are built on metal

containers and charcoal is carried out or put in main current of river and pulverized by the hydraulic action of the water. Fires prohibited in certain areas.

(4) Prohibited camping and/or hiking in certain environmentally sensitive areas.

(5) Collection of archaeological or historical artifacts prohibited.

C. *Safety Procedures and Equipment*

(1) Life jacket requirements.

(2) First aid kits.

(3) Emergency signaling or communications.

(4) Extra oars or motor.

(5) Boat repair kits.

(6) Pumps for inflatables.

(7) Maps or guide books.

(8) Watercraft type and capacities.

D. *Boatman Qualifications (Commercial Guide or Private Trip Leader)*

(1) Minimum experience with similar boat or comparable river.

(2) First aid training.

(3) Boating safety training or certification--State or Coast Guard.

(4) Interpretive skills.

E. *Other Miscellaneous Requirements*

(1) Insurance coverage (commercial).

(2) Equal employment opportunity (commercial).

(3) Permit or franchise fees (commercial).

Immediately following the implementation of management schemes, most managers began working on studies, research, and inventories. These efforts have been aimed at developing data for resolving social and ecological impacts.

Many land managers have already spent considerable money doing research and gathering other data. At Grand Canyon, during the past 4 years, about 500,000 dollars have been spent on such studies. These initial studies are nearing completion and are currently summarized and reviewed for use by managers in making decisions for future use and management.

As a result (at least partly) of the National Environmental Policy Act, Federal agencies have in the last decade been going to the public for review of changes in management direction. This is especially so of the National Park Service, Bureau of Land Management, and the USDA Forest Service.

Public involvement in river management policies is a sign of the times. We have to have review prior to decisionmaking if we ever hope to make decisions that will be accepted by the river-running public.

Grand Canyon personnel spent a considerable amount of time and effort gathering public input through meetings at various major western cities and such things as questionnaires and workbook response to management proposals.

Most managers in the situation we have outlined have generally been looking at the research and study programs in combination with public involvement and legislative authority as a means to a "Final Management Plan."

As Grand Canyon managers began the management plan effort, it became evident that they would *never* reach a final management plan. Public demand for river trips is dynamic. Some of the research and studies will continue and likely will turn up new data. As new information becomes available and public demands change, managers will have to respond with dynamic plans that adapt to changing conditions and pressure. No management plan can be of value if it is "set in concrete." Grand Canyon is currently involved in a court suit because demands have apparently changed and management has not kept up with that change.

Very few managers have completed management plans as described above. Most man-

agement schemes are so new that research data and public input processes have not been completed as yet.

Why We Need Planning and Public Involvement

When the plan is ready for implementation, whether interim or highly sophisticated, it will be tested in the crucible of the real world. Following is the reaction to an administrative response that relates to a small portion of the Colorado River flowing through one of our great National Parks. We do not suggest that the discussion is definitive but merely an observation of how administrative problems, together with attendant response, occur and the different pressures they engender, especially the political.

In 1971, it became apparent that river use was growing at a tremendous rate, and that riparian ecosystems were being placed in stress due to this increase. Alarmed at this and developing adverse situations on similar white-water elsewhere, managers took initial steps to stabilize use and limit commercial outfitter operations until answers could be obtained for the following:

A. What is the carrying capacity for Cataract Canyon?

B. What is the assessment of impact on vegetation and wildlife?

C. What impact is acceptable?

The initial response to allow growth to 10,000 visitors annually was based upon admittedly meager data and what was "felt" to be acceptable and reasonable, under these circumstances. However, continued development in other areas with similar problems indicated that what had been reasonable might be, in fact, too much for the system. As a result, the second response reduced the 10,000 allocation to 6,600.

On December 9, 1972, a meeting was held and attended by 13 of the 18 commercial outfitters involved to discuss the proposed restrictions. The decision to reduce limits was received as being in the interest of the Park and its environment and, as such, in the general interest of the outfitter, although placing a "lid" on growth. Equal allocations were then made among the 18 outfitters with a withdrawal of 333 for private use. Subsequent to this decision and its review, one outfitter received an additional 333 allocation, in that his operation would have suffered a reduction. This was not intended.

The action to limit use was quite simply an interim management response to use pressures and designed to protect the interest of the Park and its environment until results of scientific study now underway can be completed and incorporated into further management decisions.

To do less would place management in question, and quite possibly be a breach of the Enabling Act of 1916--to provide for use but not to preserve, one outweighing the other. And then came the reaction.

There is nothing like a joint resolution from a State legislative body to make one see the variables that underline a decision made by the "Little Bureaucrat" as he proceeds to make a "best judgment" decision in the national interest. Visions of expediency transfers (in the Government's interest), the clothing and feeding of one's family, careers, etc., flash before many eyes as "The Manager" goes about the decision process within a very real political arena.

"A joint resolution of the 40th Legislature of the State of Utah memoralizing the Secretary of the Interior, the Director of the National Park Service, the Superintendent of Grand Canyon National Park, the Superintendent of Canyon-Lands National Park, the Superintendent of Dinosaur National Monument, and the Congress of the United States to protect and promote proper tourism and preservation of the natural wonders of our waterways in the National Parks and Monuments.

Be it resolved by the Legislature of the State of Utah:

> WHEREAS, the majority of the river-running companies of Southern Utah are a decided asset to the environment and the economy of the State of Utah; and
>
> WHEREAS, the river-running companies headquartered in the Kane County area are aiding the local economy by hiring over 70 people; and
>
> WHEREAS, Kane and Garfield Counties are economically depressed areas with over 14 percent unemployed; and

WHEREAS, *there is apparent bureaucratic red-tape and discrimination against these river-runners to the extent that they may be forced out of total operation*; and

WHEREAS, these companies are totally committed to a clean, humanly sterile environment in the wilderness areas they visit, leaving behind them absolutely nothing but their footprints; and

WHEREAS, these companies are being forced to submit to severe reductions in patrons; (...ad infinitum...)"

When documents such as these are placed within his "in" basket, I am sure "value systems," "user perceptions," "Recreation Invasion Displacement and Succession Models," race through the manager's head and are on the tip of his tongue as he begins to defend a decision he sometimes wishes he had never made.

Everyone wants to help; many have suggestions and seemingly gloat:

"My good friend called this morning, asking if I knew anything about the political clout that...might be able to muster...He explained the problem that you may confront as a result of the river traffic cutback.

He may raise some hell with Senator _____. We have another senator on our side, however. He is interested in the river--very interested. So I suggest that if...does try to give you a bad time, why don't you write to our senator. He's a good friend of mine. If I can help you on that score, don't hesitate to call on me.

Sincerely,"

Some deal with "Big Bureaucrats," not really wanting to assess the situation fully nor be confused with facts--only to support a friend or special interest:

"Deputy Assistant Secretary
Washington, D.C.

Dear _____:

I would deeply appreciate it if you would, as an urgent matter, look into what appears to be a very serious question of unfair treatment by someone in the Park Service... of one of the Nation's leading river guides and spokesmen...

It appears clearly an arbitrary and capricious action, but the result will be to put...a small company out of business.

Sincerely,"

Some individuals go within the agency to attack a decision. The battle can reach grand proportions.

"Dear _____:

Thanks for your letter of November 15th. I am sorry that I have been remiss in getting back to you.

I was amazed with the response that you received after informing the National Park Service that you, one of our most conscientious concessionnaires, would not be operating in the Park next year. I was embarrassed by the negative tone of that letter and certainly hope that it is not indicative of strained relationships.

Note: My brief acquaintance with...leads me to believe that they are not merely squeaky wheels. They are very professional in their approach to doing business, and I am not sure that they are being given a fair shake."

You can imagine the joy and good will experienced by the "manager-administrator" after he reviews this note, issued from on high.

Meanwhile, threats have been shrugged off and the "keeper of the national trust" continues, believe it or not, to hold ground.

"In a letter to a protesting outfitter, a steadfast manager explained that the current regulations were in force, pending completion of carrying capacity studies. He further explained that when the studies are complete, he would meet with the outfitters concerning what is best for the environment, the park, and its visitors. The manager reminded the outfitter that he intended to develop a long-range management plan, in cooperation with the outfitters, based upon sound, unbiased, scientific data.

The managing official also assured the outfitter that he agreed with his state-

ment recommending that both sides look seriously at the facts rather than listen to untrue statements. In closing, the manager again reminded the outfitter that he had been going out of his way to keep the outfitters informed of what he did or intended to do, and had solicited their ideas on all phases of the river running operation.

Sincerely yours,

Superintendent"

That being the case, start all over again:

A concurrent resolution of the 41st Legislature of the State of Utah.

"The Governor concurring therein, memorializing the Secretary of the Interior, the Director of the National Park Service, the Director...and the Congress of the United States to protect and promote proper tourism while preserving the natural wonders of our waterways in the National Parks and Momuments by insuring that any regulations of these United States agencies governing the use, equipment, or registration of vessels and motorboats upon the waters within the territorial limits of Utah and other western States be maintained in conformity with State laws and regulations and regulations of the United States Coast Guard and that no efforts be made by those agencies to reduce or restrict the numbers of visitors upon those waters so long as ecological and environmental values therein may be maintained.

Be it resolved by the Legislature of the State of Utah, the Governor concurring therein:

...that we call upon the aforementioned agencies and individuals to reconsider adopted and proposed reductions in numbers of visitors permitted access to white-water trips and to allow normal increases in visitation unless and until evidence based on objective studies reveals that increased usage will cause harm to the public lands through which the rivers flow, so that the ultimate enjoyment of the parks can be achieved with the minimum amount of ecological imbalance, if any...(ad infinitum)..."

How do we, as managers with great regulatory powers over a vast national trust whose management is dependent upon sound thinking and judgment, get into such predicaments when only following orders?

By letter of December 5, 1971, the Director, Office of Management and Budget, asked the Secretary of the Interior to have prepared a study report on "Rationing use of existing Federal park and recreation areas and facilities."

Earlier in 1971, Secretary Morton had written, in a June 17 memorandum to the Director, National Park Service:

"The Public Land Law Review Commission Report has recommended that the National Park service ration the use of certain national parks and wilderness areas in order not to compromise the experience of the visitor...I would like to see this attempted, accompanied by sufficient advance notice to the visitor as to what we are trying to do and why."

The March 1972 task force reports of the Conservation Foundation on National Parks for the Future contain recommendations such as the following:

"High priority should be given to research directed at finding the physical, ecological, and sociological carrying capacity of every unit under the jurisdiction of the National Park Service. This information should be the basis for establishing and enforcement of user quotas to prevent visitation from exceeding the carrying capacity of the environment."

Most of us have repeatedly stated that it is our practice to prepare and maintain a master plan to guide use, development, interpretation, and preservation.

We have also realized for years that to "promote and regulate" appropriate use in accordance with the mandates of the Congress requires for the most part a variety of related services which satisfy the subsistence and accommodation of the public. The important considerations are that appropriate use requires the service, and that geographic or other factors require that the service be provided within rather than outside the agency/area boundaries.

However, to do this adequately, to identify essential services and where they will be provided, requires a plan without bias, prepared in the absence of political, as well as environmental, pressure. *We may say* that it has been our practice to prepare and maintain plans to guide the use and preservation of each area; however, it remains, in fact, that we were without suitable planning in the past and are without suitable planning for a future which has incorporated adequate meaningful public involvement--people do not know what we're doing or why! It's that simple.

The administrative situation that we have just described is not atypical. It has occurred at Everglades, Yosemite, Yellowstone, Cape Hatteras, Bureau of Land Management, USDA Forest Service, etc. The commonality of this experience is that rather than systematically identifying problems and arranging for data to assess, support, or develop a decision, we must first be burned. Then we respond and continue to be burned.

The data that we obtain hopefully will have been collected in a professional manner, presented without academic jargon, concise, and in such manner as will be understood by all, particularly the manager. We do not expect research to make the decision--only provide facts upon which to make it. In this manner, we will move from sheer stopgap tactics to a well defined strategy for management that is politically, legally, and morally sound. One that is understood and can be defended in rational terms.

Public workshops with data collected based upon values and concerns consistent with existing constraints are our only hope--the public *must understand.*

Their representatives must understand that what we do, we have been asked to do by the citizen through his representative.

EXPERIENCES IN MANAGING RIVER RECREATION AND RIVER USE IN MICHIGAN

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ABSTRACT.--Presents a history and analysis of Michigan's attempt to control river recreational use for resource protection and reduction of conflicts by regulating numbers and conduct of canoe users on its rivers by utilizing State Rules and Regulations. Michigan's Natural Rivers Act, the program implementing the law, problems encountered, analysis of progress, and suggestions for more effective river and associated land-use management are also reviewed.

MICHIGAN'S NATURAL RIVERS PROGRAM

Michigan's Natural Rivers Act was launched by overwhelming endorsement of both houses of the legislature and was signed into law by Governor Milliken in 1970. It was passed in response to the public outcry over the misuse of our public waters and their frontages. The Natural Rivers Act provides a system for preserving and enhancing the water quality and flood plains, and the ecologic, historic, scenic, fisheries, wildlife and general recreational values of Michigan streams. It seeks to preserve for the frontage owner, the stream user, and generations yet to come those qualities that initially attracted people to the rivers.

Armed with the Natural Rivers Act and prodded by impatient conservationists (who hoped to designate every river in the State by a wave of the wand), our two natural rivers specialists marched bravely, if hesitantly, into battle.

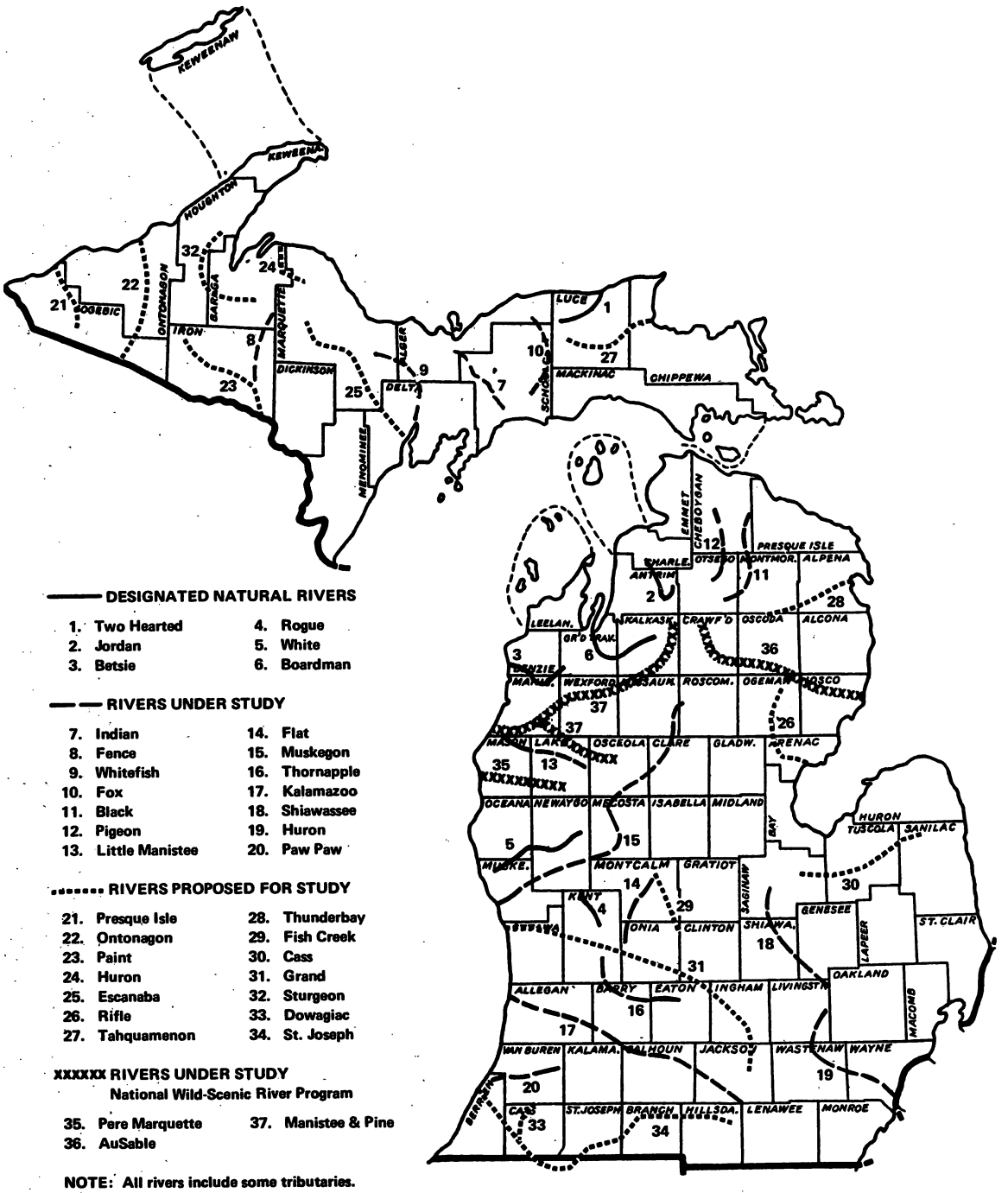
RIVER SELECTION

Three rivers were selected as pilot rivers for the Natural Rivers Program and the identification of the outstanding streams of the State was begun. Next 10 rivers were selected from each of the three broad regions of the State (Upper Peninsula, Upper Lower Peninsula, and the Lower Peninsula below the Bay City-Muskegon line) for study. This provided a diversity of rivers, from remote to near urban in terms of accessibility, and provided protection to outstanding streams throughout the State (fig. 1). The selection process involved recommendations from DNR's own field staff, outdoor writers, conservation clubs, soil conservation service, and other groups or organizations interested in river quality and preservation. This was probably the first test of public involvement. The intuitive knowledge of these informed contributors could not have been improved upon by a $500,000 "scientific" study. The 30 rivers selected, have approximately 6,000 miles of river eligible for designation.

So far 6 rivers have been designated as natural rivers by the Natural Resources Commission and work is in various stages on 13 others. As a river is designated or as local interest develops, additional rivers will be added to the study group.

EARLY PLANNING EFFORTS

The Natural Rivers Act requires a long-range comprehensive plan for a selected river, upon which local zoning or State zoning rules can be based. Plans for the first two rivers to be studied were developed largely by DNR



——— DESIGNATED NATURAL RIVERS

1. Two Hearted
2. Jordan
3. Betsie
4. Rogue
5. White
6. Boardman

— — RIVERS UNDER STUDY

7. Indian
8. Fence
9. Whitefish
10. Fox
11. Black
12. Pigeon
13. Little Manistee
14. Flat
15. Muskegon
16. Thornapple
17. Kalamazoo
18. Shiawassee
19. Huron
20. Paw Paw

..... RIVERS PROPOSED FOR STUDY

21. Presque Isle
22. Ontonagon
23. Paint
24. Huron
25. Escanaba
26. Rifle
27. Tahquamenon
28. Thunderbay
29. Fish Creek
30. Cass
31. Grand
32. Sturgeon
33. Dowagiac
34. St. Joseph

XXXXXX RIVERS UNDER STUDY
National Wild-Scenic River Program

35. Pere Marquette
36. AuSable
37. Manistee & Pine

NOTE: All rivers include some tributaries.

Figure 1.--*Michigan's Natural River System.*

staff in cooperation with a functional river watershed council, or a local planning commission. Citizen involvement was virtually absent, much to our later regret. A degree of grudging agreement was reached by participants in the planning process in each case, and was quickly met with the wrath and indignation of frontage owners at the public hearings. It became obvious that plans for other people's properties could not be made without some effort toward public education and involvement.

THE EVOLUTION OF PUBLIC INVOLVEMENT

Taking the cue from our success in identifying the prime candidate rivers for preservation and benefiting from a 2-month sabbatical in Europe, where I was exposed to the "Plannungs Gruppe" approach used in West Germany, the natural rivers staff initiated an innovative step of directly involving property owners, local public officials, knowledgeable local technicians (such as planners, health officers, soil conservationists, etc.) and other interested citizens as coequals and partners in developing river plans for recommendation to the Natural Resources Commission. Thus, we applied the "Mitbestimmung" or codetermination of West German labor-management decisions (which has been astoundingly successful) to the natural rivers planning of the DNR.

We must recognize, however, that we benefited from a peculiarity of the times. As the Wall Street Journal on October 16, 1972, reported:

> "From New England to the west coast, the average taxpayers, the men and women who make the economy and the country tick, were backing away from the plans and programs, the causes and crusades that they had enthusiastically jumped into in recent years. Possessed by almost a quiet desperation, residents of America were disregarding the larger issues and turning inward. They were and largely still are, frustrated with institutions--from the top of the federal government on down. They have learned from some very real experiences. They have come to understand that the institutions are running things, and that they're beyond the control of individuals. So people are just giving up. They are directing all their efforts toward influencing the things that, rightly or wrongly, they think they can control."

Thus, the "problem" of preoccupation with one's own back yard, or one's own thing--became the "opportunity" for the Natural Rivers Program. In the past few years, the natural rivers staff has vigorously promoted a policy of informing as many citizens, organizations, and governmental bodies as possible before beginning natural river planning. This is accomplished by contacting community leaders, the county extension agents, field personnel, sportsmen's clubs, watershed councils, soil conservation districts, and any other organizations that might be interested in the program and having them arrange meetings at which to present the program.

THE CITIZEN PLANNING GROUP

When it appears that acceptance or at least some support of the program has been attained, representatives of organizations, governmental units and property owners are asked to be a part of a "Planning Group" responsible for developing the natural river plan. In this atmosphere of give and take, grass-roots planning and direct involvement, it is usually possible to develop a mutually acceptable natural river plan. The commitment in time, infinite patience, perseverance and tolerance cannot be underestimated. Frustrating as it is, citizen groups and local governments are careful about detail and cautious in making decisions. Decisions regarding portions of river to be designated, setback requirements for new homes or structures along the river, depth and type of management of a natural vegetation strip, minimum lot widths, industrial and commercial setbacks, septic system requirements, earth moving and disturbance requirements, size of boat docks, stream channel stabilization requirements, litter enforcement, and canoe and motorboating controls are long in coming. But after the property owners champion a setback of only 25 feet, and the environmentalists advocate 300 feet, much discussion, sometimes heated debate and even threats of physical abuse follow. Then votes are taken on motions for 25 feet and 300 feet, both of which fail. After several more votes and amendments, a setback of 150 feet finally passes, and nobody is happy. But that is democracy, and the process, hopefully, leaves the participants more enlightened. One often reflects

that it would be much faster to arbitrarily develop a plan within staff, but the result would be only to add to the already burgeoning shelves of solid waste matter that line our planning offices waiting to be recycled. Our activities are governed by the old proverbs: "Without knowledge even zeal is not good"--and "he who acts hastily, blunders".

Even though the "Planning Group" method is a slow process, Michigan leads the Lake Central Region in miles of river protected under State Natural Rivers Programs. This success in spite of the fact that we have a much smaller budget than most other States.

Efforts of this type are not without their ups and downs. For instance, it is somewhat unnerving to have a burly property owner poke his finger in your chest with the words "You're not bullet proof, Buddy". However, there are also times of reward when someone steps forward at public hearings to say "What use is a home on a river when the river is an open, muddy sewer, with buildings shoulder-to-shoulder along its banks? Zoning is an accepted thing in cities. It is commonly understood that in order not to destroy the neighborhoods, folks cannot do a lot of things with their property. It is time we gave the same consideration to our rivers and lakes".

LAND-USE CONTROLS

Michigan is emphasizing land-use controls along streams because we feel strongly that although nonconsumptive uses such as heavy canoe and fishing pressure may injure streams temporarily (as did the logging runs in days past), it is much more critical to control stream bank development. Once a home is built along a stream bank, it becomes a fixture for generations, and often is the reason for other stream bank changes such as erosion control structures, bulkheads, docks, etc. A few years ago, the Bureau of Sport Fisheries and Wildlife retained the Gallup Poll organization to find where people would like to live for a quality life if they had a choice. Only 15 percent wanted to live in the cities. Eighty-five percent would rather live on the farm, rural area, small town or area of resource beauty--such as mountains, rivers, seashore, etc. This tells us our troubles are just beginning.

CANOE USE INCREASES

The law which establishes the Michigan Department of Natural Resources also permits it to establish rules to protect the lands and property under its control against wrongful use or occupancy and from depredation or destruction.

As in other States blessed with scenic river resources, the number of canoeists are increasing rapidly in Michigan, for example the number of commercial liveries increased from 165 in 1972 to 226 in 1975. Canoe sales are also up according to some manufacturers in Michigan. One concern quadrupled its production from 1972 to 1974. On one popular river, the Pine, the number of canoe trips increased from 13,000 in 1973 to about 30,000 in 1975.

CONFLICTING USES

Heavy canoe use is conflicting more and more with other river users. Many trout streams are no longer fished during the daytime hours because of canoeing disturbances. This situation suggests the need for users time zoning in the future. According to the U.S. Forest Service, this canoeing pressure has resulted in the deposit of about 20,000 beverage cans and bottles in a 40 mile stretch of the Pine River, Michigan. In addition, noise, drunkenness, rowdyism, trespass, vandalism, and theft are increasing rapidly. Conflicts are common among canoeists and fishermen, sightseers, bird watchers, swimmers, and frontage owners. Serious canoeists who appreciate the esthetics, outdoors, and solitude are offended by the shenanigans of hordes of boisterous social canoeists.

CANOE-USE CONTROLS

Early in 1970, there were virtually no controls or limits on the usage of rivers on any Federal or State land of other States in the United States. Today, 47 rivers or river stretches under Federal or other State jurisdiction in 13 States have controls either on the number of launches on streams, number of liveries that service the streams, or both.[1] Controls of these types are enforced either by the Forest Service, Bureau

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[1] *Paul Rasmussen: Michigan DNR phone and mail survey conducted August 1976.*

of Land Management, National Park Service, or by State or local units of government.

As early as August 1970 the problems and conditions on the Au Sable River were discussed at a Natural Resources Commission meeting and a study proposed. Under the auspices of the Au Sable River Watershed Council, the varied interests in the river from property owners to users to canoe liveries were brought together to come up with a use control program. Although it worked on the river problem until the spring of 1971, the council failed to agree on a solution.

One positive spin-off resulted, however, because the Crawford County Board of Commissioners with the assistance of the Marine Safety Section of the DNR, adopted rules for the Au Sable River in July of 1971. To become effective, the County rules also required the approval of the Natural Resources Commission. After a soul-searching session of the Commission, it directed Department personnel to draft a set of more comprehensive River Use Rules that would encompass not only Crawford County, but the heavily canoed Pine, Pere Marquette, the remainder of the Au Sable and the Manistee rivers as well.

As stated in the paper prepared for the Legislative Service Bureau by the Department of Natural Resources' Paul C. Rasmussen, the rules were designed to serve the following purposes:

1) Protection of the physical resource against abuse and the environmental resource against degradation--now and preventively as to the future. This objective includes protection against streambank degradation, destruction of fish habitat, littering, etc. It includes protection against overuse of rivers which precludes the enjoyment of beautiful, natural, and relatively quiet surroundings or an esthetic environment.
2) Resolution of the conflicts between river-users in the most equitable way:
   a) Canoeists and trout fishermen
   b) "Social canoeists" and "serious canoeists"
   c) Motorboaters and the above types of recreationists
   d) Riparian owners and other river users, especially canoeists
   e) The above type of river-users and future new types of river recreationists.
3) Aid in insuring the safety and enjoyment of all river-users.

Groups such as Trout Unlimited, Michigan Trail Finders Club, the large and influential Michigan United Conservation Clubs, the prestigious West Michigan Environmental Action Council, as well as the Lake County and Pine River Property Owners Associations supported the rules. Canoe Livery Associations, which have a direct economic interest, were the primary opponents at the public hearings that are required in the rule-making process.

In short, as Rasmussen reported, the rules provided for "limitations on weekends and holidays on the number of watercraft and their time of use during the heavy-use season from the opening of trout season through Labor Day, and by imposing rules of conduct for all river-users during the entire year". Comparable standards applied to all similar stretches of the rivers. Heavily used sectors of each river were divided roughly into stretches that appoximate the average day's use by watercraft (4-6 hours), taking into consideration available access points.

Carrying capacities involving such factors as stream width, rate of flow, depth of water, and meanderings or the course of the river, were determined for intensive nonmotor watercraft use by Fisheries Division and other officials in the Department of Natural Resources who work with and are familiar with the rivers.

Field observations showed that a problem was developing on a stretch of the Pine River. The use on that stretch was estimated at about 200 canoes per day on heavy-use days. After much deliberation, a limit of 150 permits per day was set in addition to special watercraft users (such as riparian owners) who would be on the stretch by special permit.

This figure was then applied to a lower but similar stretch on this river and to the other three heavily used rivers considered to be similar in carrying capacity. A lower limit (100) was assigned to stretches

with lower capacity. On the Pine River where there are three successive stretches, the fact that many canoes might pass from one stretch to another, was accounted for by applying a lower limit to the upstream stretch.

In scheduling canoes on a stretch, the pertinent factors are point of release and speed of canoeing. Most canoes on these rivers float at around 3 miles per hour or a mile in 20 minutes. At this rate and assuming a common beginning or release point, a 2-minute spacing interval, or 30 canoes per hour, would be required, to keep canoes limited to 10 per mile.

All watercraft were banned on the headwaters and certain small tributaries of designated rivers in order to protect the river bed and fish habitat. In other words, these stretches were so small or of such small carrying capacity that they were considered unsuitable for significant watercraft use or more important for fish management.

Motorboating was prohibited on some stretches and limited to slow no-wake speeds on others in order to avoid conflicts with both canoeists and fishermen.

During the review of the rules by the Joint Rules Committee of the House and Senate, the rule limiting the hours of canoe use to between 8:00 a.m. and 6:00 p.m. was eliminated. This rule would have left the stream free for trout fishing in the dawn and evening, the peak time for fishing on these premier fishing streams.

Provisions were made to obtain permits at the liveries and DNR field offices. Advance reservations and certain types of limited exceptions to the permit requirements for people on the river, camping, or living along the river were provided for. Seasonal permits were also available to riparians for up to two water craft owned by them. Special permits could also be granted for special events and compassionate cases, with discretion to make exceptions as to time, type of craft, and areas for watercraft use.

In order to protect against litter, the rules required plastic container bags be used for the wastes of river users. In order to ward off river bank erosion and keep usage under control, the rules provided for the use of only designated put-in and take-out points for watercraft users.

Rules of conduct for all river users were publicized and distributed at liveries to help ward off conflicts between different types of river recreationists and riparian landowners.

Thus by limiting canoe use on the rivers specified, the canoeists would be encouraged to spread over a greater number of rivers and reduce the pressures which are depreciating the select streams.

After the Natural Resources Commission adopted the rules in June of 1972, the Recreational Canoe Association sued to enjoin the State from promulgating the rules. The DNR subsequently agreed not to effect the rules until the legality of the Department authority to establish such rules and the legality of the precedures followed to establish the rules could be tested in court. The court focused upon the Department's rule-making authority because it was a paramount issue.

The Lake County Circuit Court found that the DNR did not have the authority under the law to promulgate such controls. The Attorney General's office in representing the DNR appealed to the Court of Appeals which also ruled against the rules. The ruling implied that courts in other States might make a different decision because of more liberal rules. With this hint and the momentum of past efforts, the Attorney General, acting for the DNR, appealed the decision to the State Supreme Court which heard the case in June of 1976. We are still awaiting its decision.

In the meantime a bill has been introduced which would by legislative act give the DNR specific authority it has been so arduously seeking in order to establish river use rules. Of course, were this bill to become law, it would be limited to controlling problems on heavily used rivers and would not give the DNR authority to make rules on all threatened natural resources. A favorable Supreme Court decision for us on the river use rules, however, would.

In conclusion, Michigan is moving to protect its river resources on two fronts. The Natural Rivers Act of 1970 permits land use controls along the banks of designated streams to regulate docks, structure setbacks, cutting of natural vegetation, and

other uses. Second, River Use Rules promulgated under Department of Natural Resources permissive legislation would regulate numbers of canoeists using certain heavily used streams, but currently are being challenged in court. We are optimistic that the public's right to quality recreation without depreciating the natural resources will prevail.

ALLAGASH WILDERNESS WATERWAY

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Augusta, Maine

ABSTRACT.--Describes problems and solutions and use experience during the first 10 years of management. Problems related to increasing use include establishing public routes of access, registering users, dispersal of users along the route of travel, restricting group sizes, establishing total use limits, and the proper disposal of litter.

The Allagash Wilderness Waterway consists of a 92-mile long corridor in northern Maine, beginning at Telos Dam at the eastern end of Telos Lake, extending northwesterly to Allagash Lake and Allagash Stream, and then northward towards the St. John River and Allagash Village (fig. 1). There are no organized local jurisdictions in the Waterway.

In the early 1960's, the Allagash received national attention because of two reports published by the U.S. Department of the Interior: (1) a "proposed Allagash National Recreation Area" and (2) a "proposed Allagash National Riverway". Both suggested that the area be added to the National Park System.

In 1963, the State of Maine created an "Allagash River Authority", which provided for the creation of an Allagash Advisory Committee to "formulate plans and proposals for preserving the Allagash River Watercourse so that the people of the State and its visitors may be assured of the continued opportunity to enjoy the benefits of the Allagash River Watercourse as a place of natural interests and scenic beauty". As a result, the State Legislature in 1966 passed two acts: the first created the Allagash Wilderness Waterway and appropriated monies for its initial operation and maintenance; the second authorized a $1,500,000 bond issue to acquire lands and waters to encompass the Waterway. The first act allowed for the State acquisition of an inner or "restricted" zone in which camps, timber cutting, and construction of any kind (except for administrative purposes) are prohibited. This zone varies from 400 to 800 feet from the high water mark (average, 500 feet) and contains 22,760 acres of land and approximately 30,000 acres of water. Lands in an outer zone (one mile back from the high water mark) are privately owned but timber harvesting operations based on approved cutting plans by the State are allowed. The outer zone encompasses approximately 150,000 acres.

In July 1970, the Allagash was designated as the first State-administered component of the National Wild and Scenic Rivers Act of 1968. By 1972, all land acquisition was completed. The cost was $3 million, one-half of which was financed by the Federal Bureau of Outdoor Recreation out of the Land and Water Conservation Fund. Except for one minor exception, all landowners sold their land willingly to the State. In 1973, an Allagash Wilderness Waterway Concept Plan was published by the Bureau of Parks and Recreation.

MANAGEMENT PROBLEMS

The Allagash Wilderness Waterway Concept Plan and an Allagash Visitor Use Survey conducted in 1973 addressed the major management problems in the Waterway: establishing public routes of access; registering users; dispersal of canoers and campers; restricting group sizes; establishing total use limits; and proper disposal of litter.

Access

Access into the Allagash Waterway is

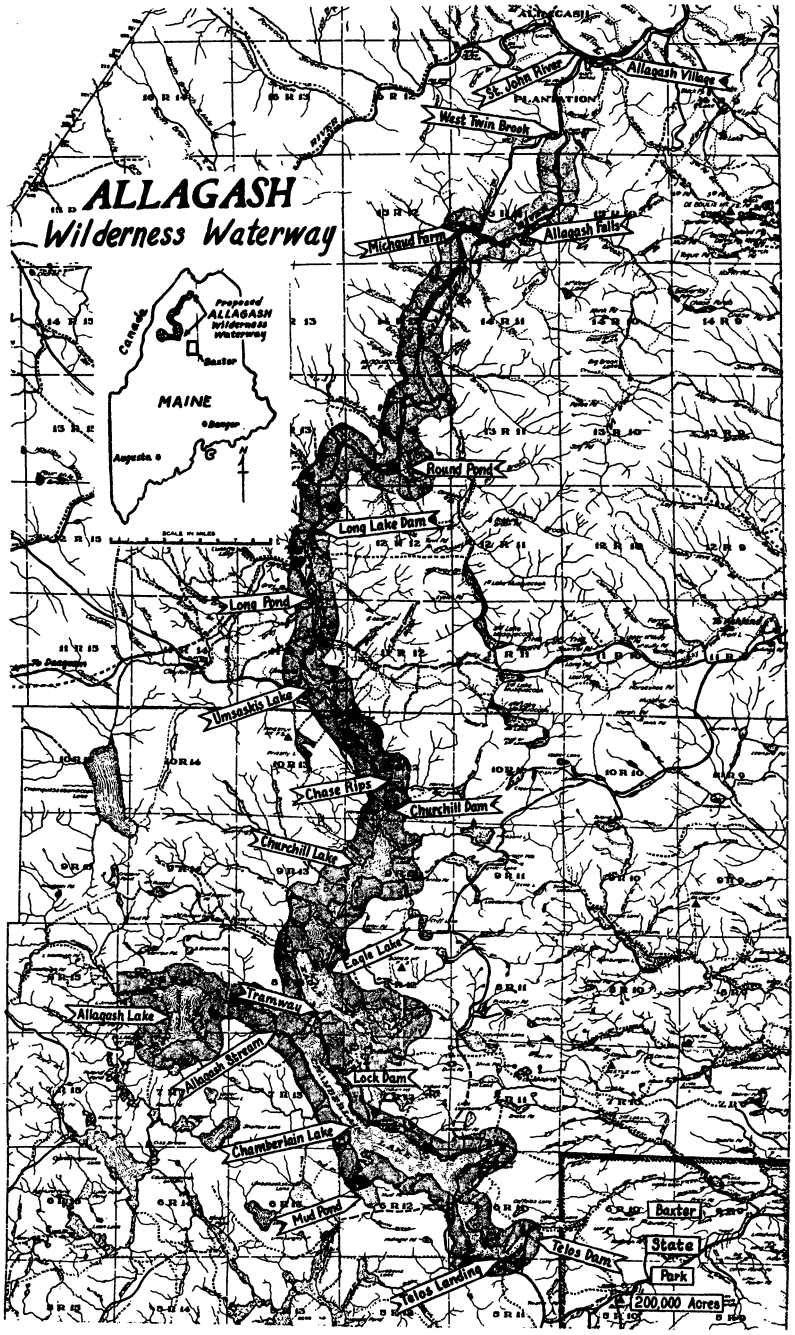

Figure 1.--*Map of Allagash Wilderness waterway.*

possible only over two privately controlled gravel roads that have been designated by the State. The Bureau is negotiating with landowners for easements to guarantee that the public will always be able to use these two roads.

There are possible water access routes along private roads that are not within the Allagash Boundaries. The Bureau requires that users entering by these water routes register with the first ranger they meet or the first ranger station they reach. Those entering by float planes have the choice of six designated landing sites within the Waterway and also must register upon arrival.

Registration

Registration was initiated in 1967 primarily to ensure the safety of visitors and their contactability during emergencies. These registrations also provide data for use histories. The Bureau hopes to conduct Visitor Use Surveys every 5 years by expanding the registration process.

Beginning in 1975, registration fees for overnight users were collected at the control gates operated by the private landowners on roads leading to the Waterway. Though still in the experimental stage, this procedure seems to have worked satisfactorily. It allows the Allagash rangers to spend a greater percentage of their time on more important management functions, though they spend some time registering parties and collecting fees.

Visitor Dispersal

Dispersal of canoe/camper groups during the peak use months (July and August) from the straight line, linear route of travel, is a problem. Such groups are urged to use campsites located off the normal route of travel, especially large, organized groups. Groups led by guides have responded well to this, but dispersal still remains a problem.

Group Size Restrictions

Our 1973 Visitor Use Survey showed that parties of 12 or more persons created a disproportionate impact within the Waterway. Such parties accounted for about six percent of the total but accounted for 30 percent of the total visitor-nights. Although such parties were primarily fishing and wilderness oriented, they created a negative visual impact to the smaller parties both along the watercourse and at the campsite.

As a result, and after a thorough discussion of the alternatives with the Allagash Advisory Committee (a citizens advisory committee), the Bureau restricted party sizes to 12 persons or less beginning in 1975. The only exceptions were granted for parties led by commercial guides serving such a function on the Allagash for the previous three consecutive years. Eventually, as these guides cease to do business in the Allagash, there will be no parties of more than 12 allowed in the Waterway.

Use Limits

The 1973 Visitor Use Survey also disclosed that total use during the peak month of August was reaching a maximum level. An average of 1.1 parties used the 71 designated campsites each night during August of 1973; this assumed that all sites were being used equally. This meant, given the dispersal problem, that each group probably had to share its campsite with at least one other party, a situation that detracts from the wilderness experience.

Again, after a thorough discussion of all of the alternatives with the Allagash Advisory Committee, the following three measures were adopted: (1) group-size restrictions were imposed; (2) Maine publicity agencies were requested not to publicize the Allagash; and (3) a fee system was imposed in 1974. The thinking behind No. 1 was that such parties as scout and church groups would not want to reduce their size and therefore would seek another area for their wilderness trips.

All Maine publicity agencies have cooperated. They have not publicized the Allagash. They only provide information upon request.

The registration fee began as a $1.00 registration fee in 1974. It was expanded in 1975 to be a $1.00 per night fee for Maine residents and $2.00 per night for out-of-State residents. It was purposely started at a low fee in order to get users accustomed to paying a fee.

It is too early to confidently predict the impact these measures have had on total use. Table 1 does provide an indication of the impact.

Table 1.--*Annual visitor totals for the Allagash Wilderness Waterway by parties, individuals, and visitor days 1966-1975*

Year	Parties	Persons	Visitor Days[1]
1966	1,011	4,141	27,008
1967	1,065	4,539	26,831
1968	884	3,786	25,921
1969	1,134	4,820	29,720
1970	1,251	5,460	37,303
1971	1,492	6,345	36,274
1972	1,579	8,260	42,952
1973	1,877	8,337	50,361
1974	1,684	7,477	45,294
1975	2,400	9,477	43,498

[1]A visitor day is the total number of nights, plus one, an individual camps in the area.

Total visitor use increased only 10 percent from 1966 to 1969 but almost 70 percent from 1969 thru 1973. It has decreased almost 14 percent since 1973. The measures taken must have helped, but the national energy problems that began in 1974 were certainly a factor.

Designation of the river, which occurred in July of 1970, may have been responsible for the large increase in use between 1972 and 1973. Publicity of this on maps and in brochures also may have been a factor.

The effect of the group size restriction are most evident. The number of 1975 parties has greatly increased while average party size has decreased and average length of stay has greatly decreased (from 6.04 days in 1973 to 4.61 days in 1975). The decrease in length of stay is most likely attributable to the overnight fee imposed in 1975.

Disposal of Litter

The proper disposal of litter has always been a problem. During the 1960's and early 1970's, users were encouraged to carry-in and carry-out. A trash barrel was also placed at each campsite and users were encouraged to dispose of wastes in campfires.

This procedure never has worked. Users seem inclined to leave wastes in trash barrels, often filling the barrels to overflowing. Rangers spent a large percentage of their time cleaning campsites and hauling trash. In 1974, again following the discussion of alternatives with the Allagash Advisory Committee, it was agreed that trash barrels should be removed from campsites and located only at the ranger stations and users are encouraged to transport their wastes there. This program seems to be working. A carry-in, carry-out policy is still encouraged.

SUMMARY

State management of the Allagash is now into its tenth year. Total visitor day use has increased 61 percent in those 10 years. Number of parties has increased 137 percent; number of persons, 128 percent. Winter use has also steadily increased with the advent of the snowmobile for ice fishing and snowmobiling. A winter use registration program was begun during the winter of 1975 to 1976; it is presently difficult to predict the future winter use of the area until a few years of user statistics have been gathered.

If anything has been learned since 1966, it is that managers must be willing to be flexible and must be willing to try different methods towards solving problems. Problems that are seemingly hopeless can often be easily solved: a so-called "illegal" water entry point was simply made legal; a hopeless litter problem was solved (at least temporarily) by removing trash barrels from the campsite.

The Bureau's policy is to update its Visitor Use Survey and its concept plan at least every five years. These efforts, combined with discussions with the Allagash rangers and the Allagash Advisory Committee, will usually yield simple, acceptable alternatives to solving management problems. The Bureau does not want to be in the position of being a law enforcement agency; it desires to manage the Waterway both for the people and for the protection of the resource.

CANOEING USE OF HURON-CLINTON METROPARK

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ABSTRACT.--An urban regional Metropark system continues to encourage use by canoeists of the Huron and Clinton Rivers. Unrestricted canoeing use has been encouraged by river inventory, canoe maps, clean-up, and canoe rental concessions and facilities. We need to establish different standards for urban rivers than for wild rivers. These standards should include landscaped urban scenes and manufacturing sites as well as natural scenery. Canoeing use should be unrestricted to alleviate social pressures and offer canoeing experiences to urban residents.

The French voyageurs and the Indians from villages along the banks are gone, yet today the Huron river is teaming with canoes. Not the birch barks, but rather those of aluminum, fiberglass, wood and canvas--with names like Sawyer, Oldtown, and Grumman. The canoe rental folks have arrived too, to meet the needs and demands of new river users. We are beginning to see developing a love affair between people from all walks of life--businessmen, students, children, and retirees--and the Huron and Clinton Rivers because the waters of the river are cleaner than they have been in a long, long time.

THE HURON-CLINTON METROPOLITAN AUTHORITY

The Huron-Clinton Metropolitan Authority, or "Metroparks", created in 1939 by the State Legislature, is a regional park agency covering 5 counties in southeastern Michigan. The Authority has an income of some $8,000,000 annually based on 1/4 mill of the assessed valuation of property in the five-county region surrounding the City of Detroit (fig. 1).

The Huron-Clinton Metropolitan Authority has developed park facilities in the Huron and Clinton river valleys which encircle the city of Detroit on the north, west, and south (fig. 1). The Authority is dedicated to providing outdoor recreation for the more than 4 million people living in southeast Michigan. We learned early that one of the necessary attributes of a regional park must be water--to look at, fish in, swim or boat in. The park facilities if not on water, are located close to it, and range from boat and canoe rentals, swimming pools and ice skating areas, to picnic grounds, cross-country ski areas, and nature centers.

We've asked our land acquisition people, planners, engineers, and natural resource managers to keep in mind that a Metropark must accomodate large numbers of people. For example, in one Metropark of 4,500 acres, annual attendance is about 2 million, or about the same as at Yellowstone National Park with its hundreds of thousands of acres. Regional parks must be so designed that they can accommodate these crowds without limiting attendance or degrading the resource.

Our nature centers and nature areas, comprising about 400 acres, can handle on a sustained basis an annual attendance approaching 100,000 without overcrowding. These areas are not some people's idea of a nature area because the trails are 4 feet wide, avoid steep and treacherous areas, and are relatively short. The point is that many, many people like these facilities and use them throughout the year and may get from them the only opportunity that they will ever have for this type of experience. Annual attendance is generally running about 10 million total for all 10 regional Metroparks.

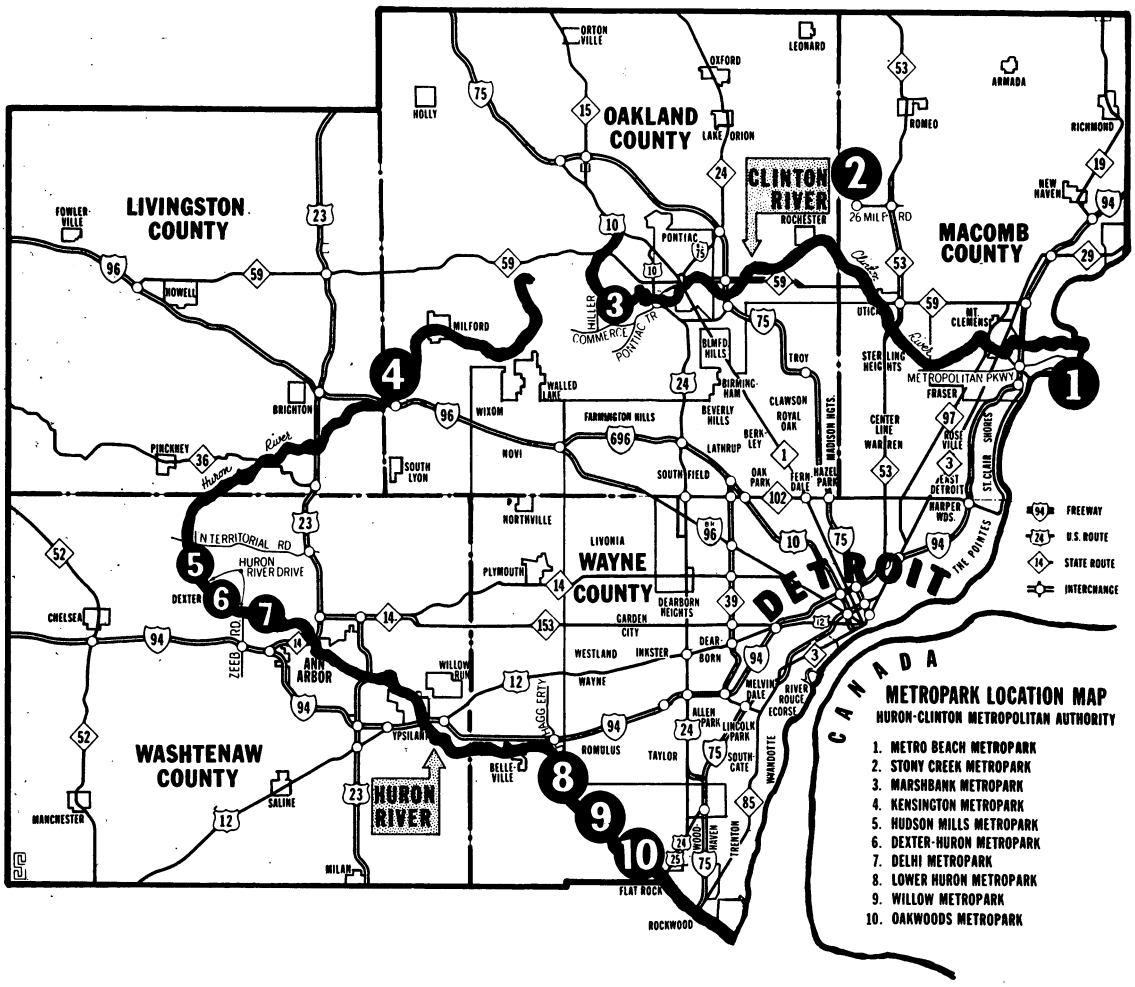

Figure 1.--*Metropark location map also showing Clinton and Huron Rivers.*

DEVELOPMENT OF CANOEING

The Huron River is about 125 miles long and gently flowing except during the spring flood stage. It varies from 6 to 8 feet wide at the headwaters to about 125 feet wide where it empties into Lake Erie. The Clinton River is similar except that it is somewhat shorter and empties into Lake St. Clair above Detroit. Both rivers have a number of natural lakes and a few impoundments create artificial lakes. Most of the year the current is gentle enough that canoeists can paddle upstream, although floating downstream is most popular.

In order to encourage canoeing of these backyard-type rivers located in an urban area, staff people of the Authority have canoed the rivers, keeping track of time and distance, bridges, possible launching sites, portages and other pertinent natural and manmade features such as college campuses, city, regional and State parks, restroom and clean-up facilities.

Making the Clinton River canoeable took much effort because of the Dutch Elm disease. Elm trees are found along flood plains in great numbers, and as they succumbed to the disease, they fell and effectively blocked

the Clinton River. The Authority, several cities, and many people working together were successful in opening the Clinton River in one year from Rochester to the Lake, a distance of some 25 miles (fig. 1). Communities through which the Huron and Clinton Rivers flow recognized and were willing to assist in developing the recreation potentials.

Two coinciding movements--cleanup of the environment and the back-to-nature movement--have caused a great upturn in canoeing, and to a lesser extent boating, on these rivers. The leadership of the Michigan Department of Natural Resources, Water Resources Commission, the river communities, and the Federal government in guiding and accomplishing the cleaning of the Huron and Clinton Rivers has been great. Ten years ago the rivers were not very attractive due to unsightly and smelly water. Now the rivers are relatively clean and as a result are repeatedly used. According to canoe rental businesses there is a trend toward returning to use the same rental canoes going both up and down the river.

There is also increased use by our urban residents. With improvements in water quality, availability of canoes, and nearness to cities, every indication is that canoeing will continue to increase.

SHOULD CANOEING ON URBAN RIVERS BE UNRESTRICTED?

Contrary to the views of some, I believe that a river in an urban setting should be unrestricted. Properly used, an urban river can do much to alleviate pressures on more remote and sensitive river systems. This is not to say that there is no need for restricting, or perhaps prohibiting, use on some rivers that are environmentally sensitive or of outstanding quality. We must, however, guard against ill-advised restrictions. One such example is the Au Sable River in northern Michigan, a beautiful, clean, sandy river ideal for canoeing and trout fishing. Restriction as to canoeing hours and numbers was attempted by a special interest trout fishing group. Today. however, the Au Sable remains open on an unrestricted basis for canoeing.

Unrestricted use of urban rivers also can help to alleviate social pressures in our crowded urban areas. In many cases these rivers offer the only possibility that city people have to experience canoeing. They should not be denied the right to canoe these rivers because someone feels they are overused by wild river standards. Often a quiet urban river is about all the canoeing experience that they can or wish to handle. People should not be denied the opportunity to canoe because they do not have the time, money, or inclination to travel to the more remote rivers. They too become state representatives, congressmen, and professors and as such will be voting and directing programs and development.

One of the trends that seems to be emerging on these two urban rivers is greater use by single canoes as contrasted with groups of canoes. More and more we are seeing a 1-canoe party using their own canoe or renting one from a concessionaire. The results seem to be a more quiet experience for the canoeists and less disturbance to others living close to the river. Another trend that the concessionaires report is that single canoe parties are being more selective about when and where to go canoeing. Some of them seek solitude and want to avoid crowds; others want to join crowds and be where the "action" is. Weekdays tend to be quiet, while on weekends there are many people and activities and much heavier use. Some sections of the river also are better adapted for quiet and environmental experiences while other sections such as that running through the University of Michigan campus, lends itself more to socializing.

Encouraging Use

Metroparks have taken several positive steps to encourage the unrestricted use of these two rivers by the general public. One of the first was to record the canoeing time and distances between launching and takeout sites, bridges, potential canoe camp sites, and portages. Next came the clearing of the river of fallen trees and other debris, sometimes with our crews and sometimes in cooperation with cities and citizen groups. Other steps that contributed a great deal to the use of the river were the establishment of canoe camping sites and the publishing of canoe guides. Currently the Metroparks publish some 15,000 of these guides annually for free distribution to the general public. In spite of this we know very little about who canoes the river, when, and how often. We only know that demand and use is heavy. Perhaps

the dissemination of information through canoe guides has worked against us in that it permits all to use the river without giving us a check on use. Perhaps the studies currently in progress by several universities on the Huron River will clarify and detail this matter.

Another step the Metroparks have taken to encourage use of the river for canoeists is to write concessionaire contracts with canoe rental people. Three such contracts have been written in the past two years and additional ones remain a possibility to encompass sections of the rivers not presently covered. We write news releases at appropriate times to alert the public to these facilities. The news media then follow through with pictures, TV spots, and announcements of special events such as canoe races,' etc.

Finally, in my opinion, wild river standards should not be imposed on our urban rivers; we need to encourage urban canoeists, not restrict them. Let our river banks remain open to our urban scenes so the canoeist can see the landscapes, the structures, and even the manufacturing plants and railroads for they too are part of the urban life. Just as we do not permit 20-foot wooden fences along our city streets so we should not permit those who would line our urban rivers with a 50-foot or wider strip of dense vegetation 60 feet high. As we move into the next stage of river use, let us plan for variety in our river systems and develop standards for urban scenic rivers to reflect the beauty and creativeness of man in urban areas. Let us keep restrictions to a minimum as we plan our urban river use.

GETTING YOUR STORY ACROSS — INTERPRETING THE RIVER RESOURCE

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ABSTRACT--Interpretation as it relates to river systems, has special needs. These are discussed in light of the opportunities and problems associated with different sites, audiences, messages, and media. The appropriateness of media to river classifications is emphasized. Examples of interpretive services are used to illustrate the principle points of the discussion.

While most river managers are blessed with an exciting interpretive resource, they are also faced with some special interpretive needs and problems. Water naturally attracts people, thus this provides a great opportunity to further educate them through interpretation. However, safety considerations, user problems, and competition between media and the natural magnetism of rivers, call for careful interpretive planning.

The mushrooming need for effective interpretation is evidenced in many ways. Visitors increasingly request information that will help make their river trip more enjoyable. Not helping a visitor to appreciate the resource's vulnerability along with the special management needs of the river results in action that is misguided, or no responsible action at all. Insufficient training of visitors in safe, comfortable, and low-impact use of rivers means that more of the manager's efforts and budgets go instead toward remedying negative impacts. Observations have also shown that a lack of appreciation by visitors for the effect of large numbers of users on the river resource and on other users results in antagonism toward regulations and increased vandalism.

Dynamic interpretive programs can change all this, but it takes careful planning, creative design of media, and effective administration to have a quality program. Since detailed guidelines for interpretive planning and administration can be found in agency handbooks, these are discussed only briefly. The main emphasis of this article is on which media are appropriate for use in river interpretation.

GETTING STARTED

There is an unfortunate tendency for managers to select the medium they want to use before deciding who their target audiences are and what they want to say to them. This has led to some costly mistakes. The "communication spiral", (**fig.** 1) should guide all interpretive planning. Carrying out the steps in the sequence shown will produce an effective communications program.

Audience Analysis

Audience analysis is the first step, and basic to everything that follows. An audience analysis checklist is given in the appendix. A lot of detail is required; but the more that is known about an audience, the better the resulting interpretation.

One item needing close attention is visitor motivations as they relate to the river resource. In a recent study conducted at Dinosaur National Monument, Roggenbuck[1] found that is important to understand the

[1]*Socio-Psychological Inputs Into Carrying Capacity Assessments for Float-trip Use of Whitewater Rivers in Dinosaur National Monument. 1975 Unpublished Ph.D. Dissertation, Utah State University, Logan, Utah.*

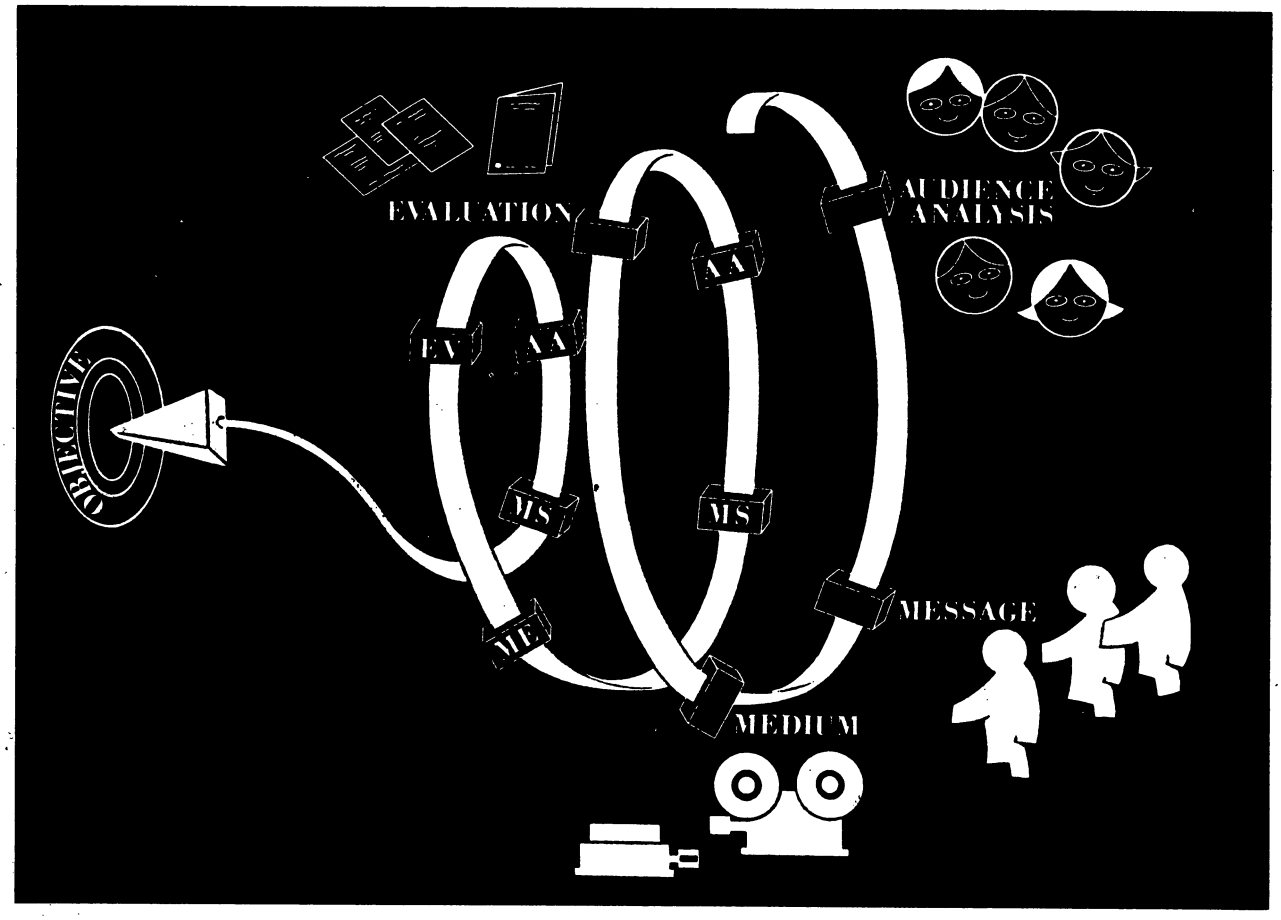

Figure 1.--*Interpretive planning is an ongoing process, providing for continual refining of the interpretation until the original (or revised) objective is met. This "Communication Spiral" shows the sequence of each cycle from audience analysis to evaluation.*

correlation between visitors motives for taking a river trip and which types of interpretive media they preferred. Roggenbuck found that user motives varied and included solitude, achievement, self-awareness, excitement, nature study, affiliation, and status. He then correlated the relative strengths of these motives between various subgroups (day *vs.* overnite users, experienced *vs.* inexperienced, commercial *vs.* educational, seasonal, etc.), and found that in certain settings, a group with one set of motives may have a different interpretive preference than those with another set. Thus in selecting between self-guided and conducted media, the manager must understand his visitors' basic motivations. Roggenbuck's findings are supported by the following situation that occurred at one Forest Service visitor center. The center staff offered to conduct canoe trips one season, which attracted little or no public interest. The staff concluded that these trips, though offered in a wilderness-type setting, were in conflict with the visitors' stress release/solitude motivation. A switch to brochures and other self-guided media proved successful.

After identifying target audiences, the manager must match the *message* with the audience and define *objectives* for each situation. The message and the objectives are based on the needs of both the audience and management, and are drawn from a comprehensive story inventory of the site.

The objectives can mean the difference between a "blah" and an exciting experience. After all, if the manager doesn't know what he wants to accomplish through interpretation, the visitor will most likely be lost in a haze. Therefore, objectives should be specific and measurable, and should be based on clear resource management goals. An example of good direction is seen in the river-oriented programs at Lord Stirling Park in New Jersey:

- To give visitors an enjoyable learning experience that is unique and beyond anything that can be achieved at any other kind of facility.
- To provide foundation experiences for youth which lead to positive attitudes toward the environment.
- To demonstrate that there are many possible uses of natural resources, some of which will bring positive benefits to man, others which lead to negative consequences.
- To demonstrate how visitors can actively, effectively, and creatively involve themselves in correcting the abuses of their environment.

As they have at Lord Stirling, objectives should go beyond awareness and motivate visitors to action (see Fig. 1 in Wagar 1976).

The third step is the selection of that tool, or *medium*, which is best suited to delivering each message and meeting objectives (Hanna 1975 , Sharpe 1976). Be aware too, of the medium's appropriateness to the setting, i.e., a message repeater may work well in some urban river settings, but could only serve to irritate visitors to a wild and scenic river. The media which are finally selected should then be knit into an integrated and effective system. This system should be outlined in an Interpretive Plan for the unit.

The fourth step in the refinement cycle is *evaluation* of the interpretive program's effectiveness. Guidelines for this critical step are discussed in articles by Wagar (1976) and Screven (1976).

UTILIZING INTERPRETATION AS A MANAGEMENT TOOL

One aspect of interpretation which managers often overlook in their planning is how it can alleviate certain user problems. Inventory your own user problems. What are they? Where and when do they occur? How extensive are they? Who creates them and why? How can interpretation reduce both the problems and the costs associated with them? Once these questions are answered, the manager is ready to define, in detail, his target audiences and message objectives.

For example, boating accidents were a problem on the Ashley National Forest in Utah. The Forest staff, in cooperation with the Coast Guard Reserve, set up a program in which three times a week boater safety talks and demonstrations are given at various campsites from a boat on a trailer. The Virginia Game Commission has another approach, using puppets to demonstrate elements of boating safety.

How about other water-related accidents? At the Park Service's Ozark Scenic Riverways unit in Missouri, a large, backlit transparency graphically shows water safety precautions. By using cartoon figures and *no* text, various problems and hazards (drowning, flooded campsites, waste disposal, etc.), as well as the proper response or preventive measures are illustrated. It is displayed in a riverside visitor center and its design draws viewers to search for all the situations illustrated. A popular exhibit, it has excellent possibilities for showing rules and regulations in a more positive manner.

Is there a problem with user dispersal? The answer might be found in developing a canoe orienteering program which prepares visitors for safely leaving the major routes and traveling less congested areas; or, install a low-power radio transmitter along major highways and direct river users away from sites already at capacity by telling of other sections in the area which can still meet their needs. These radios can reach up to 80 percent of your visitors. Or you could adopt the Bitterroot National Forest's idea of a brochure which shows, by the thickness of the trail line on the map, the amount of traffic on each route.

If you anticipate strong public reaction when initiating a new regulation or prohibiting a popular activity at a heavily used site, consider what the National Park Service did. The quantity of fish that was wasted and dumped into garbage cans resulted in a loss of wildlife food, and made it necessary for the Park Service to prohibit fishing from the famous "Fishing Bridge" at Yellowstone. Using interpretation as a tool, they installed TV monitors at the bridge and showed video tapes which discussed fisheries resource and the reasons for the prohibition. The anticipated outcry never came. The key was in explaining the "why".

INTERPRETIVE SERVICES

Self-utilized Media

Once the interpretive planner has gone through the planning steps and analyzed user problems, what is the likely outcome? The following pages describe several facilities and media which have been developed for visitors to river-oriented areas across the country by using this process. Contact the unit or agency mentioned for further details on those services which could add sparkle to your own programs.

Publications

Printed media are often the first to be considered by many interpreters who deal with river users. Publications have an advantage where visitors want to learn at their own speeds and in their own groups. They can often deliver more information than many other media forms. The pamphlets or brochures can also be taken home and studied in more detail. Printed materials are particularly good in those settings (wilderness, etc.) where conducted activities are not appropriate.

One major use of the publication is as a river guide for canoeists or boaters. Stress practicality by printing on waterproof paper and producing it in a pocket-sized format (about 4 inches x 8 inches). Pocket-size may necessitate printing it as a booklet showing sequential river sections on each page; on a single long sheet that accordian folds into a smaller publication; as a large road map, or rolled like a scroll. The last three forms may be preferred because they show a long, unbroken stretch of the river and are easier for visitors to use to orient themselves. The scroll is often preferred because of its obvious utility.

The guide to Oregon's Wild and Scenic Rogue River is an example of a complete river guide. Printed and folded as a large road map, this guide shows almost the entire wild and scenic section of the Rogue River on a single side of the sheet. Keyed to mileage points and landmarks, information which deals with river conditions and is of interest to boaters is printed in blue, while interpretive messages are interspersed in black. In addition to the river guide, the publication includes sections on outdoor manners, boating safety, recreation facilities, an overview of the history, vegetation, and wildlife of the Rogue River and sources for further information.

When publications include information on site and food selection, fires, equipment, and waste disposal, they become valuable in handling pre-trip requests and can be distributed at launch points or through outfitters, chambers of commerce, or sporting goods suppliers.

Publications can also be used to interpret special features along the route--an old mill, miner's cabin, or Indian site. If you want to avoid attracting increased river use to a remote area, while explaining the unique features to those who do visit, consider following the Bureau of Land Management's (BLM) example. BLM produced a small brochure, "Of Gold'N Men", and made it available at the register box which was located at an old cabin near a Rogue River campsite. The brochure is not available anywhere else; thus, only river users have access to it.

In developing all media, including publications, follow the principles of good advertising and design. Make sure the publication communicates rather than smothering the reader with words.

Interpretive Trails and Tours

In a sense, the above river guides are self-guided river trails. But, interpretive canoe trails are becoming increasingly popular. The St. Croix self-guiding canoe trip (Minnesota State Parks) which follows a popular wild river is a good example of

this medium. Here, riparian ecology, aquatics, and wildlife ecology have been interpreted for the visitor. To keep the interpretation in mood with the wild setting, brochures with maps keyed to mileage or numbered points may be the best medium. Landmark trail guides displaying photos of the area's unique features are also good choices. Elsewhere, interest points may be marked with signs, buoys, numbered posts, or other structures, but *only* when these do not intrude on the visitor's experience.

Don't dismiss the unusual. At Virgin Islands National Park, an *underwater* trail has been set up. Visitors can take snorkle lessons before attempting the underwater route where they read the labels through their face masks.

The more common interpretive trail skirts the *shoreline*, adding to the visitor's knowledge of river ecology from shore through the use of labels, message repeaters and brochures. At Patuxent River Park in Maryland, a floating boardwalk traverses a marsh and features a 50-foot observation tower from which visitors can watch waterfowl (fig. 2).

Before developing any trails, check your audience analysis. Does the medium meet the need? Are the message and location such that the visitor will use the interpretive resource? A canoe campsite could be the wrong location for a land-based trail, if the majority of boaters use the river because of its solitude or the challenge it offers. This group may not be receptive to interpretation.

When selecting and designing media for land-based trails, keep in mind such potential problems as vandalism, vulnerability of the tread to boat waves, and user conflicts. Some of these problems have developed at a streamside trail near Seattle where joggers and walkers have come into conflict; and, on a braille trail on the George Washington National Forest (Virginia) that was routed near a favorite fishing spot and has had its guide rope cut repeatedly by antagonistic fishermen. Remember, too, while drawing attention to unique features improves the interpretive resource, it may also encourage vandalism of the feature.

Figure 2.--*Floating boardwalks and waterfowl observation towers, such as these at Patuxent River Park in Maryland, expand your self-guided opportunities.*

Special Services

Wayside exhibits, interpretive signs, and self-activated recorded messages also have a place in the world of interpretation. Use them at launching points to orient users, along the river to interpret special historic or natural features to boaters, and at wayside stops along roads to explain the river to auto travelers.

The low-power radio transmitter offers exciting possibilities. The transmitter is installed at a strategic point along a highway, and visitors can tune into the special announcements by switching their car radios to a specified frequency. These messages can be changed hourly to give visitors current information. Studies show that over 75 percent of the visitors are reached through the use of this method, indicating the radios may be invaluable in delivering safety messages, diverting canoeists to lesser used routes, announcing fire conditions, and making other announcements essential to visitor safety and

enjoyment. New equipment developments give the transmitter a range of up to 5 miles, increasing its usefulness.

Unmanned information stations provide more opportunities. Whenever possible, take advantage of existing historic or other unique structures for visitor contact stations (fig. 3).

However, it may be necessary to build a facility which meets your special needs. One such facility is the stream profile chamber located on a self-guided trail on the Tahoe National Forest (California). The chamber attracts several hundred thousand visitors each year, giving them a first-hand look at the dynamics of a live stream and showing the importance of watershed management in maintaining a healthy stream (fig. 4).

A Word About Visitor Involvement

Although visitor participation is recognized as one of the best ways to promote effective and enjoyable learning, most interpreters feel interactive exercises are associated only with personal services. However, interaction should be a part of *all* media whenever possible. Excellent sources of ideas for self-guided media are the articles by Screven (1974, 1976) which have been published in Museum News and other publications. Dr. Screven's work with exhibits at the Milwaukee Public Museum and the Smithsonian Institution show the value of such tools as small, hand-held teaching machines with punch cards, rub-off response dots (fig. 5), "magic pens" that reveal answers, and other simple interaction devices. Visitors can use these tools to record their answers to questions asked on exhibit or trail labels, tour booklets, or tape-cassette messages. The results of pre- and post-tests and the extent of visitor interest have shown these interpretive tools to be highly effective.

Personal Services

By far the most effective and flexible interpretive medium is the personal contact. It allows for use of all the senses; feedback to visitors' questions; the tailoring of presentations to fit visitors' backgrounds, abilities and interests; flexibility in providing changeable messages; guiding interaction with and among visitors; effecting attitude or behavior change; and, protecting unique features.

Conducted Trips

On Foot.--Guided walks and wades are common activities along rivers. They are easily arranged, involve visitors directly with the river, and rely on rather simple equipment and safety measures. By providing visitors with hand lenses, thermometers, dip nets and seines, collection bottles, water quality test kits, and some guidance, they can have an exciting time doing their own interpretation of river systems. The water investigation, developed for use with Forest Service Environmental Education Workshops, is a very popular activity that leads visitors to their own conclusions rather than feeding them answers. Riveredge Nature Center near Milwaukee supplements similar field investigations with an excellent list of follow-up activities. Students are asked to find out how sewage affects water animals, to help clean up a pond, to encourage parents not to use detergents with phosphates, etc. Teachers report that the program's objective--to encourage groups to develop an action plan to resolve a local environmental problem--has repeatedly been translated into action.

In planning programs, consider ways to insure that visitors are properly prepared for the trip (good footwear, clothing, etc.). Also, keep in mind necessary safety precautions (i.e., avoiding slippery rocks, extremely cold water, steep dropoffs, dangerous currents). Programs should not only result in heightened visitor enjoyment, but also in behavior that reflects respect for stream life, equipment, and regulations.

By Canoe.--The popularity of guided canoe or float trips makes them a highlight of many interpretive programs. Visitors usually rent or bring their own canoes, although some host agencies furnish canoes, paddles, and life vests for the trip.

In urbanized areas, these trips can be a dramatic interpretive tool. At Lord Stirling Park in New Jersey, canoe trips range from 2 to 6 hours and visitors pass from rural to industrial settings. During

Figure 3.--*Consider capitalizing on the interpretive values of historic structures. This mill house at Markham Springs, on the Mark Twain NF in Missouri, was converted to a popular mini-visitor center.*

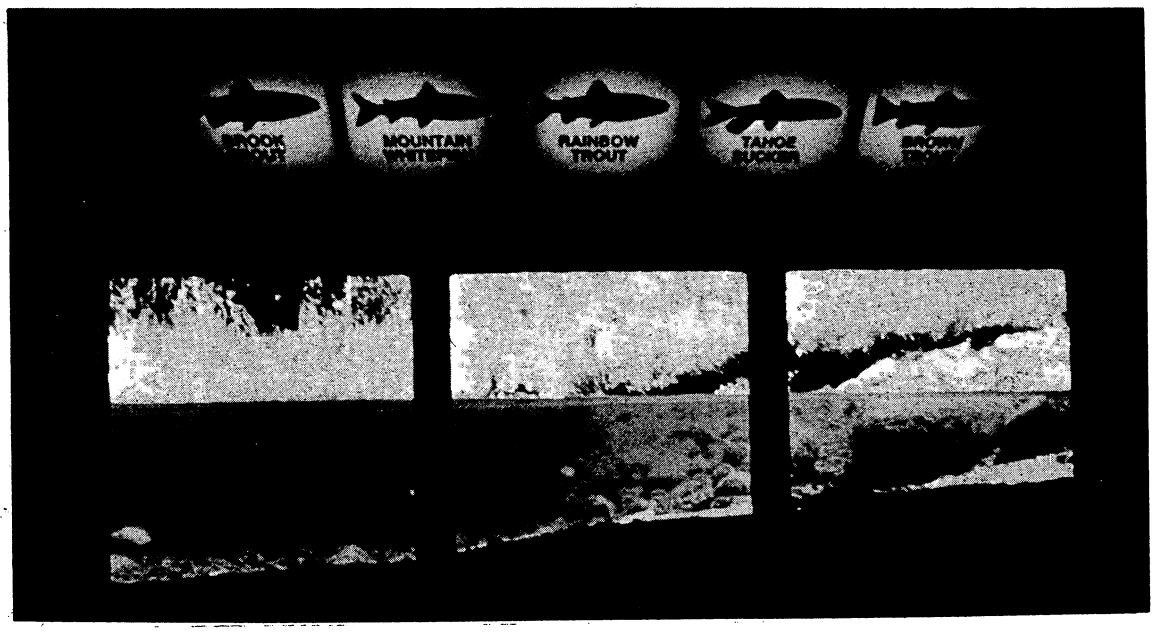

Figure 4.--*Through these windows, visitors to the unique Stream Profile Chamber on the Tahoe NF get a below-surface look at a live mountain stream and the trout and other life it harbors.*

the trip, they experience drastic changes in water quality. Visitors' subsequent involvement in flood plain zoning ordinances and water quality legislation is a good indicator of the trip's impact.

One variation of these trips are the popular inner tube and air mattress float trips offered at some National Park areas (fig. 6). Groups study river ecology, comparing findings between quiet pools, riffles, and marshy edges.

Areas which offer longer conducted river tours have often found these trips to attract individuals who want the security of a guided trip, but aren't necessarily interested in interpretive activities. In these cases, the interpreter serves more as a resource person than as an instructor and facilitator, and must be sensitive to his audience so as to avoid an overkill with too much interpretation. These canoe tours help show visitors safety skills and low impact river use, and at the same time are an excellent opportunity to add to visitor understanding of river management.

Interpreters must give close attention to potential safety problems. On canoe trips at Lord Stirling Park (New Jersey), children under 12 years are permitted only if they travel with the parent in their own personal canoe, and all participants must sign a release of responsibility. Such a release, however,

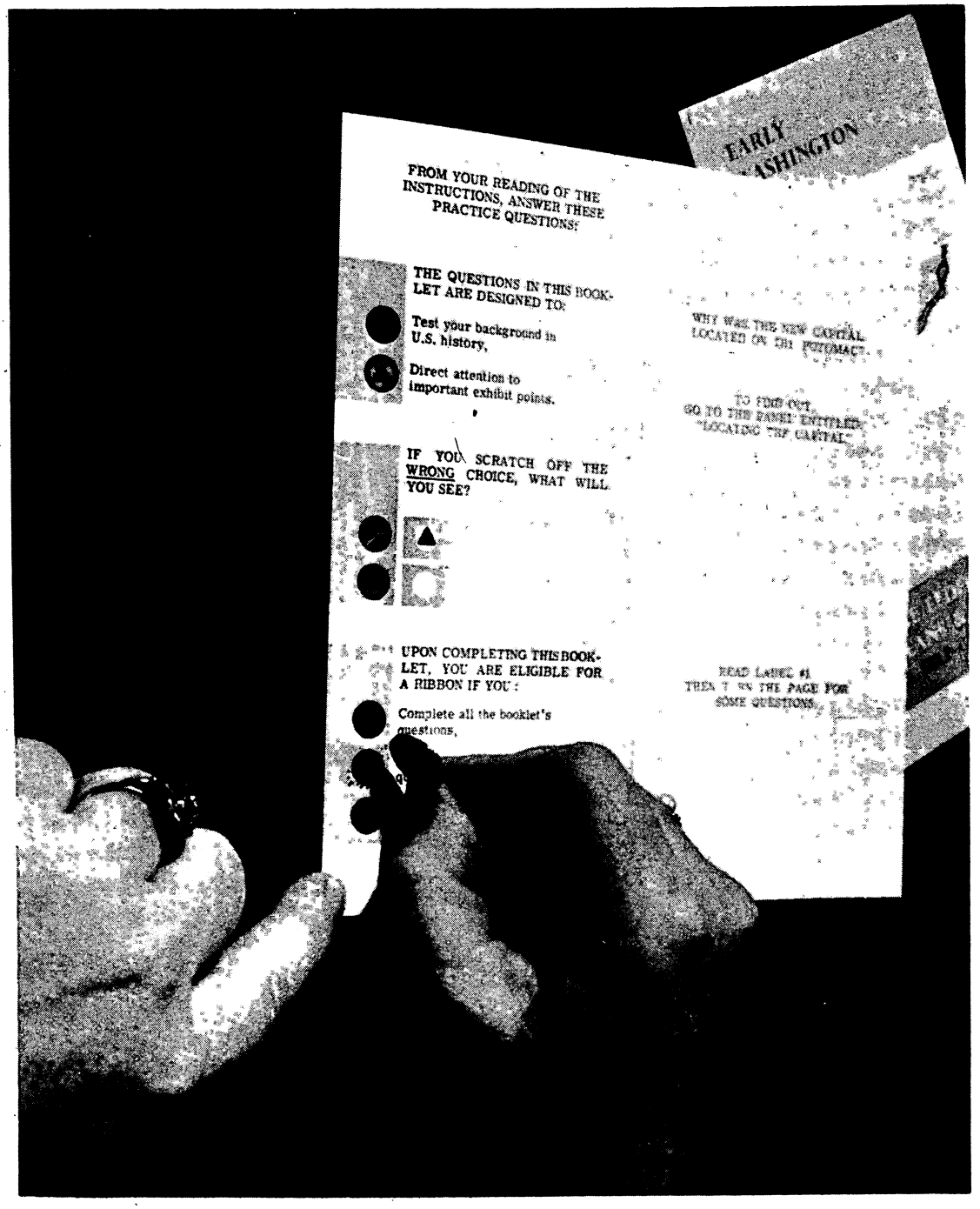

Figure 5.--*Visitor interaction should be a major goal of interpretation. This self-guided tour booklet, used at the Smithsonian Institution in Washington, D.C., encourages learning by providing feedback. Visitors receive booklets or tokens as a reward for perfect scores. Such tools could be applied in all interpretation.*

Figure 6.--*Float trips down the Merced River at Yosemite National Park have grown so popular that, in order to protect both the resource and the quality of the trip, the Park Service has had to offer them by reservation only.*

is no substitute for safety precautions. Programs at other sites have additional rules: no more than two adults to a canoe; all participants must wear a life jacket and know how to swim; everyone must wear tennis shoes as protection from broken glass or sharp rocks; the naturalist travels the route within 7 days before the scheduled trip to become familiar with the route and possible dangers; and, each trip must have an interpreter and an assistant who brings up the rear, and both people must be capable swimmers with water safety training.

Demonstration and Skills Program

Many concepts can be interpreted in a dynamic way by using demonstrations. Workshops on river skills can't help but attract audiences. At Yellowstone National Park, a demonstration on fly fishing, fly tying, casting, and fishing strategy is a popular program with visitors and park managers. Visitors learn skills which help them to better enjoy their sport, while managers get a chance to introduce Yellowstone's fisheries management and catch and release program.

Family canoe workshops covering canoeing skills, safety, river reading, and ecology (fig. 7) are becoming common and proving worthwhile. One such workshop, offered at a Canadian nature center by Edmonton Parks and Recreation Department, includes an actual canoe trip down the Saskatchewan River during one of the five skills sessions.

These workshops are of direct benefit to the visitor, placing him in the role of a river user and bringing him closer to the water resource. In these situations, resource interpretation takes on a new meaning for the user. At the same time, he learns how to be a better river user, how to better enjoy a water sport, and how he can help to minimize some river management problems.

Presentations

In contrast to guided walks and trips, group presentations while on a boat tour can allow the use of a wider range of media. Interpreters may present on-deck, audio-visual programs, children's programs, guided walks on-deck and on-shore, as well as developing exhibits, and providing general informational services.

In California, Forest Service naturalists give presentations during boat tours of Lake Tahoe, where they encourage discussion of water management and obvious pollution problems. On the other hand, the Helena National Forest in Montana, stretches its limited budget by cooperating with private riverboat tour operators. Forest staff provide private tour guides with basic information and training assistance, while showing them the need for specific messages regarding fire safety, resource management, and user problems. As a result, passengers hear land management messages from the private sector which adds a degree of acceptability.

Campfire programs at canoe campsites are another possibility. Sites for these

Figure 7.--*The 75 participants who showed up for a canoe skills workshop at Trees for Tomorrow Camp in northern Wisconsin required a staff of about 17 instructors, most of whom were experienced volunteer instructors. Such skills sessions are extremely popular and can be valuable in encouraging low-impact river use.*

programs must be selected with caution when in wilderness-type settings, so as to make sure presentations are patronized, but that they don't infringe on the visitor's back-country experience.

Don't limit the use of audio-visual presentations to interpretation alone, they also offer countless training opportunities. In one successful slide program on canoe skills, each visitor is given two cardboard cards--one green and one red. After showing a short series of informational slides, a question slide is flashed on the screen and visitors are asked to answer the question by holding up the appropriate colored card. For example, a slide showing two alternative routes through rapids, the green route and the red route. The audience's understanding of the subject is noted by the number of correct colored cards held up. The interpreter then encourages group discussion which clarifies the subject or otherwise adjusts the emphasis of the presentation. This process has proven beneficial to the visitors and the interpreter.

Other Personal Contacts

Roving contacts by canoe rangers is another way to reach river users. On the Current River in Missouri, Park Service interpreters travel the river in decked canoes, equipped with seines, minnow traps, and other equipment for use by any visitor who wants to participate in informal river studies.

Environmental work projects can also have great educational value. Whenever a group is out cleaning up trash at a canoe campsite, building stream channelization structures, or working to halt pollution or erosion, they become very receptive to interpretive messages.

Program Balance

When designing the overall program, remember that balance is the key to effective interpretation. Visitors come with all sorts of backgrounds, abilities, and needs. It takes a carefully designed composite of media to effectively communicate your message to all of them.

The comprehensive program at Lord Stirling Park is a good example of balance. Their "Marsh Mullers" (4- to 7-year olds) investigate marshes and streams. There are also the "Swamp Stompers" (8- to 12-year olds), "Indian Lore" groups (which study Indian canoe skills, food gathering along rivers, etc.), and "Conservation Corps". (This group of 7th to 9th graders deals with management techniques, water sampling, stream clearing, erosion control, wildlife management.) There are also all-day "Wetland Ecology" canoe sessions for grades 10 through 12. These are supplemented by a wide range of workshops and tours for adults and family groups.

Patuxtent River Park (Maryland) offers a wide variety of less structured activities. Two boats are available for river studies while 12 canoes can be reserved for recreational use. A wetlands boardwalk, mobile bio-van (equipped to monitor river environments), river orienteering course, fishing trail (requiring a special permit for use), and homemade raft regatta are just some of the program's activities designed to appeal to a wide spectrum of visitors.

GETTING THE JOB DONE-WHERE TO GO FOR HELP

Listed among the references are several books which will help guide development of interpretive programs. General guidelines can be found in the publications by Brown (1971), Tilden (1957), Sharpe (1976), and Alderson and Low (1976). These contain information basic to planning, media development, and program administration, as well as basic interpretive philosophy. For specific ideas revolving around water-related activities, consult books by Van Matre (1972, 1974), Hammerman and Hammerman (1964), and others. For content and for some beautiful examples of the magical side of interpretation, be sure to read Mae Watts' (1957) book (it's a classic), as well as those by Eckert (1967) and Dillard (1974).

Having the knowledge is one thing, but getting the job done is quite another. A major barrier to program development is the retaining of knowledgeable personnel. Try to hire trained interpreters, either full-time or seasonal, who have the necessary media and communications skills. However, budgetary, personnel, or other limitations may force you to turn to other sources for

help. To accomplish initial planning for interpretation on the Eleven Point River, the Mark Twain National Forest contracted with a University. The school did the inventories and made recommendations on media and facilities. The Siskiyou National Forest in Oregon turned to local volunteers for the production of a trail log for the Rogue River.

Many other National Forests have found volunteer interpreters to be an invaluable source of help, with one visitor center having trained a cadre of about 40 individuals. There are few if any limits on where these giving people can be utilized--programs, presentations, demonstrating pioneer river skills and crafts, producing media, or as speciality experts to help outline story opportunities along the river route. Staff at the Voyageur Visitor Center on the Superior National Forest (Minnesota) turned to volunteers for help in reaching Boundary Waters Canoe Area (BWCA) visitors. The call for assistance was answered by members of an Outward Bound group who were looking for a chance to use their skills while serving others. The group conducted 2-hour skills sessions for BWCA visitors. The audiences were split into small groups which moved from station to station, learning and practicing the various skills taught by two Outward Bound volunteers located at each station. They picked up tips on paddling techniques, camp and cook fire safety, low-impact camping, portaging, map reading, and many other skills.

Special university programs such as student internships, senior practicums and work-study are other excellent sources of trained assistance.

One source of outreach help that is often overlooked by remote resource units are interpretive organizations within the areas from which most of their visitors come. Interpreters can contact these groups, invite them on a show-me trip through the resource unit, point out user problems, and then suggest possible ways in which the visiting interpreters might incorporate some of the resource management needs of the area into their urban programs. Some at-home possibilities include a trip planning workshop for wilderness travelers and a message campaign aimed at educating city dwellers about how their consumptive habits and activities directly effect the management of distant resource units. These interpretive organizations may represent county and metro park systems, private nature centers, State and Federal agencies, universities, and museums. These groups can often reach several hundred people with one program and are thus invaluable in reaching potential visitors *before* they leave home.

GUIDELINES

- When planning the overall program, follow the interpretive planning steps in proper sequence as shown on the "Communication Spiral" (fig. 1).

- Base messages on Tilden's (1967) 6 principles of interpretation, outlined in his book.

- Design a unified combination of media which effectively communicates while it complements the river setting.

- Whenever possible, use participatory activities or skills sessions to convey resource concepts.

- Strive to motivate and prepare visitors to do their own interpreting.

- Make quality and effectiveness of interpretation the primary concern:

  (1) Provide for careful personnel selection, training, and periodic evaluation to assure quality of contacts.

  (2) Keep all in-place media maintained in a good quality condition.

- Inventory hazards and provide FULLY for visitor safety in all river activities.

ACKNOWLEDGMENTS

The activities outlined in this paper were shared by a number of individuals and agencies involved in river interpretation. Of the many respondents, special thanks go to:

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APPENDIX

Audience Analysis Checklist

Descriptive Data
- Origin
  - Urban or rural?
  - Local or distant?
- Occupation and economic level
- Size and nature of group
- Personality traits (if applicable)
- Age
- Sex
- Education
- Types of questions asked

Attitudinal Data
- Interests
- Expectations and basic motivations
- Beliefs and prejudices
- Values
  - Hard to get a handle on without stereotyping
- Goal-oriented vs. receptive
  - When and where are they in either state?
- Present knowledge of subject
- Interest in subject
  - Hostile or Apathetic?
- Attitude toward Forest Service
- Attitude toward interpreter!

Behavior Data
- Mode of transportation
  - Any access problems?
- Purpose of visit
  - Restrooms?
  - Along for ride?
  - Definite goal?
- Length of stay
- Attendance:
  - Daily, weekly, and seasonal cycles
- Frequency of visits
  - Repeater or first time?
- Traffic flow pattern
  - Sequence of visitation; Route
- What is their destination?
- Points of visitor concentrations
- Where do they stay during visit?
  - Confined to specific area?
- What are the expected activities during their stay?
- What other activites are related to their on-Forest visit?
  - Special event?
  - Attraction?
- Who *does not* participate in VIS services?
  - Why not?
    - Access?
    - Inability?
    - No interest?
  - What impact do they have?
  - Do you want to reach them?

TVA'S ROLE IN RIVER-ORIENTED RECREATION

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ABSTRACT.--The Tennessee Valley Authority, in cooperation with other agencies and organizations, has surveyed a number of streams, acquired public access, developed parking and recreational facilities, written descriptive brochures, rated canoeing difficulty, and regulated streamflows from its dams. Providing use, not restricting it, is the present course. TVA will monitor the river resource to assure protection.

Every river is a valuable natural resource with a variety of potentials and should be dedicated to the uses for which it is best suited. The Tennessee River, which flows through portions of seven Tennessee Valley States, was a mud-and-flood river in the early 1930's. The need for water control was overriding and the creation of cove-studded lakes added far more to recreation use and scenic beauty than it subtracted. TVA has also recognized that other streams are recreational resources which can complement the system of reservoirs, and has actively pursued a program to encourage public use and recreation development of these waterways.

Some of TVA'S early efforts in behalf of river conservation were on the Obed and Buffalo Rivers. Both were recognized for their outstanding scenic features and promoted by TVA before the passage of the National Wild and Scenic Rivers Act of 1968. In 1965 local citizens requested TVA to study the Obed system for possible reservoir sites to alleviate flooding in the Emory River system. During this investigation, TVA made intensive studies of the Obed's natural and scenic qualities and developed a concept designed to take advantage of these qualities. The proposed flood control project was ruled out. Subsequently, in accordance with the National Wild and Scenic Rivers Act of 1968, the Bureau of Outdoor Recreation (BOR), the State of Tennessee, and the TVA undertook a study on the Obed River. This study concluded that the Obed River was eligible for inclusion in the National System and recommended that TVA and the State of Tennessee implement this plan. TVA has expressed willingness to share administration and development of the Obed with the State.

TVA and the State of Tennessee in 1967 concluded that the Buffalo River's highest and best use would be as a State scenic river. A proposal to develop this stream was approved by the TVA board in 1968 but was never implemented due to the passage of the National Wild and Scenic Rivers Act, which designated the Buffalo as a study river. In accordance with that Act, TVA is now assisting BOR and the State of Tennessee in studying the Buffalo to determine its qualifications for inclusion in the National System.

TVA has also cooperated with the State of Tennessee in preparing and implementing a master plan for development of the Hiwassee River as a State scenic river. TVA'S role includes:

1. Providing favorable daily streamflow during the peak recreation season.
2. Providing scenic easements on TVA land along the river.
3. Development of public use recreation areas.
4. Economic development through local citizens to provide needed facilities and services in the area.

As a result of TVA efforts and the favorable streamflows, the first successful river outfitter in the Tennessee Valley was established for the Hiwassee 6 years ago. This venture encouraged a number of similar business ventures on the Hiwassee and other Valley streams. Technical and economic data are made available to entrepreneurs who wish to expand these services to other suitable streams. At the present time there are 13 operators on 7 streams. TVA is also

working with the State of Tennessee on developing the Tennessee portion of the French Broad River as a State scenic river.

MANAGEMENT PROBLEMS

While studying the Buffalo and other streams, the TVA noted several problems that restricted public use. The most obvious was lack of public access. Access was restricted mostly to bridge crossings and was usually over private property. Parking at these locations was almost nonexistent; in some instances cars were towed away because they blocked or impeded the flow of traffic. Launching of canoes was difficult to almost impossible, often down steep banks. Three years ago, only three areas had public access to Tennessee Valley streams with developed facilities for parking and canoe launching. (These were on TVA dam reservations at Douglas, Cherokee, and Norris; one by USDA Forest Service on the Hiwassee River, and two by the Tennessee Wildlife Resources Agency on the Clinch River.)

Another problem was lack of streamflow information. Stream gages were located on most Valley streams, but information correlating streamflow with canoeing conditions was lacking. There was no systematic method of making this data available to the public.

The third major problem was a general lack of canoeing information for streams. Data on stream characteristics, stream suitability for canoeing and floating, and maps showing access points were not available. There was no information on difficulty ratings: would these streams be safe for family outings or should they serve the danger-loving white water enthusiast? Put-in and take-out points were only known by word-of-mouth and located by trial and error.

To solve these problems, TVA started a program to assist in guiding recreation development and use of Valley streams. Stream surveys were begun to provide an inventory of the scenic and recreational streams in the Valley and determine how they could best serve the recreating public. This program will:

1. Identify streams with "significant recreational potential."
2. Evaluate and classify these streams according to their recreation capabilities.
3. Select sites for development to enhance public use and enjoyment.
4. Work with appropriate State and Federal agencies to develop these sites.
5. Publish brochures to help the public enjoy the recreation attributes of each stream.

A list of 60 streams was compiled cooperatively by TVA and Valley canoeing groups. A field survey determined:

1. Maximum and minimum flow for good boating on streams with available gages.
2. Most desirable scenic stretch.
3. Stream "difficulty rating" so canoeists can choose streams appropriate to their canoeing skills.
4. Potential location of put-in and take-out points for public access.
5. A rating for each stream based on esthetics, streamflow, water quality, road access, and overall recreation capability. This rating allows comparisons with other streams.

We determined a need for over 200 public access areas on 40 Valley streams. Those streams with suitable streamflow during the recreation season, located near major population centers or major visitor attractions, and capable of supporting a significant amount of recreation use, were given development priority.

Access points on the selected streams are being acquired throughout the Valley. Launching areas with adequate parking and sanitary facilities will be provided at each site. Over the past 3 years, 18 sites have been provided, 15 of which were acquired and constructed by TVA.

We anticipate working closely with other Federal, State, and local agencies in development of these access points. The State Game and Fish, Recreation, Conservation, and Highway Departments in the Valley have all expressed strong support and willingness to cooperate and carry out this program.

A series of brochures on the Elk and Obed Rivers, and principal recreation streams in the Little Tennessee River watershed has been prepared and published. These brochures provide information on access points and streamflows that are acceptable for

canoeing. Other brochures on Valley streams are being prepared.

To assist the canoeist in planning his outings, a 24-hour telephone recording gives the latest streamflow on selected streams. Also, daily streamflow readings and weekend powerhouse discharge forecasts are published in the major daily Valley newspaper. Controlled release of water at TVA dams has contributed much to recreational use of certain streams. Scheduled releases over the past 8 years on the Hiwassee and South Fork of the Holston in Tennessee, and the Nantahala and Tuckaseegee Rivers in North Carolina, have made it possible for annual canoeing events of local and national significance to be held at times when flows on these streams would normally be too low for satisfactory boating.

TVA has also made a effort to facilitate public use and enjoyment of streams downstream from its most recent dam construction projects. On the Elk River, scenic easements and needed access were purchased on 30 miles of the stream while flood control rights were being acquired providing the longest segment of protected scenic stream in the Tennessee Valley. A similar program is underway to provide access on 28 miles of the Duck River below Normandy Dam, and access and scenic protection on 25 miles of Bear Creek just below TVA'S Upper Bear Creek Dam. These projects will provide regulated flows. Access areas will have boat ramps, parking areas, sanitary facilities, and garbage cans.

In conclusion, TVA is striving to assist interested agencies and organizations in developing the recreation potential of Tennessee Valley streams. Because the use of Valley streams is not as great as the use of streams in other regions, our principal concern is providing opportunities for stream recreation rather than restricting them. At this time we feel that overuse will not be a problem on most of the Tennessee Valley streams, with their convenient access, road systems, and nearby recreation facilities. Increased use can be adequately handled by increasing the intensity of management. However, the river resource must be constantly monitored and evaluated to determine if significant damage is occurring. If it does, you may be assured that TVA will take the lead in protecting these valuable resources.

RECREATION MANAGEMENT PLANNING FOR A MULTI-USE SCENIC RIVER CORRIDOR

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ABSTRACT.--Thirteen Mile Woods is a highly scenic strip of forest land along the northern reaches of the Androscoggin River in New Hampshire. A survey of its visitors--canoeists, kayakers, picnickers, campers, fishermen, and snowmobilers--indicated their desire to maintain the area in its undeveloped condition. Land capability and administrative viewpoints indicate the same minimum development. Design capacity is discussed as a management concept for this land and river corridor.

The Androscoggin River is one of the many scenic resources of rural northern New Hampsire. Its headwaters are in the heavily forested region of Lake Umbagog from where it meanders 161 miles to the coast of Maine, encompassing a drainage basin of 3,450 square miles (fig. 1).

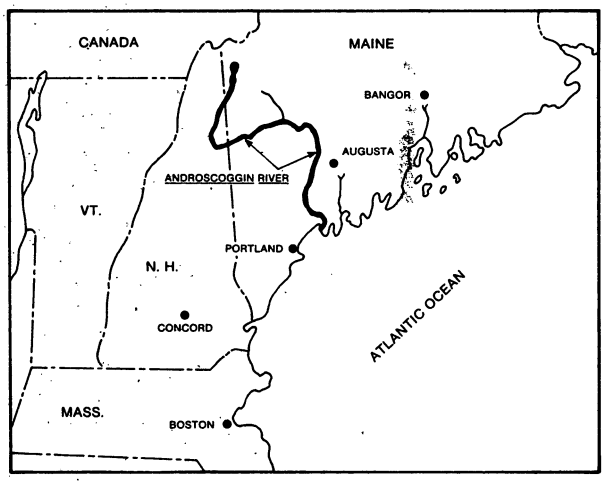

Figure 1.--*The Androscoggin River Basin of New Hampshire and Maine.*

An important section of this historic river basin is the Thirteen Mile Woods Scenic Easement. This is a narrow, 329-acre strip along the west bank of the upper reaches of the river. It is an area that is largely undeveloped and remote in character, lying in the midst of the northern hardwood and spruce-fir forest. Although the Thirteen Mile Woods Scenic Easement does not include the Androscoggin River, the river is the main attractive force and cannot be separated from the actual land area of the Easement.

The "Woods" is presently managed by two private companies, Brown Paper Company (Berlin, New Hampshire), who purchased a 25 percent undivided interest in 1947, and Seven Islands Land Company (Bangor, Maine), a land management company representing the private owners of the other 75 percent. Both companies have observed the change from a primarily log transporting river to one of unique recreational use.

Until 1964, the year of the last log drive on the Androscoggin River, the river was unsuitable for any other use. Since that time recreation has been emphasized. The high quality water provides excellent fishing, the rapids are good for canoeing and kayaking, and the shores provide sites for picnicking, camping, and sightseeing.

The two companies managing this area have responded to the public's demand for recreation by realizing the potential of this area and implementing a recreational management program. In 1972 both companies entered into a scenic easement with the State of New Hampshire, Department of Public Works and Highways. The main purpose of this easement is to ensure the scenic beauty of New Hampshire's Rt. 16 through the Thirteen Mile Woods area. This easement gives the State of New Hampshire the authority to regulate development of the area for its scenic beauty and still allows the two companies to harvest timber from the land selectively.

MANAGEMENT PLANNING

By 1975 the recreational use of the Woods and grown to such an extent that the timber companies and State of New Hampshire began seriously considering the need for a more comprehensive management plan. They suspected, based on some local experience, that the fairly recent arrival of growing numbers of kayak and canoe enthusiasts were conflicting with the fishermen. Moreover, they felt the number of visitors may have exceeded the capacity of the area. Thus in the fall of 1975 Sno-engineering was contracted to develop a recreation management plan for the woods. This was to include *objectives, policies,* and *alternative* action plans.

Initial review of secondary information indicated Thirteen Mile Woods to be an interesting situation. Although the area is remote in overall character, *a good highway runs its entire length providing excellent access to the land and river.* This means there is no simple way of controlling the use of the Woods. Fishing, camping, picnicking, and sightseeing have been the main historic uses of the Woods; however canoeing and kayaking are now identified as "fast comers". The surge in these last two activities is due to privately organized races, *commercial outfitters,* and naturally good white water; dams along the river result in an unusually long white water season.

The management planning for the Woods was done using a flow-chart method. The following six major areas of concern were identified for the purposes of the study:

(1) *Social.*--This includes items such as the easement administrator's desires and objectives, the desires of local residents and government, and visitors' thoughts on the use and management of the area.

(2) *Legal.*--This includes the scenic easement agreement, river control and ownership, land ownership, and the various Federal and State laws.

(3) *Site analysis.*--This category includes soil, water, timber, wildlife, and geology as a basis for determining resource capabilities.

(4) *Recreational use.*--This includes information on the number, type, and timing of users, as well as the identification of use conflicts.

(5) *Outside influences.*--This includes factors such as other recreational areas, improved accessibility, and community support services that are important outside influences in management planning.

(6) *Economics.*--This would include a cost-benefit review of any facilities development, and recognition of the basic costs required to maintain the area.

Most of the necessary information for these categories was available from secondary sources. However, there were some major gaps in information that had to be collected first-hand. For example, it was discovered that little data existed on the number of visitors, by activity, for the area. Also, there were no factual data on such important questions as the level of development desired by visitors, and visitors' perceptions of use conflicts and the existing intensity of use.

The number of visitors using the Woods was determined by actual counts on sample days. On these days two persons travelled the road from 8:00 a.m. until 6:00 p.m. and recorded the number of visitors by activity (an effective but tiring technique). This was done in such a fashion as to reveal: (1) the total number of visitors/activity/2-hour interval, and (2) the total number of *different* visitors/activities/day.

To complement the use figures, personal interviews with visitors were held

along with the counting. The objectives of each interview were: (1) to characterize the person by activity, (2) to determine the level of development they desired for the area, and (3) to determine their perceptions of use conflicts and the current intensity of use.

Because the woods is an area with a strong French-Canadian influence, and many fishermen spoke only French, a quesionnaire had to be developed in that language. This aspect of the study proved once again that river planning situations are often unique, and that you must take into account the cultural setting of a study.

PRELIMINARY RESULTS

At the time of preparation of this paper final results of the study had not yet been determined, but following are some preliminary results. Only those results of possible interest in other planning areas are discussed because every river seems to represent a unique planning situation.

Social.--Both local residents and visitors had a strong identification with the "Woods" and would like it to remain as is. Less than 10 percent of the visitors perceived any conflict of activities. The conflicts that were perceived were related to noise and behavior in the campground.

Legal.--The Thirteen Mile Woods Scenic Easement is the guiding legal document for the area. Minimizing any development, and permitting logging, are the main points of this agreement.

Site.--Soil drainage characteristics limit any development to a few select sites. These are the sites already in use.

Economic.--The undercapacity use of the campground and picnic area indicates future facility development should be limited.

Outside influences.--Possible wild and scenic river designation might influence timber management plans. Possible State park development nearby could attract more visitors.

Recreation.--The Thirteen Mile Woods is uncommon in the diversity of its recreational potential as evidenced by the variety of users. This can be observed in the activity breakdown for the average 77 people per weekday and 141 people on Saturdays and Sundays (table 1).

Table 1.--*Visitors engaged in various activities on weekdays and weekend days*

(In percent)

Activity	Weekday[1]	Weekend day[2]
Camping[3]	3	4
Fishing	43	27
Canoeing	19	31
Kayaking	2	15
Picnicking	16	8
Sightseeing	17	15
Total	100	100

[1] 30 percent are engaged in more than one activity

[2] 38 percent engaged in more than one activity

[3] Camping only

NUMBER OF VISITORS

Because everyone likes to "have a feel for the situation", one kind of useful data developed in this study was the average number of visitors to the area. During the week the average number of visitors per day was 77, which can be further broken down into activities (table 1). The average number of visitors per day on a weekend was 141, which can also be divided into activities (table 1). These numbers of people by no means made the area crowded, as they were usually well dispersed along the 13 miles of river. These average figures also do not indicate the fact that on many good weekends few recreationists use the area, although on others (particularly kayak race weekends) the area is congested, especially at the best rapids.

The reasons for such light use in a desirable area are not entirely clear. One possibility, though, is location. Thirteen Mile Woods is an hour north of the very heavily used White Mountain National Forest, and this may put it out of reach for the average visitor to northern New Hampshire. This notion is supported by the fact that many visitors to the woods are local north-county people. It is only on canoe and kayak weekends, or when the snowmobile

season has ended in the southern regions, that large numbers of nonlocals visit the area. A compounding factor is that, according to our collection of data, this has been an "off" year for use of the area.

CONFLICTS OF USE AND LEVEL OF USE

In the context of these use figures, especially considering the mixture of activities taking place, there were very few people who perceived any conflict of use. In fact, less than 10 percent of the visitors noted any kind of conflict when questioned on this matter. Most conflicts mentioned related to noise and people's behavior in the campground. It was interesting that the fishermen and canoe/kayakers seemed to have little problem coexisting. On weekends of kayak and canoe races the fishermen apparently used other areas outside the Woods, and left the water to the boaters.

This minimum of conflict turned out to be an interesting point in the study. A number of persons providing background data prior to the beginning of the study indicated there was a serious conflict between the fishermen, longtime visitors to the area, and the kayakers. Supposedly kayak activities, including their slalom wires, got in the way of the fishermen. Moreover, it was implied that the kayaker's spent little money locally. On the contrary, our observations indicated little conflict on the river and that the kayakers do use the local motels and restaurants.

One reason for lack of conflict may have been the level of use. When questioned on how they felt about the number of people present--"too many, just right, or could accommodate a few more" --most people responded "just right". The fact that this response occurred over a variety of levels of use indicates a great amount of elasticity in defining the number of people an area can sustain on a social basis.

A related, yet probably more important, reason for lack of conflict was people's behavior. Those few conflicts that did occur were mostly related to people's behavior--noise in the campground or raucousness on the part of a very few people on race weekends. Most people visiting Thirteen Mile Woods seemed polite and responsible, which is undoubtedly basic to the fact that the Woods receives year-round recreational use in a generally unsupervised manner and yet environmental deterioration is not great.

LEVEL OF DEVELOPMENT

In addition to considerable homogeneity of response regarding the two situations described above, most people were in agreement that maintaining, but not expanding, the existing facilities was the best idea. Currently the camping and picnic areas have a minimum of rustic facilities. A frequent comment at the completion of an interview was "just keep the area like it is".

MANAGEMENT CONCEPT

As previously stated, the final report on this river planning effort was not prepared at the time of this writing. However, some notion of its possible outcome can be presented through the planning concept that will be used. This plan, and the synthesis of information into a plan, will be based on the concept of "design capacity" (Leonard 1976). This states that the management of a resource-oriented recreation area is conditioned by three characteristics: (1) *the desire and expectations of the visitors,* (2) *the capability of the resource to sustain recreational uses,* and (3) *the intensity of management that is available.*

The desires and expectations of the visitor can generally be veiwed as a spectrum of alternatives. At one end of the scale would be those recreation areas where one anticipates encountering many people and where the site might be highly developed in terms of facilities. At the other end of the scale would be those areas where one expects to meet few, if any, people, and where visitor facilities would be essentially nonexistent. In the case of Thirteen Mile Woods, most visitors indicated a desire to maintain the limited, rustic facilities with a use level similar to what exists today.

The capability of the resource refers to the amount and kind of use it will sustain. This feature of design capacity is difficult to quantify in terms of allowable recreation pressure. However, a visual assessment of current site conditions

combined with a resource evaluation for facility development (i.e., sewage effluent, soil foundation, etc.) gives some indication of resource capability. In Thirteen Mile Woods there was little visual evidence of resource damage, and a thorough site analysis revealed only limited areas suitable for development.

Intensity of management concerns the amount of funds and effort an organization is willing to put in an area. This varies, at least to some extent, according to the amount of use and site conditions. For example, the fragile condition of high elevation recreation sites often requires more intensive management to maintain them. By the same token, if administrators anticipate they can only provide a minimum of management, then they may have to consider minimizing use or accepting site deterioration. In Thirteen Mile Woods the administrators desire a low intensity of management.

These three management planning considerations, taken as a group, indicate that Thirteen Mile Woods should remain a largely undeveloped area catering to a small clientele. This would satisfy the visitors, the resource, and the administrators.

Based on our experience in this study, certain aspects of river planning have become evident. One is that conflicts of use as reported by local people appear not to be an accurate indicator of what is actually happening. The easy access of Thirteen Mile Woods and the River creates an unusually difficult situation in terms of controlling use. Although the existing scenic easement provides some guidelines for management, it alone will not ensure the implementation of a responsible management plan.

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PROBLEMS AND CONFLICTS ASSOCIATED WITH RIVER RECREATION PROGRAMMING AND MANAGEMENT IN THE EAST

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ABSTRACT.--Increased river recreation has resulted in conflicts over project development, between landowners and users and problems related to management and administration. Controversies are typically the result of varying attitudes and values, philosophies, and failure of managing agencies to incorporate such considerations in river programs. Most problems and conflicts are symptoms of an uninformed public.

The objective of this evaluation is to identify in general terms problems and conflicts associated with river recreation programming and management in the eastern United States. Three subject areas are considered that in the opinion of the authors constitute the most significant sources of difficulty related to stream based recreational use. These areas include (1) controversies associated with river recreation project development, (2) conflicts between the river user and the riparian landowner, and (3) problems related to management and administration of river recreation.

To better identify trends, questionnaires on the problem areas were mailed to eastern State agencies apparently active in river recreation planning and management. Seventeen States, or 68 percent of the 25 States contacted, responded. In addition the authors' opinions, knowledge, and direct experiences regarding the subject in Tennessee, as well as other States, constitute this evaluation.

CONTROVERSIES ASSOCIATED WITH RIVER RECREATION DEVELOPMENT

A fundamental conflict exists between the philosophies of water resource development (impoundment, diversion, channelization) and of nondevelopment or preservation (i.e., free-flowing streams). Since most river recreationists in the East use natural or unmodified streams, it seems important to maintain streams in their natural and unmodified state. The increased competition for land and water, however, will continue to influence decisions on the equitable distribution of resource use. As noted by some eastern States, conflicts with real estate development, hydro-electric projects, and certain agricultural operations will persist. There is also disagreement among environmental interest groups as to the "appropriate" utilization of resources.

After certain river resources are committed to recreation projects, it is difficult to ensure that such use will be perpetuated. The increasing popularity of river recreation in the East requires that methods of land and water management be devised. Such management methods will ultimately involve controls and regulations imposed by some level of government. Six or 35 percent of the States sampled maintain river programs that exercise or have potential jurisdiction over designated waterways and adjacent riparian lands. (Jurisdiction is typically the authority to defer certain water resource development projects and acquire interests in land from private owners (Tennessee Department of Conservation 1976)).

The "scenic" or "conservation" easement has been frequently used to control unwanted development on desirable land along many designated project streams in the East. Public receptivity to the concept is typically negative among those immediately influenced by the restrictions. Most property owners identify the easement as an unwarranted and unjustified encumbrance on their land. Subsequently, issues develop that often must be resolved politically. While lawmakers may support the intent of a river recreation-preservation program, many continue to maintain the values and considerations of their local constituencies and are not inclined to evaluate the advantages of river projects to the region or State.

Negative reactions of local landowners whether apparent or implied often result in the deferral or cancellation of river recreation projects. Opposition continues to be a matter of values and attitudes. Landowners confronted by proposed river projects typically raise the following issues.

Individual Sovereignty.--Many individuals purport that implementing certain aspects of river projects contradict the personal options and liberties guaranteed in the Constitution of the United States. It is frequently maintained that no government agency has the right or authority to impose land use restrictions or regulations, e.g., scenic easements, on the private sector. This attitude is most prevalent among farmers along river projects. (In the East most land along the most popular recreation streams is agricultural or forest land.)

Insensitivity of Governmental Agencies.--It is a common opinion that implementing agencies are insensitive to local considerations and entirely preoccupied with the "project for the project's sake". It is maintained that administrators are not concerned with individual problems but only with technical aspects of implementing the program.

Inconsistency of Governmental Policies and Procedures.--A typical criticism of government agencies is their failure to maintain consistent administrative policies. Procedures and methodologies initially presented to the public may change significantly with little or no prior notice.

Incapability of a Bureaucracy to Maintain Effective Liaison with the Local Area.--It is often alleged that government agencies by virtue of their typically complex administrative and organizational structure are incapable of maintaining close contact with local landowners and interests. Further, most administering agencies are far removed from project areas and are, therefore, in no position to evaluate essential daily considerations.

Encroachment of Government.--Local interests suggest that there are no assurances that initially established regulations will not be amended in the future to include additional and more binding restrictions. It is often stated that the private sector is already unduly subject to governmental regulation without further encumbrances.

Invasion of Community and Personal Privacy.--A common assertion is that project development will promote changes in community and personal life styles by virtue of increased "outside" visitation and use. A fear is expressed that river projects emphasize and encourage public use and consequently impose social problems on the immediate community.

Landowners Unjustly Compensated For Loss.--Landowners frequently state that the government does not provide just compensation for rights of interests acquired. Appraisals do not reflect what many consider to be a reasonable market value. Further, the subject appraisal cannot evaluate or place a value on intrinsic and implicit qualities inherent in the land, e.g., familyties, history, esthetics, etc.

Technical Aspects of Project Implementation.--Most individuals influenced or affected by the project are unaware of the often complex and technical aspects of implementation. The various components and intricacies of law, politics, socio-economics, public administration, and natural resource management are most difficult, if not impossible, to relate or explain to the layman. Efforts to explain such concepts are necessarily superficial and typically result in confusion or misunderstanding. The subsequent public reaction is to reject or disapprove of concepts that remain unclear or obscure.

In summary there are two basic issues associated with river recreation project development. First, a fundamental problem of land use commitment must be resolved. It may not be appropriate or desirable to promote river recreation along a stream

apparently committed to significant modification or incompatible use e.g., impoundment, industrialization, etc. Second, the involvement of governmental agencies in resource planning and utilization typically generates local controversy. It is most difficult for an administering agency to establish credibility with landowners affected by river projects.

CONFLICTS BETWEEN THE RIVER USER AND THE RIPARIAN LANDOWNER

There are significant conflicts between the river user and the property owner whose land is adjacent or close to popular recreation streams in the East. The frequency and severity of such problems depend on river location, relative popularity of the site, property ownership distribution (size and number), availability of support facilities, and inevitably the personality of the landowner, the river user, or both.

The most serious landowner-user conflict in the East is trespass. Approximately 65 percent of the sampled States specifically noted trespass as a significant problem on popular recreation rivers (Tennessee Department of Conservation 1976). The primary adverse impact of trespass is the fundamental loss of privacy suffered by the property owner. As previously noted, invasion of community and personal privacy is a fear frequently expressed by residents within areas of increasing popularity. While trespass is often accompanied by problems such as vandalism, litter, fire, etc., the personal impact of encroachment is significant in and of itself.

Trespass on lands adjacent to popular streams occurs for a number of reasons. Such encroachment, intentional or not, usually involves hunting, picnicking, nature study (exploration), adjustment of gear, etc. Campers frequently trespass; overnight canoeing or extended float trips are common on certain rivers as noted by 59 percent of eastern study States (Tennessee Department of Conservation 1976).

Typically, many individuals guilty of trespass are unaware of the infraction. Users often assume that their temporary occupancy along river banks is of no legal or moral consequence. Such ignorance is to some extent a function of insufficient education and inadequate public relations on the part of responsible administrative agencies.

Lack of public access also contributes to the incidence of trespass. Popular float streams in the East will continue to be used whether or not support facilities exist for such activities. Clearly, trespass and its attendant problems will continue to increase on those rivers without adequate management and programming for recreational use.

Litter also causes conflict between the user and the riparian landowner. Littering can be especially intense on rivers where activities like camping and picnicking may cause much abuse to private lands. Litter is often evidence of trespass and indiscriminate use. It should be noted, however, that visitors or users are often accused of littering areas that are in fact popular disposal sites for the local community and have been utilized as such for many years. Like trespass, the litter associated with intense recreational use can be minimized by effective educational and administrative efforts.

Other conflicts arise from property damage, vandalism, noise, fire, poaching, indiscriminate use of firearms, and general disrespect for the landowner. Though not as common as trespass and litter, a single incident can have lasting repercussions. The destruction of one gate or blatant discourtesy to one local resident can promote endless controversy between subsequent users and the landowner.

PROBLEMS RELATED TO MANAGEMENT AND ADMINISTRATION OF RIVER RECREATION

The most serious problem facing river recreation management in the East is overuse (as noted by 47 percent of the sampled States) (Tennessee Department of Conservation 1976). Overuse implies unpleasant user experiences as well as degradation of the natural resource. An increase in the frequency and intensity of trespass and litter are indicative of overuse.

The recreational experience is often adversely affected as more individuals engage in more activities on the same resource base. Competition among recreational activities is apparently intense on certain popular streams in the eastern United States. Of particular note are conflicts between boating (canoeing

and kayaking) and fishing enthusiasts. The degree of conflict is usually a function of space, time, and individual philosophy. Other conflicts include fishing vs. swimming and boating vs. swimming. Although limiting recreational activities, zoning, or both may reduce problems of competition, it is interesting to note that few eastern States have incorporated such management regulations. Only Maine specifically reports visitor use regulation (Allagash River). The majority of the States (53 percent) agree, however, that use should be controlled or qualified in some manner to maintain quality experience and minimize resource degradation (Tennessee Department of Conservation 1976).

While it is generally agreed that river recreation in the East is increasing and that overuse is a critical problem, few States monitor or evaluate stream activities. The only measurements of any consequence are those related to regulatory programs such as creel census, game law enforcement, and boating safety requirements. Since 59 percent of the States surveyed noted that most river users have little or no canoeing or boating experience, there is need to monitor at least the boaters' capabilities and expertise. Five States indicated, for example, that most accidents on popular streams involve novice canoeists (Tennessee Department of Conservation 1976).

The failure of eastern States to satisfactorily monitor recreation activities and thereby address the critical issue of overuse is not surprising when current levels of river recreation programming and planning are assessed. About 70 percent of the States sampled indicated that river recreation planning is a "low priority" with their respective agencies. Approximately 60 percent of the survey agencies have no data or information regarding the relative importance or significance of stream recreation with respect to other outdoor activites. Similarly few States have any basic information about the river user, e.g., age, economic and educational background, etc. (Tennessee Department of Conservation 1976).

In general it seems that inadequate planning and programming contribute as much to the difficulties of management and administration of river recreation as do the attendant problems of overuse. In fact the adverse impacts of overuse are in part a result of insufficient programming, planning, and research.

CONCLUSION

The problems facing river recreation programmers and managers in the East are complex. The issues are difficult to assess and resolve due to different values placed on the resource. The recent emphasis on river recreation is in part a product of renewed and enthusiastic interest in environment that started in the middle and late 1960's. The often emotion-filled controversies regarding stream preservation and protection still generate confusion and misunderstanding, particularly among local landowners who must necessarily "live" with the decisions of large and insensitive government bureaucracies.

While politicians and bureaucrats struggle with procedures and methodologies, recreational use on popular streams in the East has increased to the point of intense user competition and resource degradation. Managing agencies have apparently underestimated the impact of stream recreation and failed to provide for appropriate use, facilities, and administration.

The most critical oversight, however, is insufficient information and education activities and an inadequate public relations program. Overuse, trespass, and landowner-user conflicts are only *symptoms* of the basic issue--an uninformed public.

HOW TO RATION RIVER FLOATING USE: THE MIDDLE FORK OF THE SALMON EXPERIENCE

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ABSTRACT.--Rationing was started when crowding and congestion began to destroy wilderness values. Permits are issued to 32 outfitters; noncommerical parties get the rest. Each outfitter is allowed to launch one party, not over 30 people, every 8 days. Outfitter launch dates are fixed to facilitate their advertising. Noncommercial parties apply for reservations in advance, listing a first, second, and third choice of dates. Launch dates are chosen by lottery. Maximum party size for noncommercial parties is 15 people. Maximum trip length is 10 days. Problems include finding an equitable means of allocating permits between commercial and noncommercial parties, and dealing with people who show up without reservations.

THE PROBLEM

Use on the Middle Fork of the Salmon River has increased from approximately 1,260 people in 1966 to over 5,500 in 1976. As this use grew, it became evident that some type of control was necessary if the Wild River values were to be maintained. A float trip on the Middle Fork of the Salmon is a nice five- or six-day trip. Before controls were imposed, most parties started their Middle Fork trip on a Sunday or Monday; very few started on Wednesday, Thursday or Friday. Since all parties float at about the same speed, there would be a large group of people travelling down the river together while elsewhere the river was completely deserted. Wilderness values were lost and problems of campground shortages and deterioration occurred.

It became a common practice for one boat of a party to start out early in the morning and go straight through to the planned campsite for that night. It was then the duty of this boatman to defend that camp against all comers. There were sometimes 150 to 200 people camped on a relatively small area. At each bottleneck, such as launch facilities, take out facilities, major rapids, popular campsites, and points of interest, there was congestion. Some control on use was needed.

DETERMING CAPACITIES AND CONTROLLING USE

The first step in setting up control was to determine the capacity of the river. Since capacity is a very complex subject on its own, I will only briefly state some of the variables to consider. The river manager must decide whether capacity should be based on daily, seasonal, or a year-long numbers of people. Or should capacity be in terms of use-days on the river, number of boats, or number of parties? Is the limiting factor ecological, physical, or social? These criteria will be different for each river.

Once the capacity is decided upon some type of rationing system must be initiated if the capacity is being exceeded. There are many alternatives. One is making the access more difficult. This might be done by closing roads or trails, removing boat ramps, or by other means. At best, limiting access is a stopgap measure and will only buy time. Eventually, use pressures will overcome even the most difficult access problems.

Another alternative would be to make the trip more expensive. This might be accomplished by increasing the permit price or requiring that each user obtain the services of an outfitter. The opposite

alternative--that of eliminating use by outfitters, would also decrease use, at least temporarily. Still another alternative would be to require a certain level of skill or knowledge before a permit is issued, as is required for hunting licenses in Europe. A national "river-running license" might be initiated.

Use could be cut by limiting the number of trips for which a person is eligible--one trip per year, one trip per lifetime, so many rivers or miles per year or lifetime, etc. At present the most common method is to require a permit and limit the number of permits issued.[1] This is the only system that gives positive control of the number of users.

Any rationing system tends to discriminate against some portion of the public. This discrimination is to be expected and is not necessarily bad. Anytime a Wilderness is established it limits the use on that area for some portion of the public.

THE PERMIT SYSTEM

If a permit system is decided on, how should their numbers be limited becomes the next question. One method frequently suggested is to require that each user apply for and obtain a permit. The individual may then decide whether he wishes to go on his own or hire an outfitter. This sounds like the most equitable method, much like the big game trophy permit system used by many state fish and game agencies, but the mechanics of implementing this type of system make it impractical. A difference between hunting and river running is that the hunter may go any day of the season he wishes, while a river floater is not that flexible. Scheduling launch dates, differences in length of trips, putting together a complete party or family group, and other problems of such a system make it impossible to implement.

On the Middle Fork of the Salmon River a fixed number of permits are issued to commercial outfitters; private groups get the rest by lottery. A Forest Service Special Use Permit, modified to fit float-boating outfitters, is issued annually to each of the 32 outfitters permitted on the Middle Fork. No additional permits will be issued but beginning this year they are transferrable. Commercial outfitters are set up on an 8-day launch schedule; each outfitter is allowed to launch one party every 8 days. Maximum party size for outfitters is 30 people, including boatmen. These launch dates normally do not change from year to year; an outfitter that launches on July 2, July 10, July 18, etc., launches on those dates each year. This stability is necessary for their advertising and brochure printing. Beginning in 1976, outfitters will be limited to their past use and many of the smaller outfitters will not be allowed to grow.

The remaining capacity on the Middle Fork is allocated to private, or noncommercial, parties. When an inquiry for a noncommercial permit is received, a general information letter and trip application are sent. The information letter gives the Middle Fork permit requirements, safety information, and other information that we feel the prospective floater needs to know. The actual trip application lists first, second, and third choices for launch dates; names and experience of boatmen; number and types of boats to be used; a complete passenger list; a cost estimate and statement that the trip is private or noncommerical. The completed application must be returned to the Ranger District office. We try to limit reservations to one Middle Fork trip per summer per person. This is the reason for requiring a complete passenger list.

When the application is received it is date-stamped and given a number. The first working day in February our lottery is held. As a number is drawn, that application is pulled out and the applicant given his first choice of launch dates, if is not already taken. If all three of the desired launch dates are taken and the individual has not indicated that he will accept the closest available date, then he is notified that his requested dates were filled and he is invited to try again next year. If the applicant is successful in obtaining a launch date, a confirmation of the reservation is sent.

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[1] *Interagency Whitewater Management Guidelines, Appendix H, lists the major western floating rivers, their permit requirements, and a short description of various permit systems. This unpublished guide is available from Sam Warren, Middle Fork District Ranger, Challis National Forest, Challis, Idaho 83226.*

About the first of May, each successful applicant is contacted by mail to determine if they still plan to make the Middle Fork trip and if they have had any chances in their anticipated trip participants. After we get a response from these letters and after the outfitter schedules are firmed up, additional reservations are issued for the available launch dates to persons on our waiting list.

The actual trip permit is not issued until the launch date. The same trip permit form is used for commercial as well as noncommerical parties. A completed passenger list, with addresses, is obtained from the trip leader. Campsite assignments are made for each night on the river. Any special river hazards, safety warnings, and fire warnings are noted on the permit. The trip permit is extremely useful for gathering management and use data as well as for controlling use.

PERMIT PROBLEMS

There have been many problems encountered in the Middle Fork permit system. Determining river capacity is one of them. At the present time we estimate the capacity of the Middle Fork to be seven launches per day with maximum party size of 30 people (including boatmen) for commercial parties and 15 people for noncommercial parties. The trip may take any time up to 10 days. From our experience I would recommend that both commercial and noncommercial parties be the same size. Whether the capacity of a river is in number of people, number of parties, number of user-days, or some other factor, depends on individual river limitations.

We require reservations for only the main floating season, but permits (obtained on the launch date) are required throughout the year. Limiting the capacity of the river during periods of peak use tends to encourage early season float trips which cause some safety problems with high water. We have yet to deny anyone a permit to float the Middle Fork for safety reasons, but the Forest Service will advise prospective floaters of river conditions, boatmen qualifications, adequacy of equipment, or other safety factors.

Probably the biggest controversy on the Middle Fork management system at the present time is how permits should be allocated between the commercial and noncommercial parties. Past use was mostly commercial, but noncommercial use has increased rapidly. In 1976, it was necessary to turn down approximately 150 requests for private permits on the Middle Fork. At the same time the commercial outfitters did not fill up their allocation. There is no data or research available on which to base a percentage division between commercial and noncommercial trips.

A rigid permit system that assigns launching and campground dates allows little flexibility in your daily floating schedule. This rigidity detracts from the river trip and from the wilderness experience for all parties. Nevertheless, a fixed launch date is necessary for outfitters if they are to advertise and otherwise maintain a healthy, viable business.

People who show up without reservations and persons who make a reservation and then fail to show up both present problems. It is difficult to explain to the party from the east coast who has just driven 3,000 miles that they must have a permit to float a Wild River in the National Forest. We have partially solved this problem by allowing people without reservations to launch--provided the maximum capacity of seven parties per day has not been reached. This is the case many days out of the year due to no-shows in both the commercial and noncommercial sector.

ADVANTAGES OF THE MIDDLE FORK

There are some natural advantages that the Middle Fork of the Salmon River has that make the tight management possible. One is that the Middle Fork is entirely under the jurisdiction of one manager and one agency. The Forest Service has jurisdiction at all of the major access points. Launching from private land would be possible along the river, but this is not the established procedure, and at the present, constitutes a very minor portion of the use. There is a limited floating season on the Middle Fork of the Salmon. This allows the campsites to recover the rest of the time so they can maintain adequate vegetation for the short period of continual use. Other uses on the Middle Fork corridor are very limited. There is a minor but increasing amount of

backpacking. There is also some horseback riding, but mostly in connection with fall big game hunting. The majority of horseback riders only pass through the river corridor to the hunting area in the adjoining higher country. The very few other activities makes the river management job much simpler.

REDUCING IMPACTS FROM RIVER RECREATION USERS

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ABSTRACT.--The dramatic increase in river usage makes it mandatory that managers utilize the latest knowledge in prevention of site degradation in order to maintain the desired experience. The manager must be constantly trying to utilize methods that prevent site deterioration. Often, through innovative management such as scheduling use, hardening sites, or improving human waste disposal, the manager can make it possible for a Wild and Scenic River Area to support more people without lowering the visitors' experience or the environmental quality.

Suddenly America's rivers are the place to be. The number of users on some rivers has doubled within recent years, and no leveling off is seen in the trend. The river manager is given certain goals that the river and the adjoining land should provide to best meet certain standards. A typical goal statement is: maintain the natural free flowing condition of the river; protect water quality; protect scenic, recreational, geologic, fish and wildlife, and other similar values; maintain the essentially primitive shorelines; and provide recreation opportunities in harmony with the wild and scenic nature of the river areas.

These are big orders for the manager to fill. In addition, in many cases, resource modification from past usage (buildings, roads, erosion) must be restored to an essentially natural appearance. Although little research has been done in reducing impacts of river recreation, much work has been done in wilderness areas and developed recreational sites that can be utilized in river management.

This paper is devoted to bringing together information that an administrator can use to meet the goals for a particular river.

REGULATING PUBLIC BEHAVIOR

Recreationists come to the forest to get away from the regimentation so prevalent in our everyday world. However, there are many reasons why they cannot be given free rein when they visit the forest. The manager is faced with trying to protect the site from degradation, provide for the visitor's safety, and accommodate as many visitors as possible. Obviously, there has to be compromising of each to obtain overall goals.

The principle goal for Wild and Scenic Rivers is to protect the natural features of the area. Primitive resource-oriented recreation is a subordinate use that must be regulated to avoid detracting from the principle objective. The manager must seek to apply the minimum amount of necessary controls in an inconspicuous way once the visitor reaches his destination. Probably the most effective control is to separate the visitor from his vehicle as soon as possible to get him to travel on his own. This forces him to decide what is worth carrying and what should be left behind. Thus on his own he will usually leave behind gasoline lanterns that bake the cambium when hung on trees, radios that disturb other groups, firearms that endanger others, axes that are used to mutilate trees, and soft drink bottles that litter the landscape. This is part of the philosophy of the 1/4 mile corridor for Wild and Scenic Rivers. The abuse to the Chattooga Wild and Scenic River has been significantly reduced in the sections where visitors have been required to carry their equipment and boats into the corridor.

Visitors should be informed of regulations before starting their trip rather than encount-

ering signs during their trip. Regulations can be presented on a bulletin board at an entrance point, told by rangers who register the individual, or printed on the back of self-registration forms.

Lime and Stankey (1971) feel that the dissemination of information to the public is one of the most fruitful tools administrators can use to modify visitor behavior. By increasing contact with the public, managers can probably solve many current problems and help avoid others.

River Rangers are on duty at the three major access points along the Chattooga River. They ensure that all boaters use the required equipment and inform them of the best routes through rapids, what to do if trouble should develop, and how to dispose of litter. The results have been gratifying; the death toll on the Chattooga has dropped from 15 during a 2-year period to zero during the last 15 months.

Managers sometimes cause overuse of certain areas by the information they provide the public. If, for example, one portion of an area is overrun with people because the agency's publication features it on the cover, it may be well to feature some less impacted area that is harder to reach. Maps can be more detailed for areas where it is desirable to redistribute people away from more heavily used sections.

The number of boaters can be decreased by requiring certain skills and equipment before the user can participate. Because proficiency tests on the Chattooga River are not practical, all boaters on the most difficult section (4 miles) are required to use helmets. This often screens out the novice because few beginners own a whitewater helmet. Another method of reducing the number of persons using a particular area could be to require a permit for overused areas while no restrictions are placed on visitors using the less used areas.

Sometimes it is necessary to reduce one type of use to feature the use specified in the management plan. If hikers are utilizing most of the campsites on the only good whitewater river in the region, major foot travel routes should be relocated so as to bypass the most desirable campsites and eliminate the potential for conflict.

"Designation of a river as a unit of the Wild and Scenic River system can bring greatly increased visibility and popularity with consequently rapid increases in visitation. The resource has not changed that much, but is notoriety has, and popularity often increases abruptly" (Peters 1975).

Studies of wilderness users, which might also apply to river users (Stankey *et al.* 1974), suggest "a substantial percentage of them might find their desired experience more readily in a nonwilderness setting. It is likely that current pressures on wilderness stems from persons simply seeking a chance to hike or get away from the highly developed, civilized world for a short time".

CAMPSITE PROTECTION

The campsite is usually the river area receiving the greatest abuse. Chief impacts are soil compaction, erosion, and the elimination of vegetation. Research conducted in and experience derived from wilderness area management and lake areas designated for primitive travel can be utilized in river management because problems are similar.

Most site deterioration is caused by poor planning or administration on the part of the agency. "The evidence indicates quite conclusively that one of the principle reasons for widespread site degradation prevalent today has been lack of understanding by recreation planners and managers of vital resource of soil and soil related factors in the overall site management picture" (James 1974).

The manager has two courses of action concerning camping. First he can permit camping anywhere within the area, and second, he can permit camping only in developed or hardened sites.

Camping by boaters on some rivers is limited. Because of the rugged water on the Chattooga, the additional weight of camping gear makes a canoe very unresponsive so few people camp while canoeing. Regulations on the Chattooga allow both hikers and boaters to camp anywhere as long as the site is at least 1/4 mile from a road and at least 50 feet from a river, stream, or trail.

Where camping is a major activity, such as the Eleven Point River in Missouri and the Boundary Waters Canoe Area in Minnesota,

camping must be closely regulated. Campers in the BWCA are discouraged from using undeveloped campsites and forest officers should contact and educate users of this policy.

Requiring visitors to stay in designated campsites is probably the only realistic means of reducing resource damage when camping use is heavy. There are generally two to four camping units, as in the case of the Sylvania Recreation Area in Michigan, at each location, with a minimum spacing of 100 feet between units (fig. 1). Little or no brush removal between units is done to provide a measure of privacy. Generally the camping unit is located at least 100 feet from the water. Facilities usually consist of a toilet, fire grill or ring, space for up to three tents and sometimes a wooden table. The fire enclosure is provided to eliminate multiple fire spots and to reduce the chance of wildfire rather than as a convenience for the user.

Large groups are particularly hard on campsites when space is limited. They tend to cut down the screening between units to make room for more tents. This trend was well documented in a study in the BWCA (Merriam *et al.* 1974) that showed that newly cleared campsites nearly doubled in size in a 3-year period with use pressures from 320 to 900 cumulative visitor days (fig. 2). To minimize this site enlargement problem, the BWCA now limits each campsite to no more than 10 persons at a time.

Group size restrictions at the Sylvania Recreation Area on the Ottawa National Forest in Michigan limit each campsite to only one family or up to five persons per unit. If a larger group wants to use the area, they are required to split into smaller groups and camp and cook separately rather than gather at one site for meals.

It is far better to put money into initial planning, than to try to maintain

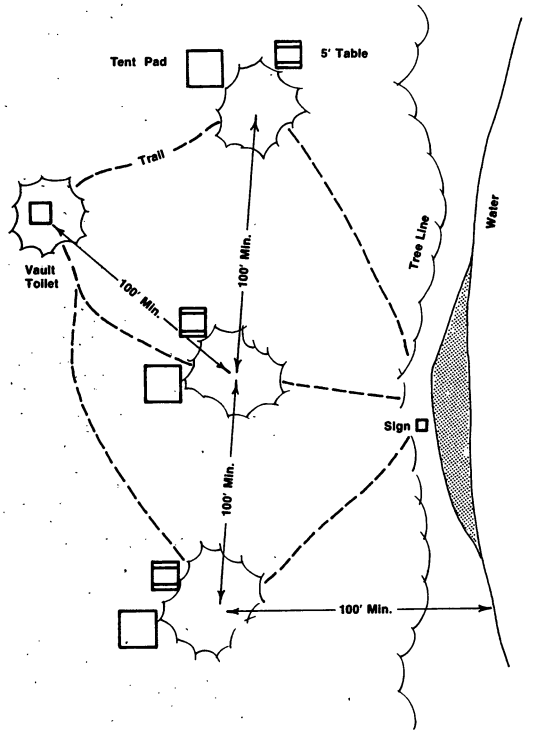

Figure 1.--*Typical Campsite for Boaters-- Sylvania Recreation Area*

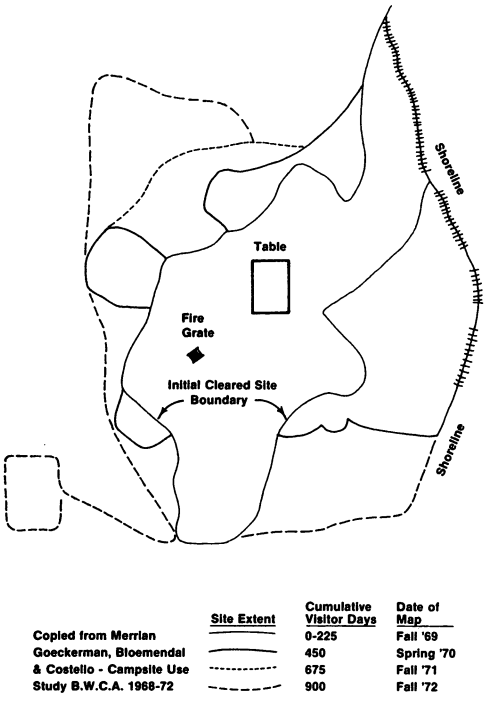

Figure 2.--*User Caused Expansion of a Boundary Waters Canoe Area Campsite*

a poorly selected site. The site selected should be above the high water line, have the best soil that will resist compaction, provide drainage for both camping and latrine, be fertile enough to support a lush growth of vegetation, have natural barriers such as rock walls or dense shrubs to impede site enlargement by visitors, and have a good landing area on water.

HUMAN WASTE

Public health laws often require that water used for recreation meet certain standards for biological purity. Heavy use by recreationists who fail to properly dispose of human waste can seriously degrade the water sources for both drinking and contact sports such as whitewater boating and swimming.

A wide variety of sanitation practices are used on our rivers and lakes ranging from ignoring the problems to constructing flush toilets. Decisions made depend on factors such as the number of users, funds available, ease of access, and agency goals.

Where the total number of users is not high, acceptable water quality can often be maintained by getting individuals to properly dispose of their waste.

Instructions in the use of the cat hole method can be printed on maps or given verbally. This is a single use pit covered with about 6 inches of earth. Management plans generally indicate that the cat hole should be no closer than 100 feet to the high water line, and studies have shown that decomposition is rapid.

Because of the heavy concentration of people, the BWCA uses a single seat toilet at many locations. This is simply a box with a hinged lid mounted over a pit. It is not surrounded by a building but is located in an area that provides vegetative screening. This minimal design standard was selected in an effort to reduce administrative costs and maintain a relatively pure experience (free from buildings). To protect water quality, BWCA standards require at least 48 inches of permeable soil below the pit and a minimum distance of 100 feet to a lake (BWCA 1969).

Pit privies are utilized in the majority of areas where structures are provided. If road access is not available, these privies can either be prefabricated and floated in pieces into the location or dropped in by helicopter.

Human waste may be causing biological contamination or nutrient enrichment of water bodies. A study of nine sites and controls (Merriam *et al.* 1974) "found that recreation use of sites increased coliform bacteria and phosphate concentrations in the lake water at campsites to a point higher than public health standards allowed for drinking water." Latrine location or lack of utilization of the latrine by users may be the cause.

A method to ensure that no human waste enters water bodies from toilets is to bury a 300 to 1,000 gallon sealed vault below a privy type structure. This provides satisfactory collection of waste, but it must be pumped out periodically. The only effective method of pumping is to use large trucks equipped with tanks and pump that can be driven to the site. Adequate venting and addition of biological odor control compounds can usually prevent objectionable odors in the toilets.

The Sylvania Recreation Area put a number of 300 gallon vault toilets in isolated areas that could be reached only by boat. When the vaults were full, they were emptied by hand pump into 55 gallon drums for transportation by boat to a road. The results were undesirable because great difficulty was found in moving sewage. All remote 300 gallon vaults in the Sylvania Recreation Area have now been replaced with 30 gallon above ground vaults. These small holding tanks are slid into the back of the toilet under the seat. They can be used either in a manufactured fiberglass enclosure or in a modified Forest Service single seat pit toilet building.

A 30 gallon holding tank will hold waste from about 500 visitor days of camping use and has a lid that can be sealed when full. When one is full, it is removed and an empty tank is then inserted into the toilet. Full tanks can be carried out by boat or stockpiled until the end of the season. A helicopter can be brought in to carry four of the full vaults per trip to a road (Somerville 1976).

Recirculating toilets are used at some locations where odor control is difficult (high use areas, cool conditions that impede growth of odor controlling bacteria compounds).

These offer many of the advantages of a flush toilet system without the need for a pressurized water source or electricity. However, to avoid expensive pumping, they should be mounted over a holding vault because the contents (70 gallons) of the toilet have to be emptied about every 1,000 flushes. A fresh charge of 15 gallons of water plus a couple quarts of chemical makes the toilet ready for another 1,000.

SOLID WASTE

The mess some recreationists leave behind is staggering and creates a great impact on resource managers. It is known to the public as litter and to resource managers as solid waste.

Studies have shown that river users often consider that the presence of litter is the low point of their trip and they put it above other negative factors such as too many people, obstructions to canoes, rowdy individuals, or erosion (Solomon and Hansen 1972). Because a large portion of many managing agencies' budget goes into cleaning up solid waste along waterways, it warrants attention.

Obviously the best strategy from an agency's position is to get the recreation users to carry as much of their trash as possible. The "pack it in, pack it out" policy of the Eleven Point River assumes that if a person can carry a full container of food in, he can easily carry out the empty cans and foil that can't be burned. The program is successful with 75 to 90 percent of empty cans being removed (Lefler 1976).

The BWCA provided plastic litter bags to boaters for a number of years in an effort to increase the percentage of containers carried away from the area and correctly disposed of. The bags helped, but because of the many uses, even the small percentage of litter thrown into the shallow water of the lake was excessive (Reid 1976). The BWCA now enforces a bottle and can policy where all "cans, bottles, and other food and beverage containers which are disposable but not burnable are prohibited." Other containers such as insect repellent, fuel, toothpaste, etc., are permissible but empty containers must be removed from the area by the user. Instead of cans, visitors must repack food in reusable plastic or metal containers. This policy has been successful in reducing litter cleanup costs and has had good acceptance with BWCA users.

Because it is hard to stop littering, a difficult cleanup problem exists at many areas. The majority of solid waste pickup responsibility falls on the managing agency. On the Chattooga River, ground crews pick up trash within about 1/2 mile of the river and carry it out by hand. The amount of trash beyond this point is usually much less concentrated because few visitors walk this far.

A lot of litter is also collected by nonagency personnel. Commercial outfitters run "pickup" trips down the river on days when no commercial trips are being run and the guides are still in pay status. Also, volunteer groups such as scouts, sportsmen, and outdoor groups may schedule cleanup trips in an effort to get their members involved.

On some very rugged rivers, wreakage of boats may be a major problem. After being wrapped around a rock or broken in two, these boats are often abandoned by their owners in disgust and can be difficult to remove from the river. On the Chattooga one private individual recovered 16 abandoned canoes in 1 summer. If his efforts to find the owner failed, he repaired and sold the canoes as his payment for the cleanup job.

MINIMIZING CONFLICTS THROUGH ZONING AND SCHEDULING

The managing agency must make the best use of the river and adjoining land to meet guidelines provided by legislative and agency policy. There will usually be many more special interest groups wanting to use the area than the land base will support.

The management plan must determine what uses will be permitted. To eliminate conflicting uses, only compatible interests can be permitted to be near one another. This gives the manager three choices: (1) noncompatible uses can be totally excluded, (2) the area can be zoned to permit different uses for portions of the area, or (3) incompatible uses can be scheduled when conflicts will be minimized. This calls for compromise.

Motorized vehicles are prohibited in wild sections of the Chattooga River corridor because areas for motorized use can be found easily in nearby locations. Different

portions of a river may be zoned for different uses. Fishermen may object to heavy boating use because it may interfere with fishing. The upper 30 miles of the Chattooga River are narrow and shallow, resulting in difficult boating conditions while providing the best cold water trout fishing in South Carolina. In contrast, the lower 28 miles of the river are too warm for optimum trout production, but offer some of the best boating in the eastern United States. So the USDA Forest Service closed the upper portion to all boating, and fishermen are told that they will encounter numerous boats when they fish in the lower portion of the river.

Conflicting uses can also be zoned so that one type of land use, such as horse trails, is permitted along one side of a river and another type, such as hiking, is permitted on the other side. Naturally the terrain, steepness, and soil suitability should play a major role in determining the zoning rather than simply continuing past usage.

Conflicting uses can be reduced by scheduling one when it will have minimum impact on the other. Outboard motor use is a long standing tradition by local groups on some rivers. If large numbers of canoeists begin floating the river, serious problems may develop because canoeists generally despise motor boats. It may be possible to work out a compromise if the primary use of motors is for gigging fish during the winter when there is little canoeing. Thus, the regulations might permit outboard motor use only from October 1 through March 31, thereby meeting the needs of both groups of users.

Scheduling daily departure times for river trips can reduce bunching up at difficult rapids. Commercial raft trips on the Chattooga are spaced at least an hour apart. This gives the clients an experience of boating in an uncrowded river and also makes it easier for faster-moving private kayaks to get around slower-moving raft flotillas. Limits can also be put on the number of trips commercial outfitters may make. Because most private boaters come to the Chattooga on weekends, the three commercial permittees are presently limited in the number of trips they can make on weekends.

Scheduling can also be used to give the campsites a rest. Campsites on the Middle Fork of the Salmon are assigned to boating groups with the objective of no more than one party using the site at one time and allowing the site to rest unused 4 out of every 10 days (Middle Fork Plan 1973).

Many Wild and Scenic Rivers have poor distribution of visitors. Some places are overused and others are underused. Ease of access largely determines where people will begin and end their trip. Managers can utilize the fact that many visitors try to minimize their contacts with other users. Maps showing areas of high recreation concentration may be useful in spreading the people out and therefore reducing the impact on the overused areas.

The areas near entry points often take a beating because so many people are concentrated in them. On the Eleven Point River, no trail camps will be located within a mile of any major road or trail head. This distance separates the majority of those who are just looking for a place to camp and those who are looking for the type of experience offered in a Scenic River.

VEHICLE CONTROL

Motorized use such as 4 wheel drives or trail bikes may be determined to be incompatible with the management plan's objectives. However, especially in the case of newly established Wild and Scenic Rivers, use of motorized vehicles may already be well established, making it necessary to stop people from using vehicles in the area.

More than 60 closures of primitive roads were made to exclude vehicles from the Chattooga corridor. This action by the USDA Forest Service caused deep resentment among the people accustomed to driving in the area. To be successful, a major closure like this must be supported by public document in the decision-making process, by informing the public of the regulations, and by effective law enforcement programs including publicity of convictions for violating orders.

Each road to be closed must be analyzed to determine how serious an attempt will be made by off road vehicles to travel it. Roads with minor appeal to 4 wheel drives can be closed by felling a few trees across them, pushing a small (3 foot high) earth mound

across the road with a bulldozer, or erecting post barriers and signs.

Where a medium amount of effort is expected to breach the barrier, earth mounds or tank traps about 7 feet high are often effective in stopping vehicles if there is steep terrain so the vehicle cannot drive aroundthe barrier. Finally, on roads where 4 wheel drives are determined to come through, the slope on either side of the road should be at least 50 percent and double mounds about 10 feet tall should be pushed with a deep hole between them.

Gates stoutly built with enclosed locks have proved successful in stopping vehicles on the Chattooga. Much of this success is probably due to the realization by the driver that he is destroying government property rather than just winching his vehicle over an earth mound. However, on some gates, hack saws have been used and it then becomes necessary to fill the pipe with reinforcing rod and concrete.

All road closures must be backed up by appropriate regulations prohibiting driving on closed roads and damage to government property. Closure signs are needed at each location and these need to be securely fastened. A method found to be effective is putting at least 8 largeheaded, long shank roofing nails in each 8 10" metal sign and placing the signs high up on trees so they cannot be pried off. Hopefully, after a couple of years citizens will begin to accept the closure and signs can be relocated to posts.

People who have traditionally used the roads resent being forced to walk to the river and seeing the river being used more and more by outside boaters. Examples of how they take out their hostilities include starting forest fires, slashing tires, putting sugar in gas tanks of agency vehicles, vandalizing signs and boaters' vehicles, shooting across boats, and cutting down trees to block the river. Managers should begin comprehensive public relations programs before closing roads and be ready with agressive fire suppression and law enforcement forces.

LANDING AREAS

Next to campsites, entry points or landings receive the most concentrated use and are thus subject to serious degredation. The ideal landing site has a gravel or solid rock surface at the water level on the inside bend of the river with a gentle slope up to an area suited for parking or camping. Steep bluffs should be avoided if possible because the heavy traffic will quickly eliminate the vegetation and erosion will begin.

In order to avoid more disturbance than necessary, people should be funneled from the parking area to the water's edge by barriers such as dense vegetation (either natural or planted), rocks, or logs. It may be necessary to reinforce unstable banks to prevent washing. In keeping with Wild and Scenic legislation, the more natural the appearance of this reinforcement the better. One method utilizes log cribs made with decay-resistant materials, and filled with coarse gravel, which can withstand both foot traffic and the river's current at the flood stage while blending well with natural features.

Campers tend to establish new landings closer to their unit instead of the central landing. Managers at lakeside campgrounds have had some success encouraging only a single landing by placing barriers to hinder boat access at some points and by adding a log or rocks so that a canoeist can enter a boat easier at a desired point.

RESTORATION

The river manager must have a good knowledge of how to revegetate and/or restore portions of his area. Restoration may be necessary because of changes in management philosophy such as closing roads to vehicles and making them less noticeable, or correcting overused areas.

Before successful restoration can be accomplished, the factors that caused the loss of vegetation must be removed. It is important to treat the problem, not the symptom. A manager's goal may be to screen improvements from a river. For example, if all the vegetation around the tables on the bank has been killed by picnickers, it is doubtful that the manager can restore the vegetation and still keep the tables. It is probable that compaction has eliminated some of the conditions that vegetation needs to grow. The tables should be moved to a site that has been hardened with gravel, or it can be located on bedrock where compaction will not be a factor. Water

eroding an abandoned road will probably continue even with grassing unless the road is drained with waterbars, outsloped, or ripp-rapped with stone.

An intimate working knowledge of conditions necessary for good growth of vegetation is also needed. Spreading seed to revegetate a site is often a waste of time and money unless proper amounts of fertilizer and lime are applied. The required rates can easily be determined by a soil sample. Compacted soils must be cultivated. If grass is to be sowed, it is very important to use the type of grass that meets the growing conditions on the site because each grass has different growth requirements.

Many rehabilitation attempts on campsites fail because managers do not realize that adequate amounts of sunlight must reach the ground for grass and tree reproduction to begin, thus it may be necessary to remove some of the shading overstory trees. Cordell *et al.* (1974) found that reducing canopy cover to 60 percent doubled grass cover produced under a 90 percent canopy and reducing canopy to 30 percent more than tripled grass production.

The additional cost and effort of mulching freshly seeded areas with hay or some of the woven mat materials is often justified, especially in sloping areas or areas with poor moisture capacity. In some dry areas irrigation may be the only way to establish a hearty vegetative mat. Because of the wide variation of the growing conditions of our nation, it is pointless to discuss the specifics in this paper. However, local county agents and Soil Conservation Service representatives are happy to work with managers seeking current information in this specialized area.

Because a natural appearing landscape is one of the chief reasons people seek our rivers and lakes, managers should strive to use nature or natural appearing plants in restoration work whenever possible. Nonnative plants such as Lespedeza and Multiflora Rose look out of place. In high visibility areas use of exotics is justified only if growing conditions are so severe that natural grasses and shrubs will not do the job.

If a manager cannot find commercial seed sources for plants he would like to use he may have to collect his own. Seeds from fast-growing plants such as blackberries and poke berries can be quickly gathered, dried, and used to achieve the natural barriers needed for quality restoration projects.

Young plants and the tramp of peoples' feet don't mix. When plants are becoming established, it is necessary to protect the area from traffic. Campsites should be closed for at least several years and foot trails relocated if possible. A lush growth of vegetation for several seasons will be needed before the organic matter needed to resist the abuse of moderate human traffic will begin to build up in the soil.

Sometimes it is necessary to remove improvements on the land. The Chattooga Wild and Scenic River Management Plan required obliteration of portions of a campground and change in type of use from vehicle access to walk-in. The gravel on surfaced roads was loaded with a front end loader into dump trucks and spread on another road outside the corridor that needed gravel. This removal accomplished two jobs. First it resulted in a net saving of $2,500 for the road getting the gravel and second, it resulted in a much better job of revegetating on the old road that would not have been possible with gravel in place.

Facilities, such as 2,500-pound concrete tables, that were located too close to the Chattooga were also removed. The decision was made to move the tables intact. Local residents may be extremely resentful of having their recreation facilities closed and from a public relations standpoint, it may be worth the effort to try to salvage and move improvements such as tables to another location even if the cost is higher than destruction of the old and construction of the new. However, on the Chattooga, it turned out that the concrete tables were moved from the river at a savings of more than $100 per table.

A restoration project is not something that can be forgotten after the work is done. The manager needs to keep checking to make sure the new vegetation is being protected and has the fertilizer and water it needs.

DEVELOPING A RESEARCH CAPACITY IN FIELD ORGANIZATIONS TO AID IN MANAGEMENT DECISIONMAKING

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ABSTRACT.--Discusses (1) the trend toward developing research capacities in field organizations of national parks, recreation areas, or wildlife refuges, (2) factors that seem to be important in making that kind of a research capacity most useful, and (3) some implications for education in recreational management and planning. A detailed case history of the development of a river research program in one field location--Ozark National Scenic Riverways in Missouri--is given.

Today recreation managers--especially of river areas--need an improved data base for various reasons: increasing use of recreation areas, conflicts among users, more public scrutiny of management decisions and challenges to decisions in courts of law.

It is becoming imperative for an increasing number of field units to have a data base that goes beyond traditional resource inventory types of data, so they can deal with new and undefined management phenomena. This calls for research-trained personnel and the use of research methods.

This paper outlines various ways in which outdoor recreation resource management agencies respond to needs for research-based information. It is suggested that there has been a shift from attempts to simply issue contracts for research (the "purchase" model) toward developing an "in-house" capacity to initiate and evaluate research on field units (the "process consultation" model). A case study of one field research program at Ozark National Scenic Riverways illustrates how such a program evolves on a management unit.

WAYS TO OBTAIN NEEDED RESEARCH

Recreation resource management agencies have been getting research done for several years. There are 3 general ways to organize to obtain research data as the need increases:

1. Create central office planning-research units.
2. Create the traditional separate research units and management units.
3. Place researchers or research-trained personnel in field units, i.e., individual national parks, recreation areas, wildlife refuges, or equivalent management units.

An example of the first way would be the Research Section of the Long-Range Planning Division of the State of Illinois Department of Conservation. Three researchers with Ph.D.'s (in economics, psychology, and wildlife biology) design and contract research for the Department. An example of the second way is the USDA Forest Service, which has followed the model of agriculture by using regional research experi-

ment stations. The third approach--emphasized in this paper--has been used by the National Park Service, which has tended to place researchers on individual parks as part of the management unit. In recent years, several other agencies (U.S. Fish and Wildlife Service, Tennessee Valley Authority, and some State agencies) appear to be following this latter pattern.

Managers have been faced with the need to determine recreational carrying capacity.[1] Such a determination is often complex (Wagar 1964 , Lime 1975a, Marnell 1976), localized in nature, and new to research. For these reasons, and because of the difficulty of obtaining research funds for field units, managers have tried various approaches to get the needed research done on their units.

One way this has been done is the approach of the Missouri State Parks System in the mid-1960's. The Director of State Parks initiated a grant of a few thousand dollars to the School of Forestry at the University of Missouri to support the new and developing area of recreation research. This tended to facilitate a series of discussions between university and State park personnel, but nothing very specific resulted. The State Parks subsequently switched to contracting for specific studies to be done. Another example is the arrangement worked out with the National Forests in Missouri and California, with the St. Louis County Parks Department, and with other field management units. In these cases a graduate student was employed as a summer employee or intern to work on specific research projects along with other duties.

Other units, e.g., Land Between the Lakes administered by the Tennessee Valley Authority in western Kentucky, have worked to develop "outside" funding sources, such as the Coleman Company, American Motorcycle Association, and American Honda, to support mutually beneficial research by university researchers.

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[1]*Data and insight for this paper come from the senior author's dual interests: (1) how land managers develop measures for determining recreational carrying capacity, and (2) how administrative organizations adapt to changing demands (Whyte 1969). Studies have been facilitated by offering the services of graduate students (who derive their theses).*

In the above examples, one common factor was the continuing dialogue with university researchers in recreation research rather than simply contracting for research. Schein (1969) has noted that the most prevalent model of consultation has been the "purchase of expert information or an expert service". This "purchase model" works well in established fields, such as engineering, where the management unit can clearly define a need and specify information needed. For less clearly defined situations, he suggests the usefulness of a "process consultation" model. This model involves the managers and researchers in a period of joint diagnosis, to explore the relevance of various approaches to the complexity of the particular situation before initiating research.

Recreation field units are usually some distance from universities or other research facilities. As the need for data on carrying capacity grows, there is a trend toward placing research-trained personnel in field units where they can act as a "process consultant", a link between the managers and various kinds of researchers. This utilization of a research-trained person to facilitate research efforts has been tried (although with somewhat different institutional arrangements) at 4 of 6 major recreation resource management units within 200 miles of Southern Illinois University.

A more important reason for the addition of research-trained people to recreation management field units is the relative newness of recreation research. In such complex matters as carrying capacity determination for large wildland areas, decision inputs are still being identified and methods of measurement are still being worked out. Thus it is often not feasible for a recreation management unit to simply contract for research services (as in the "purchase" model cited above). Rather it is necessary for research-trained individuals to work with managers on-site to develop a diagnosis of particular research needs, and then often to work with other research specialists to obtain research that is needed. Additionally, a research-trained person on a management unit can interpret the results of a research project to managers and others, and help to implement the findings of contracted research.

What kind of a person should be recruited as "research-trained" for field level organizations? How might that person be identified?

How will such a person "fit in" to the existing organization? What kinds of adaptations in organizational operations will be necessary for the researcher to function effectively? Is this recruitment analogous to the addition of specially trained persons for other organizational needs, such as engineers or architects?

Two observations might be offered about recruitment. First, it is usually desirable to recruit someone who has conducted research, or received part of his training, in the field. Second, it might be well to visit various universities to learn which ones have some fieldwork in their research training.

The latter may stimulate university research training programs into more awareness of field needs. It may also suggest research opportunities, and the need for additional kinds of training. Specifically, in addition to continuing to improve research training, it may be important for graduate students to learn more about the complexity of field operations, and to gain a better awareness of the nature of administrative organizations and the pressures involved in decisionmaking.

AN EVOLVING RESEARCH PROGRAM--A CASE HISTORY

At this point let us examine a research program and study what has happened with the organization and the perceptions of the people involved.

One management unit that has initiated a field research program is Ozark National Scenic Riverways (ONSR), a National Park Service unit that has responsibility for administering some 140 miles of the Current and Jacks Fork Rivers in south central Missouri. Ozark National Scenic Riverways was established in 1964 to become the Nation's first Scenic Riverway. The area is administered as a National Recreation Area.

The area was set aside as a Scenic Riverway because of its many large and unique springs which keep the rivers cold, clear, and moderately swift. It contains classic examples of Ozark mountain scenery, and the National Park Service maintains examples of native Ozark cultural activities for interpretive programs. These characteristics, plus its proximity to St. Louis, Missouri (about 150 miles), make the area a favorite for canoeists. From relatively few canoe float trips in 1964, floater use had increased to approximately 150,000 floater days in 1974 (Wehrung 1975). Some sections have become quite congested with canoes, especially on summer weekends.

In October 1971, an aquatic biologist was added to the ONSR staff. He had previously worked at Yellowstone and Yosemite National Parks. His assignment was to evaluate the status of the river fishery, which had long upheld an outstanding reputation but was claimed to be declining. Shortly after his arrival, however, the biologist sensed that a crisis was forming in connnection with the exploding popularity of canoe floating at the Riverways. Concerns about the fishery diminished as attention focused on river use.

The biologist recommended a comprehensive research program dealing with this matter to the ONSR Superintendent and this was concurred with--even though it would take several years, and almost no research funds were available.

By July 10, 1975, the National Park Service summarized the six approaches of the River Use Research Program at Ozark National Scenic Riverways as follows:

1. *River-Traffic Investigations*--These document the volume, composition, and distribution of river-traffic; access use; float trip patterns; floater camping trends, etc. The program relies on remote sensing technologies, survey data, and computer analyses.

2. *Floater Impact Evaluation*--Evaluates environmental impacts associated with use along the river corridor. Problems of erosion, soil compaction, vegetation response, etc., are being investigated.

3. *Sociological Aspects of River Use at ONSR*--A series of studies that yield information on floater attitudes and perceptions, i.e., effects of crowding, float group structure, user-group conflicts, etc. The data is gathered through the use of OMB-approved questionnaires. The studies are available in thesis form.

4. *Safety Evaluation of River Use at ONSR*--Emphasizes the heavy-use access points and critical enroute areas along the river.

5. *Water Quality of Current and Jacks Fork Rivers*--A baseline study for future monitoring of water quality. Correlation of water quality with river use is included as a study objective.

6. *Economic Impacts of ONSR*--A study to evaluate the impact of ONSR and recreational floating on local and regional economies.

Reports for most projects are to be completed by December, 1975. A Summary Report prepared by the NPS will be available by December, 1976. This will include findings and recommendations of all projects completed to date. This report will be fact-finding only and will *not* constitute a River Use Management Plan.

A formal River Use Management Plan will be developed following the opportunity for public input and a review of various alternatives. No data can be given for implementation of a River Use Management Plan since this will ultimately be contingent upon an approved Master Plan, fulfillment of NEPA requirements to support the plan, and the followup process of additional public review.

The evolution of the research program is much more complex than is indicated by the above summary. It is worth noting that the biologist's role shifted from researcher to research coordinator to information disseminator. It might be well at this point to examine the perceptions of participants in terms of what has taken place.

The Agency Researcher's Perspective

After securing approval to embark upon a river use research program at Ozark National Scenic Riverways (rather than "stock fish"), the agency researcher proceeded by (1) identifying specific problems, (2) immediately starting research in several disciplines, including some outside his own speciality, and (3) making contact with "outside" researchers to gain from their expertise and to encourage their involvement in the research program at ONSR.

Identification of research needs began with concerns about the lack of information on several basic aspects of the problem. Aside from environmental matters, questions were raised about river users, their motivations, and their perceptions about ONSR. The identification of program needs evolved into a dynamic process, constantly being revised as new inputs became available, or as demands for new information arose.

Research outside the agency researcher's specialization focused first on the problem of determining how many canoes were floating the Riverways. It was known only that there were "a lot" and that the numbers were increasing each year. The researcher, with a background in electronics, responded by developing a sophisticated low cost monitoring system for accurately measuring numbers of floaters (Marnell 1975). This was later expanded into a complex program involving several techniques to yield data on a broad range of use-parameters.

Contact with "outside" investigators began with university researchers who had previously conducted studies in the area, or had otherwise expressed an interest in lending assistance. The agency researcher also met with State Conservation Department personnel to learn of their experience in the area prior to its designation for Federal management. Followup on these meetings and attendance at various research conferences produced new information and additional contacts. As funding became available to support the research program, it was applied first to studies where special equipment and laboratory processing was required (i.e., water quality investigations). Funding was later diverted to graduate student projects.

As the research program developed, two unforeseen demands began to draw on the agency researcher's time; (1) more time was needed for administration and overall coordination of research activities, and (2) requests were being made more frequently for presentation of research findings. There were many frustrations involved in research contracting and in securing administrative clearances (i.e., "red tape" for approval of survey questionnaires, etc.). Also, the task of locating and arranging for the services of people possessing certain skills, often with only limited funds available, required a rather personal involvement at times by the field scientist. Requests for presentations of findings ranged from "in-house" briefings for supervisors and associates to appearances before local

civic groups such as Rotary Clubs, Chambers of Commerce, etc. There have also been increasing requests for presentations at regional and national meetings, such as this one. These are seen as opportunities for constructive discussion and the learning of new ideas.

What effects have these role changes had on the agency researcher? A few peers have been somewhat skeptical, as though he had defected from the "purity" of his discipline. However, this has been largely offset by stimulating and productive associations with researchers in a variety of disciplines. For example, recreation researchers interested in carrying capacity determination have become interested in the scope and complexity of the program at ONSR.

Perhaps the main reward for the field researcher in this type of situation is the feeling of having made a contribution to the decisionmaking process.

Whatever the outcome may be on the river use issue at ONSR, the agency and the general public will at least have the benefit of a substantial information base to work from.

The Area Manager's Perspective

The field biologist position was established at Ozark National Scenic Riverways (NSR) to accomplish rather specific tasks. The position was assigned as a staff type job reporting directly to management but having routine contacts with all other staff as well as line personnel.

The area manager had earlier experience working with researchers such as historians and archeologists, plus professionals in the fields of engineering, landscape architecture, and architecture. It had been his observation that few problems are encountered in "fitting in" a researcher or professional into a field management organization. However, a lack of appreciation and understanding of management needs and pressures more often occurs.

After a short period of orientation on the part of both the researcher and manager at Ozark NSR, it became evident that pressures to manage the rapidly increasing river use greatly outweighed the concern for fishing conditions.

As the researcher developed his study program along with a work accomplishment schedule, time became critical. It was necessary to place a moratorium on all commercial river use operations in order to limit increases during the study period.

Pressures have been increasing annually to effect changes in that moratorium, and these have ranged from political to court action. Support for the interim management position also has been substantial, and has included Congressional backing.

A comprehensive research program was required to provide the necessary data for the purpose of developing a management plan for the protection and use of the Ozark National Scenic Riverways. A firm position on interim management controls was mandatory to provide an adequate fact-finding period.

CONCLUSIONS

All three ways of gathering research data for recreation management (1) central office planning-research units; (2) experiment stations established by the managing agency; (3) placement of researchers or research-trained personnel in field units, continue to be important. However, there is a trend toward supplementing the first two ways with the third in the lower Midwest and the upper South.

Instituting an effective research program--such as the one described in the case history--takes time. Do not expect "overnight" results. As with adding other specialized persons (such as landscape architects or engineers) to field management staffs, it will take time for a researcher to learn about the area, make necessary contacts with supporting persons, and to collect and analyze research data. The case history research program at Ozark National Scenic Riverways has been operating for 4 years. If you foresee research needs on your management unit, the time to think about implementing research is now rather than under "crisis" conditions.

RIVER-RUNNING IN THE GRAND CANYON: HOW MUCH AND WHAT KIND OF USE[1]

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ABSTRACT.--Management issues relating to amount and kind of river-running use on the Colorado River in the Grand Canyon were investigated. Results show that use levels affect number of inter-group contacts, but number of contacts has little effect on perceived crowding or user satisfaction. Probable effects of an increase in commerical and/or private oar trips are described.

Colorado River trips through the Grand Canyon take from 5-11 days by motor (on 30-40 foot pontoon rafts) and from 12-18 days via oar boats, which are generally smaller (15-25 feet) crafts. Stops are made at places of scientific, historical, esthetic or recreational interest. At night, trip members camp on natural beaches along the river. River trips in the Grand Canyon can be categorized on two dimensions. They are either *commercial*--i.e., run by outfitters who are in the business--or *private* --that is, organized by individuals on a nonprofit basis. Trips can also be characterized as *motor* (75 percent of all trips) or *oar* powered (25 percent).

The Issues

Dramatic increase in use for river-running on the Colorado River in the Grand Canyon (and elsewhere) has precipitated the need for research on three management issues. The first has to do with how much use is compatible with a quality wilderness recreation experience. The question is: What density levels can be tolerated before an area becomes "too crowded" and no longer a satisfactory wilderness experience? How many is "too many" people? What, in short, is the sociological carrying capacity of the area?

This issue has received the most attention and much of the literature reflects a "user satisfaction" model. Specifically, it is assumed that density or use levels will increase the probability of contacts with other groups: that as contacts increase, users are more likely to perceive that area as crowded, and that this perception will, in turn, have a negative effect on how they define their experience. (For a review of this literature, see Nielsen, Shelby, and Haas 1977). It is expected, of course, that there are differences among users in their perception of and reaction to crowding. Wilderness "purists," for example, have been identified as those who share a pro-wilderness ideology and are expected to be more sensitive

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to crowding than nonpurists (Stankey 1972 , Hendee *et al.* 1968).

While the carrying capacity issue is salient for all wilderness recreation activities, two additional issues regarding *kind* of use are more specific to river running. One is what we call the "motor-oar" issue. This is essentially the question of whether motor travel should be phased out--a policy alternative based primarily on the argument that motor travel is inconsistent with a wilderness experience. Arguments in favor of motor trips focus on their ability to provide a river-running experience for more people in less time. A second issue has to do with the current unequal distribution of user-day allotments between the private (8 percent) and commercial (92 percent) sectors. Very simply, private users want a greater share of total user days per season.

PREVIOUS RELEVANT RESEARCH

Research on these two issues is scanty. Differences between motor boaters and canoeists in the Boundary Waters Canoe Area of Northern Minnesota have been researched by Lucas (1964b, 1964c), who found that canoeists disliked meeting motor boats. Motorists, in contrast, were not bothered by contacts of either kind.

PROCEDURE

Data relevant to these issues were generated by having participant observers accompany a stratified random sample of trips during the summer 1975. Trips were stratified on the basis of seasonal use patterns; that is, more trips during high use and fewer trips during low use periods were selected. Private trips were oversampled so that a separate comparison between them and commercial trips could be made. The total sample, consisted of 46 commercial trips (39 motor and 7 oar) and 7 private trips.

Observers recorded number and kind of contacts (i.e., whether they were on the river or at attraction sites along the river), kind of trip with which contacts were made (whether motor or oar, private or commercial, etc.), the kind of interaction that ensued (if any) between the parties, and overall reaction to seeing another boat or group.

Observers also kept a trip itinerary and recorded quality and quantity of intra-group interaction. They also recorded "adjustments for crowding" made by the boatman. These occurred whenever trips went farther or faster than planned, slowed down, changed the location of a planned campsite, or passed up attraction sites because of the presence of others.

On the last night of the trip, passengers completed questionnaires designed to measure background variables (e.g., age, sex, socioeconomic status, rural or urban residence, outdoor recreation experience), wilderness values, expectations about the trip, perceived crowding, subjective knowledge (how much you think you learned), objective knowledge of the Canyon, perceived social benefits of the trip, other evaluative dimensions of the trip, and preferences regarding kind and number of contacts. Multiple-item scales were constructed for most of the attitude and value variables. A total of 1,009 questionnaires, representing a 96 percent response rate, were completed.

To provide a methodologically valid comparison between the motor and oar experience, four experimental trips were arranged. Twice during the season, two trips (one motor and one oar) were scheduled to leave Lee's Ferry so that they would meet halfway through the Canyon. At this point, passengers on the oar boats switched to the motor boats and those on the motor boat switched to oars for the remainder of the trip. The 56 passengers on these trips filled out a modified questionnaire after the first half of the trip and the standard questionnaire at the end of the trip. Other data collection procedures used on these experimental trips were similar to those used for standard trips.

National Park Service records also were obtained to measure use or density levels. Use level was defined as the total number of people or trips leaving Lee's Ferry three days before and after a trip's departure date. Thus density can be measured in terms of people or trips per week; use levels ranged from 80 to 940 people and 13 to 32 trip per week. As might be expected, the correlation between these two measures was high (r=0.94).

RESULTS

Passenger Characteristics

Like other wilderness recreationists, commercial river travelers in the Grand Canyon (n=849) are a fairly select socio-economic group. Income levels are high; half reporting family incomes over $24,000. Educational level is also high; 78 percent had attended college, of which 53 percent had earned a bachelor's or advanced degree. The average age is 33: 43 percent are married; and the two sexes are equally represented; 64 percent live in large cities or suburban areas. Only 22 percent belong to an outdoor club or conservation organization; 31 percent were on their first wilderness-type trip.

Sociological Carrying Capacity

As expected, probability of contact increases with use level as shown in the tabulation below.

Variable	*Correlation with use level (People per week)*
Trips per week	0.94
River Encounters	
Contacts per day	.68
Time in sight (minutes)	.47
People per day	.65
Attraction Site Encounters	
Percent of sites (total) with contact	.58
Probability of meeting another trip at:	
Little Colorado River	[2].28
Elves' Chasm	.69
Deer Creek	.43
Havasu Creek	[2].31
All four sites	.58
Number of people met at:	
Little Colorado River	[2].25
Elves' Chasm	.43
Deer Creek	[2].26
Havasu Creek	[2].33
All four sites	.51

Thus, the first part of the carrying capacity model is confirmed.

The tabulation below, however, shows that there was no relation between contacts on the river and perceived crowding (r=0.05) and a statistically significant but low correlation (r=0.12, p<0.01) between attraction site contacts and perceived crowding.

Use or contact variable	*Correlation with perception of crowding*
People per week leaving Lee's Ferry	0.05
River contacts per day	.05
People per day seen on river	.05
Time in sight of people on river	.03
Percent of attraction sites (total) with contact	[3].12
Average number of people seen at attraction sites	[3].13

Correlations between number of contacts and perceived crowding were not significantly different for respondents who measured high on several indicators of wilderness values.

The tabulation below shows that the correlation between perceived crowding and satisfaction is statistically significant and in the right direction (that is, those who perceived crowding showed less satisfaction), but not large enough to be substantively important (r=0.14, p<0.01).

Variable	*Correlation with overall trip rating*
Perceived crowding	[3]0.14
People per week leaving Lee's Ferry	.00
River contacts per day	.05
People per day seen on river	.03
Time in sight of people on river	[3].10
Percent of attraction sites (total) with contact	-.01
Average number of people seen at attraction sites	.02

In sum, the data provide only partial confirmation of the user satisfaction carrying capacity model. Use is positively correlated with contacts but contacts show little relation to perceived crowding, and perceived crowding seems to have little to do with user satisfaction.

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[2] *p<0.05. All other probabilities are less than 0.01.*

[3] *p<0.01.*

Explanations for the lack of empirical confirmation of the carrying capacity model seem to fall into two categories: (1) those that assume the model is incorrect; and (2) those that assume the model is correct, but that for various reasons data from the present study don't support it. Those in category 2, for example, argue that current density levels are simply not high enough to affect the user's experience. A higher use level (e.g., over a thousand people leaving Lee's Ferry per week rather than the current average of 660, and seeing 100 people from other trips per day rather than the current average of 72) might show a significant effect on perception of crowding, which would translate into a negative experience by the user.

A second explanation is that the relations specified in the model will hold, but not for the population we tested. It has been suggested, for example, that those likely to be sensitive to crowding (and therefore show a negative reaction to higher use) have already reacted by going elsewhere--i.e. to less crowded places. This is referred to as the displacement phenomenon, meaning that more sensitive users have been displaced by less sensitive ones. It is consistent with the fact that this was the first river trip (62 percent) and the first time in the Canyon (90 percent) for a large proportion of the population.

The high percentage of first-time users in the river-running population sampled suggests another explanation for lack of empirical support of the model, but in this case the model is considered incorrect. It may be that the carrying capacity model assumed too much. That is, one must be aware of a norm or standard about crowding in the wilderness before one can define it as having been violated. The lack of empirical supportive data for the model may be due simply to the fact that current users have no specific expectation or norms about what is an appropriate contact level. More than half of the respondents did not know what to expect in terms of river contacts, and a third had no expectation regarding the number of people they anticipated seeing relative to the number actually seen.

The carrying capacity model may be incorrect in another way. Perceived crowding is only one of many variables that might reasonably affect the quality of a trip. This is supported with data shown in the tabulation below, which lists trip features that were related to user satisfaction.

Variable	*Correlation with trip rating*[3]
Personal Benefits	
Subjective Learning	0.31
Personal Growth	.19
Social Aspects	
Quality of Group Experience (subjective)	.32
Accessabilty of Boatmen	.32
Rating of Boatmen	.37
Passenger Role was Unambiguous	.28
Wilderness Character of the Experience	
Being in wilderness an important reason for trip	.20
Pace of trip perceived as leisurely	.29
Evaluation of trip as a "nature experience"	.31
Trip perceived as "noisy"	-.24
Use impact perceived as high	-.20
Would prefer more conveniences	-.29
Other	
Weather perceived as bad	-.22
Was unprepared for trip	-.22

In short, a multivariate user satisfaction model is more consistent with our findings, and the traditional model seems to be oversimplified.

In addition, there is the effect of the Canyon itself to consider. The Canyon is a spectacular natural phenomenon, and seeing it from the river is in many respects a unique experience. It may be that this singularity overshadows the effect of other trip features (e.g., contact with other trips) and makes them seem trivial or minor in comparison. (We do know, of course, that some variables are not completely overshadowed by the physical setting).

The traditional carrying model may be incomplete in another way. Research on density and crowding effects in other areas (e.g., urban settings, dwelling places, public settings, etc.) suggests that people respond to increased density with a variety of adjustment mechanisms that decrease the

probability of undesirable contacts. The assumption is that stress or other forms of malcontent are thereby avoided. Something similar may be happening on the river. If adjustments for crowding are made as use levels increase (as shown in table 1), some kinds of contacts may be avoided. Table 1 shows that number of changes in plans per day is related to density, whether measured by number of trips leaving Lee's Ferry or by number of river contacts per day. Likewise, the total number of sites visited is negatively related to these two use measures. These relations hold for both motor and oar trips, which indicates that the adjustments-use relation is not dependent on travel model. It may be that crowding adjustments are keeping certain types of contacts to a minimum--for example, those at campsites. This would keep total contacts down, thereby reducing the potential effect of increased use levels. The relation between density and adjustments for crowding, of course, does not explain the lack of relation between contacts and perceived crowding or that between perceived crowding and user satisfaction.

higher use levels will probably have little effect on satisfaction. Overall, data from this study suggest that managing for user satisfaction (i.e., with the carrying capacity model in mind) means an increase in use level. Indeed, if one did build a tram in the Canyon (a possibility we asked passengers to respond to), one could certainly increase the number of people served. And it's likely that they would evaluate their experience as a positive one. Such a policy, however, would drastically change the character of the river-running experience.

In the case of the Grand Conyon, for example, there is considerable evidence that both passengers and managers define the area and river-running experience as a wilderness one. The vast majority of river travelers defined their trip as a wilderness experience. Ninety-one percent agreed that they would consider the area "wilderness". Most people (65 percent) preferred two or less river contacts per day (low use), and almost all (90 percent) preferred to camp away from others. Furthermore, people generally viewed the

Table 1.--*Correlations of use levels with adjustments for crowding*

Variable	Use level (Lee's Ferry)	Correlation with: Down river use level (river contacts per day)	Correlation with: Down river use level controlling for propulsion
Changes in plans per day (No.)	0.23	[1]0.47	[1]0.44
Sites visited (No.)	-.12	[1]-.42	[1]-.30
Average length of stops at sites	-.12	[1]-.29	-.13

[1]$p<0.05$.

While this discussion has been rather theoretical, there are policy reasons for ascertaining the accuracy of the carrying capacity model. If the model is correct, but empirically not confirmed because of less than effective use levels, carrying capacity based on user satisfaction will eventually be reached when use increases. If the model is correct, but not empirically confirmed because of particular characteristics of the population tested, use increases will have little effect on users' evaluations of river trips in the Grand Canyon. Use levels could probably exceed an average of 56 trips per week, which would result in 9 or 10 contacts per day and aggregate user satisfaction would continue to increase. Likewise, if the model is either too simplistic or incomplete,

Canyon as a place where developments and conveniences are out of place. Only 10 percent felt there should be more developments like Phantom Ranch, and only 7 percent favored building a tram into the Canyon. A similarly small number favored more conveniences (9 percent) and better facilities (12 percent) on river trips.

To the extent that wilderness recreation is associated with low use and few contacts, then higher use levels will change its character. People will still have a "good time" but they will no longer define it as a wilderness one. The question is whether managing for satisfaction is the most reasonable strategy for wilderness recreation. From a management perspective, it might make more sense to define the

kind or character of the experience one wants to offer and choose a use level that is consistent with it.

Motors and Oars

Table 2 shows that there are few background differences between passengers on the standard trips. The only statistically significant differences are that those on motor trips show slightly lower education and occupational prestige levels. With respect to past or other outdoor experience and artifactualism (endorsement of development of wilderness areas), the motor trip passengers are less likely to participate in outdoor clubs and activities and more likley to favor development. Except for the former, however, none of these differences is very large. In short, motor and oar passengers show little differences in what can be described as pre-trip characteristics. As a result, a change in the proportion of motor and oar trips would probably have little effect on the composition of the river-running population in general.

What about the features of the trip itself? Motor and oar trips differ in a number of important respects, as shown in table 3. Motor trips are slightly larger, have more people per boat, have more contact with other parties each day but fewer contacts per trip, spend less time in the Canyon, make fewer and shorter side stops, and make more adjustments for crowding per day. Partly because oar trips are about twice as long as motor trips (14 days compared to 7 days), more stops are made (17 for oar versus 12 for motor) and the time spent at these sites is much longer (6 hours versus 1-1/2 hours).

These differences in kind of experience associated with an oar or motor trip (in spite of few pre-trip differences) seem to be reflected in attitudes and opinions about the trip itself. Like Lucas, we found that most oar trip passengers (92 percent) preferred to meet other oar trips on the river. Among those on motor trips, in contrast, 18 percent preferred to meet oar trips, and 9 percent motor trips; 73 percent said it made no difference. People on oar trips were also more likely to describe motors and their noise as inappropriate. In response to the question, "Does outboard motor noise bother you?" 94 percent said "yes"; only 18 percent (127) of those on motor trips said "yes".

Those on oar trips preferred fewer contacts on the river. More than half (54

Table 2.--*Background characteristics of passengers on standard and combination trips*

Variable	Correlation[1] with trip type	Mean value[2] Standard trips	Mean value[2] Combination trips	t Value
Demographic Characteristics				
Age	-.05	32.8	30.9	1.0
Sex[3]	.01	1.48	1.54	.6
Education	-.14*	13.2	13.9	1.1
Occupational status	-.12*	5.3	5.5	.7
Income	.09	7.4	7.7	.6
Marital status	.01	2.4	2.2	1.7
Number of children	.08	1.1	1.0	.2
Present residence (rural-urban)	.03	3.7	3.6	.9
Past residence	.00	3.4	3.3	.8
Outdoor Experience and Attitudes				
Membership in outdoor club or organization[4]	-.20*	1.2	1.2	.3
Time of first wilderness experience	-.06	3.3	3.5	.8
Experience on other rivers	-.02	1.6	1.9	2.4
Participation in outdoor activities	-.10*	11.5	11.3	.5
Artifactualism	.16*	12.4	9.4	5.2*

[1]Standard (commercial) trips only; coded 1 = oar, 2 = motor

[2]All means except those for age and number of children are based on coding categories and are by themselves meaningful only for comparison purposes.

[3]Coded 1 = male, 2 = female

[4]Coded 1 = no, 2 = yes

*p<.001

Table 3.--*Comparison of characteristics of motor and oar trips (commercial trips only)*

	Mean (average) value: Oar	Motor	t Value
Party (No.)	24.1	29.8	1.7*
Boats (No.)	5.1	2.0	5.5
People per boat (No.)	4.8	15.2	15.7
River contacts per day (No.)	2.2	3.8	2.9
River contacts (total no. per trip)	36.5	23.4	2.8
People seen per day (No.)	44.3	80.9	2.8
Boats seen per day (No.)	5.4	9.7	2.6
Minutes (per day) in sight of other parties	28.3	41.0	1.3*
Average length of contacts (minutes)	14.1	10.2	2.0
Length of trip (days)	14.4	7.3	6.0
Total number of attraction sites visited	17.0	12.1	2.3
Average length of stops at sites (hours)	6.0	1.3	2.4
Adjustments per day for crowding (No.)	.23	.43	1.6*

*p<0.10. For all other differences, p<0.05.

percent) wanted to see no other parties, 27 percent preferred 1 or 2, and only 19 percent preferred three or more contacts each day. In the motor group, only 38 percent preferred no contacts, 28 percent preferred 1 or 2, and 34 percent would have liked to see three or more parties each day.

Combination trip passengers showed a rather clear preference for the oar trip. As seen in table 4, 79 to 91 percent chose oar trips compared to the 4 to 6 percent who preferred motor trips. The most frequent reason given for this preference were that oar trips are slower, more natural, and the social interaction (in smaller groups) more satisfactory. These data indicate that the oar trip is seen as more consistent with a wilderness experience.

Since there is some controversy over the relative safety of motor and oar trips, combination trip passengers were asked to indicate which mode of travel they thought was safer: 26 percent considered the oar trip safer, 26 percent thought the motor safer, and 48 percent felt there was no difference.

Since the number of combination trip passengers was small--at least for purposes of generalizing to a larger population--it was important to know whether they differed substantially from other commercial passengers on pre-trip variables. Columns 2 and 3 of table 2 show that they differed little from standard trip passengers in terms of demographic variables and artifactualism (attitude toward development in the Canyon). However, to the extent that trips vary by outfitter, results based on these 4 combination trips (which were run by one of the over 20 different outfitters currently running the Colorado-Grand Canyon) may not generalize to trips run by other outfitters.

These findings have important implications for management alternatives regarding the proportion of motor and oar trips. While an "oars only" policy would not drastically change the composition of the population, it would mean smaller parties, and more boats per trip, thus

Table 4.--*Motor-oar preferences combination trips*

	Oar	Motor	Makes no Difference	Total	Missing Observations
If you were planning a trip on another river, which type of trip would you choose?	87% (46)	4% (2)	9% (5)	100% (53)	(3)
Which would you recommend to a friend planning a Grand Canyon trip?	79% (42)	6% (3)	14% (8)	100% (53)	(3)
Which type of trip better enabled you to "experience" the Grand Canyon?	91% (50)	5% (3)	4% (2)	100% (55)	(1)
Overall, which type of trip did you like better?	82% (45)	5% (3)	13% (7)	100% (55)	(1)
Which do you think was safer?	26% (14)	26% (14)	48% (26)	100% (54)	(2)

occupying more space on the river. Contacts per day would be fewer but total trip contacts would increase. It's probable that time in sight of other parties would be greater because oars have less ability to vary their speed, and can't pass other boats as easily. Trips in general would be longer and fewer people per season would run the Canyon if user days were held to their present limit. There would probably be more congregation at attraction sites insofar as oar trips stay longer and stop at more sites. Finally, oar trips show fewer adjustments for crowding--again partly because of their less variable speeds. In short, an increase in oar trips and decrease in motor trips would mean changes in downriver contacts. This suggests new but not necessarily more or less solvable contact problems.

People who had either a motor or oar experience tended to endorse the kind of experience they had, though oar passengers seem more supportive of oar trips than motor passengers were of motor trips. This suggests that preferences and norms about contacts and crowding are established during rather than before the trip (for most passengers, at any rate).

Private and Commercial Trips

Private users are slightly younger and more predominately male (table 5). They report slightly lower incomes and are less likely to live in cities. They are more likely to belong to outdoor clubs, and to report having had their first wilderness experience earlier. They have had more experience running other rivers, and are more likely to have been down the Grand Canyon before. They also participated more frequently in other outdoor activities, such as camping and backpacking. The largest background differences between the private and commercial groups exist on the outdoor experience variables, particularly experience running other rivers. Furthermore, except for income and membership in outdoor clubs and organizations, these differences remain when controlling on the motor-oar dimension. This means that the background differences between private and commercial trips are not explained by the fact that private trips are primarily oar. When comparing commercial and private oar passengers within the motor and oar categories, the differences between them remain. In short, an increase in private users would mean some changes in the composition of the river-running population. Specifically, it would increase the number of experienced and seasoned river-runners as opposed to first-time users.

Private trips have fewer people, more boats, and less people per boat than the average commercial trip (table 6). They

Table 5.--*Background characteristics of private and commercial river runners*

Variable	Correlation with trip type (commercial-private)[1]	Correlation with propulsion (oar-motor)[2]	Correlation with trip type controlling for propulsion
Demographic Characteristics			
Age	-.12*	.01	-.12*
Sex[3]	-.16*	.07	-.13*
Education	.00	-.10	-.07
Occupational status	-.05	-.07	-.10
Income	-.17*	.13*	-.09
Marital status	-.08	.05	-.05
Number of children	-.04	.07	.02
Present residence (rural-urban)	-.23*	.11*	-.17*
Past residence	-.09	.03	-.07
Outdoor Experience and Attitudes			
Membership in outdoor club or organization[4]	.26*	-.25*	.10
Time of first wilderness experience	.22*	-.13*	.15*
Experience on other rivers	.57*	-.25*	.48*
Experience in Grand Canyon	.23*	-.11*	.17*
Participation in outdoor activities	.34*	-.21*	.22*
Artifactualism	-.08	.15*	.03

[1]Coded 1 = commercial, 2 = private
[2]Coded 1 = oar, 2 = motor
[3]Coded 1 = male, 2 = female
[4]Coded 1 = no, 2 = yes
*p < .001

Table 6.--*Comparison of characteristics of private and commercial trips* (With separate means for commercial motor and oar trips)

Variable	Mean (average) Values			
	All Commercial	Commercial		Private
		Motor	Oar	(Oar)
Group Structure				
Number in party	28.8	29.8	21.4	17.3[1]
Number in boats	2.5	2.0	5.1	9.4
Number of people per boat	13.3	15.2	4.8	2.0
Time spent in the Canyon				
Length of trip (days)	8.6	7.3	14.4	17.3
Total number of attraction sites visited	12.9	12.1	17.0	21.3
Average length of stops at sites (hours)	2.3	1.3	6.0	3.9
Contacts with other trips				
Number of river contacts per day	3.5	3.8	2.2	2.8
Number of people seen per day (on river)	74	80.9	44.3	61
Number of boats seen per day (on river)	8.9	9.7	5.4	6.3
Minutes (per day) in sight of other parties	38.7	41.0	28.3	41.1
Number of adjustments per day for crowding	.40	.43	.23	.26

[1]This figure is inflated, since one private trip was composed of two groups which traveled as one (of 35 persons). Average private trip size is nearer to 15, and might, according to Park Service records, be as low as 12.

spend a longer time in the Canyon and visit a greater number of attraction sites. Since private trips are virtually all oar trips, it's important to know whether these differences are due to differences between motors and oars, or the commercial-private dimension. When separate means for commercial motor and oar trips on these same variables are shown (columns 2 and 3, table 6), commercial oar trips differ from commercial motor trips in the same ways that privates differ from commercial trips, but to a lesser degree. So some of the difference between commercial and private are due to the motor-oar distinction.

Private river runners were more likely to object to motor noise and show strong preference for oar travel (table 7). They also perceived more crowding--they were more likely to say they had met too many people during their trip. They were also more likely to perceive the canyon as affected by use. These differences between private and commercial trips are essentially the same differences one finds between

Table 7.--*Perceptions related to travel mode*

Variable	Correlation: trip type (commercial-private)[1]	Correlation with propulsion (oar-motor)[2]	Correlation with trip type controlling for propulsion
Opinions about			
motor noise	.42*	-.61*	.04
Canyon more wilderness if motor travel banned	.37*	-.44*	.10
prefer to run river with oar trip	.45*	.63*	.05
Contact with other parties			
prefer to meet oar trips	.39*	-.53*	.04
preferred number of contacts	-.18*	.21*	-.04
Perceptions of use			
Canyon perceived as crowded	.22*	-.23*	.07
Canyon perceived as affected by use	.30*	-.35*	.08

[1]Coded 1 = commercial, 2 = private
[2]Coded 1 = oar, 2 = motor
*$p < 0.001$

motor and oar trips (column 2, table 7). And when propulsion is controlled for--that is, the differences between private and commercial trips within the category of oar-motor trips are examined--the differences decrease in magnitude or disappear altogether. The motor-oar distinction seems to be more critical than the private-commercial distinction insofar as attitudes, preferences, and opinions are concerned.

Private passengers showed a greater willingness to pay for their encounter preferences, opposed more conveniences, and indicated greater knowledge of the canyon.

In sum, an increase in the proportion of private users would have some effect on the composition of the river-running population. Specifically, the population would be younger, include more men, and more people with river running experience. With respect to attitudes and perceptions linked to the trips, however, the differences between commercial and private trips were not as great as those between motor and oar trips. Thus an increase in private users will have effects similar to that of an increase in oar users. This is not only because private trips are primarily oar trips and share trip features with commercial oar trips, but because commercial oar passengers and private oar passengers are more alike in terms of attitudes, preferences, and opinions about travel mode, contacts, and the trip itself.

CONCLUSION

Management implications that emerge from this study are:

(1) Managing for user satisfaction implies extremely high density levels. This is probably inconsistent with the kind of experience most recreational managers are expected to provide and is certainly inconsistent with what is normally defined as wilderness recreation.

(2) User attitudes and preferences are likely to be developed *during* the recreation experience, and people tend to endorse the kind of experience they have. This is supported by the fact that there were few pre-trip differences between commercial motor and oar groups, yet both tended to endorse the travel mode they experienced. The absence of expectations regarding number of contacts and people encountered for most passengers also supports this conclusion. It is possible that user preferences and attitudes grow out of the kind of experience managers provide. The importance of the kind of experience provided (particularly for first time users) is underscored.

RIVER PRESERVATION AND RECREATION PROGRAMS

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ABSTRACT.--The circumstances that led to the passing of the Wild and Scenic Rivers Act in 1968 are reviewed. Also, the legislation that has been considered and passed since the Act was passed with respect to adding rivers to the National Wild and Scenic Rivers System are discussed.

Of the more than 3 million miles of rivers and tributaries in the United States pouring their waters down to the sea, many have been harnessed for flood control, navigation, hydroelectric power, municipal and industrial water supply, and irrigation. Cities, factories, and homes have been built on their flood plains. Their banks have been dumping grounds for waste materials and their water the recipient of our industrial and municipal wastes. In many ways we have destroyed the beauty and purity of these streams. Our affluent society has become an effluent society. It has destroyed the water we drink, as well as the values of fish and wildlife and scenic and recreation resources.

In 1961, the Senate Select Committee on National Water Resources recommended:

> "That certain streams be preserved in their free-flowing condition because their natural scenic, scientific, esthetic and recreational values outweigh their values for water development and control purposes now and in the future".

This recommendation was reinforced by the Outdoor Recreation Resources Review Commission when it concluded in its final report in January 1962 that: "Certain rivers should be preserved in their free-flowing condition and natural setting". Because of the unique scenic and recreational values that certain rivers provide, the Commission endorsed efforts to preserve them in their natural condition. To accomplish this objective, it recommended that studies be made to identify rivers or river segments having these values.

In 1962, the Secretaries of the Interior and Agriculture directed a joint effort by the two departments to set up a national system of free-flowing rivers. A wild rivers study committee was selected to formulate a procedure for setting up the system. All of the States were contacted and with their assistance a list was compiled of 650 rivers worthy of consideration. Field study teams were organized with representatives of Federal agencies and the States. The teams culled the list down to 67 rivers. A reconnaissance was then made of these 67 to determine their suitability for possible Federal designation. On the basis of this reconnaissance, a more detailed study was conducted on 22 rivers that appeared to deserve some type of protection or preservation in a free-flowing condition. Legislation to accomplish this objective was drafted and submitted to the Congress.

WILD AND SCENIC RIVERS ACT

In October 1968, after 6 years of discussion and debate, the Wild and Scenic Rivers Act became law. The Act established the principle that certain selected rivers and their immediate environments possess outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values and should be preserved in a free-flowing condition for the benefit and enjoyment of present and future generations.

The clear intent of Congress in the Act was to establish a system of areas distinct

from the traditional concept of a National Park. Rather than acquiring a massive land area, the Federal agency managing a component of the National System is to acquire only a narrow strip of land sufficient to protect the river environment. The acquisition of land is limited to an average of no more than 100 acres per river mile, and the power of eminent domain is suspended when fee title to 50 percent of the authorized area is in public ownership. Additionally, scenic easements may be acquired in sufficient amount to make the total acquisition not more than an average of 320 acres per mile. (This is equivalent to a river corridor averaging 1/2 mile wide.) The effect is to permit continued agricultural and residential use near rivers in the system, but to preclude heavy development that would impair the character of the river involved.

The Wild and Scenic Rivers Act established the National Wild and Scenic Rivers System, initially composed of eight rivers, and identified 27 other rivers to be studied for possible inclusion in the National System.

The Act encourages State rivers to be included into the system by providing that upon request of the Governor of a State, rivers that have been designated by the State legislature as wild, scenic, or recreational river areas and that meet the criteria set forth by the Congress and supplemental criteria developed by the Secretary of the Interior, may be protected as part of the National System. In addition, the Act authorizes the Secretary to provide technical assistance, advice, and encouragement to the States, political subdivisions, and private organizations in their efforts to establish State and local wild, scenic, and recreational river areas.

RIVER STUDIES AND REPORTS

River studies are conducted under the leadership of the Department of the Interior or the Department of Agriculture with representatives of concerned States, their political subdivisions, and concerned Federal agencies. The studies form the basis of reports to the President and the Congress. Each report contains information and makes recommendations about the river's eligibility for inclusion in the National System, and indicates how uses of the land and water would be enhanced, foreclosed, or curtailed if the river and its adjacent land were added to the system.

PRESENT SYSTEM

Since October 1968, seven rivers have been added to the National System under Federal administration and 31 additional rivers have been designated for study as potential components of the National System.

As of November 1976, there were 19 rivers or river segments, totalling 1,655 miles, in the National Wild and Scenic Rivers System. Eleven of them have been added since passage of the Act (fig. 1). River mileages, by classification, are approximately: Wild, 689; Scenic, 463; and Recreational, 503 (table 1). Fifteen of the rivers in the National System are administered by Federal agencies (National Park Service, Forest Service, Bureau of Land Management, and the Fish and Wildlife Service); four are under the administration of States (Maine, Ohio (2), and North Carolina); and on two rivers the administrative responsibilities are shared by Federal agencies and the States of Tennessee, Minnesota, and Wisconsin.

Twenty-four States have a river preservation program, backed by specific legislation, to enhance the value of their free-flowing rivers. Two other States have administrative or executive authority to begin scenic river programs or to study selected rivers for inclusion in a State system. This does not mean, however, that all these States have strong and effective river-preservation mechanisms in effect. The programs run the gamut from merely an "intent" to begin a program to a few States with established scenic river systems and effective land use control measures in force.

PROGRESS AND PROBLEMS

The studies of the wild and scenic river proposals have become more complex as a result of the need to consider the requirements of the National Environmental Policy Act of 1969 (including the preparation of environmental impact statements), various State and Federal water quality acts, the Principles and Standards for Planning for Water and Related Land Resources developed by the Water Resources Council, the efforts to solicit public participation in the planning process, and other legislation. This, together with the efforts to solicit State participation in the

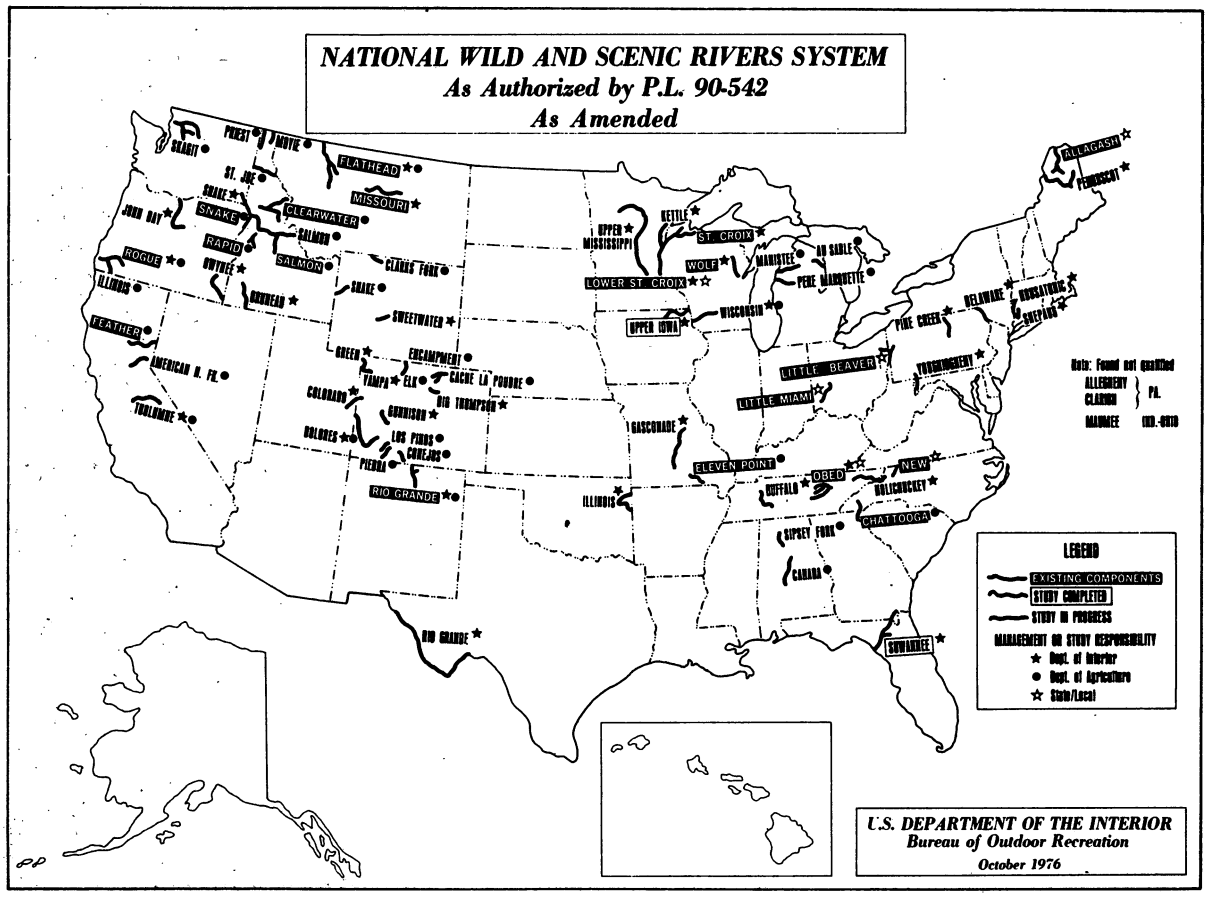

Figure 1.--*National Wild and Scenic Rivers System (As Authorized by P.L. 90-542 As Amended).*

acquisition, development, and administration of all or portions of the proposal, has slowed study progress.

Irrespective of these problems, nine of the river studies have been completed and submitted to the President and the Congress. Nine additional study reports are under review by the Executive Office of the President. The 94th Congress enacted legislation on three of the river studies prior to clearance by the Executive Office and, hopefully, the remaining six will be cleared for consideration early in the next session of Congress.

In 1975 and again in 1976, the Departments of the Interior and Agriculture jointly prepared a list of 20 additional rivers that they recommend for study as potential candidates for addition to the National System. We are hopeful that the legislation will be cleared for consideration by the 95th Congress early in the 1st Session.

Although the Wild and Scenic Rivers Act established a National Wild and Scenic Rivers System, it did not define the system or describe the extent, geographic distribution, and balance of types of rivers to be included. The Bureau of Outdoor Recreation has begun to define what should comprise the minimum system and is identifying all rivers or river segments 25 miles or longer that appear to be free from development, have good water quality, and sufficient streamflow to provide for a quality recreation experience. After review and consultation with representatives of Federal and State agencies, private organizations, and the public, the list of rivers will be reduced to those best qualified to be candidates for the National System. A fairly detailed

Table.--*River mileage classifications for components of the National Wild and Scenic Rivers System, October 1976*

River and State	Administering agency	Classification			
		Wild	Scenic	Recreational	Total
			Miles		
Middle Fork Clearwater, Idaho	USFS[1]	54	--	131	185
Eleven Point, Missouri	USFS	--	44.4	--	44.4
Feather, California	USFS	32.9	9.7	65.4	108
Rio Grande, New Mexico	BLM	43.90	--	0.25	44.15
(Rio Grande management by Agency)	USFS	7.85	--	0.75	8.60
Rogue, Oregon	BLM	20	--	27	47
(Rogue management by Agency)	USFS	13	7.5	17	37.5
St. Croix, Minnesota and Wisconsin	NPS	--	181	19	200
Middle Fork Salmon, Idaho	USFS	103	--	1	104
Wolf, Wisconsin	NPS	--	25	--	25
Allagash Wilderness Waterway, Maine	State of Maine	95	--	--	95
Lower St. Croix, Minnesota and Wisconsin	NPS	--	12	15	27
	States of Minnesota and Wisconsin	--	--	25	25
Chattooga, North Carolina, South Carolina, and Georgia	USFS	39.8	2.5	14.6	56.9
Little Miami, Ohio	State of Ohio	--	18	48	66
Little Beaver, Ohio	State of Ohio	--	33	--	33
Snake, Idaho and Oregon	USFS	32.5	34.4	--	66.9
Rapid, Idaho	USFS	31	--	--	31
New, North Carolina	State of North Carolina	--	26.5	--	26.5
Missouri, Montana	BLM/FWS	72	28	59	159
Flathead, Montana	USFS/NPS	97.9	40.7	80.4	219
Obed, Tennessee	NPS/State of Tennessee	46.2	--	--	46.2
Total		689.05	462.7	503.4	1,655.15

[1]USFS = USDA Forest Service; BLM = Bureau of Land Management; NPS = National Park Service; FWS = Fish and Wildlife Service.

reconnaissance will be made of the rivers on this reduced list to identify their specific qualities and develop a priority ranking. Following approval by the Administration, the proposed minimum system would be transmitted to the Congress.

Although not covered under the Wild and Scenic Rivers Act, the Department has an active rivers program in Alaska. In compliance with the Alaska Native Claims Settlement Act, the Bureau of Outdoor Recreation completed detailed studies on 28 rivers in Alaska. As a result of these studies, the Secretary of the Interior has proposed adding 20 new units with a total of 2,753 miles of river to the National Wild and Scenic Rivers System. Although 16 of these rivers lie within the boundaries of other areas proposed for addition to the National Park, National Wildlife Refuge, and National Forest Systems, four rivers with a total of 705 miles of river and 800,000 acres of adjacent land would be established as separate units of the system.

In addition, under the provisions of the Naval Petroleum Reserves Production Act we will be studying the rivers in Petroleum Reserve No. 4 in Alaska to determine whether they should be considered as potential candidates for the National System.

The designation of long stretches of rivers as components of the National System could be prohibitively expensive if large tracts of land must be bought. Because of this, we are continually seeking methods of providing the necessary land use control to protect the river environment without having to acquire full fee title to the land. Thus, the proposals, which we hope to transmit to Congress soon, will include utilization of scenic easements, zoning, and other forms of land use control.

We see control of use as one of the major management problems today and one that is going to become even more critical as the demand for river recreation experiences

increases and the supply of quality resources decreases. We must have the methods that permit us to determine the carrying capacity of a stream that is consistent with the preservation of the resource as it has been classified. Once established, the management plan for the river must control use at, or below, that capacity so we can assure preservation of the resource and a quality recreation expereince for the user.

Lack of acceptance on the part of some segments of the public is another problem we must resolve. Part of the problem is a matter of definition. The Wild and Scenic Rivers Act establishes three classes of rivers--wild, scenic, and recreational. The differences between the various classifications are the degree to which there is evidence of man's presence in the river environment. Wild rivers are essentially primitive with little or no evidence of man's presence and are accessible only by trail. Scenic rivers are largely primitive and undeveloped but are accessible in some places by road. Recreational rivers are readily accessible by road or railroad and have some development along their shorelines. However, many people equate "wild river" with a white water experience and find it difficult to understand how their remote, slow-moving stream can be considered wild. Scenic designation seems to be fairly understandable. However, recreational classification frequently makes people think the area will be overdeveloped for recreation activities. These and other misconceptions regarding the program must be corrected at every opportunity if we are to receive widespread public support and understanding.

A great deal has been accomplished since October 1968, and we are taking significant actions to maintain the momentum we have generated over the past 8 years. In the short term, we are hopeful that the Executive Office of the President will clear for release the study reports completed by the Departments of the Interior and Agriculture, and the legislative proposal to designate 20 additional rivers for study. Further, we anticipate that the Congress will begin considering the proposals submitted under the Alaska Native Claims Settlement Act, including the proposals to add 20 rivers to the National System. We expect to complete our analysis of the Nation's remaining free-flowing rivers by early 1978. Following that, we propose to develop a Nationwide list of rivers for consideration by the Congress as potential candidates for study for possible addition to the National Wild and Scenic Rivers System.

MANAGING CORRIDORS IN MULTIPLE OWNERSHIP

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ABSTRACT.--Planning and management techniques for river corridors in multiple ownerships are described. The Lower St. Croix National Scenic Riverway between Minnesota and Wisconsin is used as an example.

The title can be taken to describe either of two situations: first, multiple public ownership, i.e., local, State, and Federal lands within a river corridor and; second, the existence of both public and private lands along a river. Both of these situations present planning and managment problems not generally endemic to single-ownership, single-management river corridors. Because of these problems, agencies, and governmental units must seek creative methods for protecting rivers.

Irrespective of ownership patterns along any designated wild and scenic river the goals and policies are essentially the same. The policies are generally statutory, be it P.L. 90-542 or a State wild and scenic rivers act. However, the methods used to achieve river protection differ considerably.

Perhaps the single most important difference between river management along rivers bordered by both public and private lands, and those not in multiple ownership, is that along multiple ownership corridors there are fewer available management options. Specificially, such techniques as user rationing or establishing a use "threshold" are generally not feasible along rivers where there is considerable private land and virtually unlimited access.

Further, in developing a successful protection program for river corridors, the manager must recognize the importance of the "private" partner. Cooperation of landowners, local businessmen, citizen organizations, and others, is the key to success. Constant communication between managing agencies and the public is not a luxury, or "something nice to do if we have time." It is essential.

We would like to focus on the particular problems associated with planning and management of river corridors in public and private ownerships, using the Lower St. Croix National Scenic Riverway as an example of both multi-public and private ownership corridor management.

PLANNING

When an agency sets out to prepare a plan for a river in multiple ownership, it must first make sure that the public is involved at every step of the process. In trying to prepare such a document some problems, conflicts, and differences in attitudes become immediately apparent. It is readily discovered that the ability to effectively deal with certain "pre-existing" problems is constrained by legal, fiscal, or other parameters. There might be legal constraints on controlling of water surface uses or pre-existing, imcompatible land uses. Multiple ownership rivers are most often characterized by: virtually unlimited access; some incompatible, pre-existing land uses; user conflicts; multiplicity of jurisdictional authorities; and overlapping federal, state and local authorities over land and water resources. Given this situation, some would ask why even try to protect such a river? Well, these are the ones, in our opinion, that are most in need of special protection. Typically, they are closer to populated areas, yet still in a near-natural condition. As such, they can be used by a large segment of the population that will never see the "wild" rivers in the less populated areas of the United States. Often, these rivers are the types of rivers included in state wild and scenic river system or are state-administered components of the National Wild and Scenic Rivers System.

Planning of such multiple ownership river corridors means accepting certain pre-existing land and water uses as irreversible. Roads, private developments, and user conflicts are generally "givens" before management planning begins. This is why most managing agencies responsible for such rivers have established a policy of not trying to turn back the clock but rather to protect the river in its existing near-natural condition.

Along these rivers, the legal and fiscal constraints are often more limiting to management than they are to river-corridors completely in public ownership. For example, an agency can only do so much toward regulating public use of waters and must stay within the legal authorities for land use zoning of private lands. Frequently, controls which are quite desirable from a river protection standpoint would involve a "taking" of private property rights. In addition, the acquisition and relocation of incompatible developments would mean the acquisition of multimillion dollar townhouses, marinas, and other developments and simply is not a viable management alternative.

For these reasons the cooperation of the public is critical to the success of managing such river corridors. If the agencies expect the cooperation of the public in managing such rivers, the public has a right to expect to be involved in all aspects of the decision-making. We feel strongly that if the public helps write the plan, they'll help underwrite it.

Rumors, misconceptions, and misunderstandings are a way of life in such government planning. For this reason alone, opening the public planning process is quite essential to public understanding and support. Often the worst fear is the fear of the unknown. As an advertisement states: "The best surprise is no surprise". From a citizen's standpoint this is certainly a fact in river planning.

The typical ingredients of a management plan for a river corridor in multiple ownership generally includes some local zoning, fee and scenic easement acquisition, and a recreational development plan. Of course, the use of these "ingredients" varies depending on the particular river and the legislative authority. The effectiveness and application of these techniques is described in some detail in the following section.

MANAGEMENT TECHNIQUES

Zoning has generally been a poor tool for protecting anything, especially scenic river corridors. Yet, under some State statutes and regulations, the effectiveness of zoning as a tool has been significantly increased. For example, the Michigan scenic rivers programs provides for local zoning ordinances based on State standards. Ohio promotes local land use ordinances to guide compatible development. Minnesota's program provides not only for the mandatory adoption of comprehensive local zoning ordinances, based on State standards, but further provides a mechanism for the "veto" of local zoning decisions that are incompatible with protecting a designated river and its adjacent lands. However, even the best zoning must be backed up with some type of acquisition (Minnesota Department of Natural Resources 1974).

Scenic Easements

Scenic easements are being used to protect river corridors by both the Federal and State governments. Although the particular terms of the easements vary, they essentially amount to purchasing the development rights on property. In addition, these easements generally *do not* allow public use of a property.

In theory, easements seem ideally suited for river preservation. They can protect scenic river corridors, vistas, and views without having to purchase them outright. Along most rivers, public use of the entire corridor is not feasible nor even desirable. Scenic easements offer several possible advantages to both the managing agency and private landowners alike. For example, scenic easements generally cost less than fee title; the agency can thereby stretch the impact of its acquisition funds. The easements offer permanent protection that zoning cannot. Land remains on the tax rolls; and they have negotiation flexibility that fee title doesn't (negotiable easement terms). From the landowner's perspective, they often can use their property as they have in the past, yet they are paid for the easement. The landowners also retain the fee ownership of the property, and tax assessments may go down as a result of the sale of a scenic easement (Allen and Polland 1974 , Ohio Conservation Foundation [n.d.]).

While the use of scenic easements for protecting river corridors seems quite attractive we believe it is still too early to know whether they will be a sound investment. There is not a great deal of history of successful enforcement of easement terms. In addition, the "incremental" administrative costs of easement enforcement, over many years, may far outweigh the initial cost difference between easement and fee title purchase.

Fee Title

Along multiple ownership river corridors, fee title acquisition is used in varying degrees by managing agencies to accomplish their management goals. In Minnesota, fee acquisition is held to a minimum. It is generally used only for lands intended to be developed as public use sites and to consolidate existing blocks of public lands (i.e., within existing parks, forest, and refuges) (Minnesota Department of Natural Resources 1974).

Some agencies are pursuing a goal of acquiring a strip of fee title land along the entirety of a designated river. Based on the authors' experience this is a goal that is only feasible when the managing agencies have eminent domain authority.

AN EXAMPLE: THE LOWER ST. CROIX NATIONAL SCENIC RIVERWAY

The Lower St. Croix National Scenic Riverway was established by law (P.L.92-560) on October 25, 1972. Within this 52-mile reach of river from the dam at Taylors Falls-St. Croix Falls to the confluence with the Mississippi River, are most of the components of the 2 types of multiple ownership river management. This river segment was the first to be added by legislation after the original eight "instant" rivers were placed in the National Wild and Scenic rivers system in the organic act of 1968 (P.L.92-542). It is perhaps the most urban of all national system segments, and it was because of this characteristic that the 1972 act had to be a cooperative effort between the States of Minnesota and Wisconsin (whose common border is formed by the river) and the federal administration. The 1972 act specified that the upper 27 miles would be managed by the National Park Service and the lower 25 miles by the 2 states, with the State park and fish hatchery areas lying within the Federal zone to remain under State management.

However, there are several other reasons why this river reach represents a classic case of multiple ownership river administration:

(1) At the time the 1972 act was passed, approximately 83 percent of the river front properties on the Lower St. Croix were in private ownership. Not only did this constitute the great majority of land control in the corridor, but that control was in the hands of over 1,200 different private owners.

(2) At the time of the Lower St. Croix designation, there were only 2 or 3 incorporated communities on all of the 8 "instant rivers" in the national system; however, the Lower St. Croix had 15 incorporated municipalities in the corridor. Since the Federal act--and later State acts--did not allow for acquisition of property by eminent domain within an incorporated community which had in effect a proper riverway zoning ordinance; this virtually guaranteed that there would have to be a strong Federal-State-local government management partnership if the riverway was to have a continuity of protection.

(3) While about half the length of the Lower St. Croix riverway is under Federal administration, nearly all of the intensive public recreation use areas are centered around 5 State parks, one State wildlife management area, 14 public boat/canoe launch sites, 12 county or municipal parks and beaches, and about 20 nonfederal river islands. The private operators have 5 canoe or boat liveries, 2 excursion boat operations, 8 commercial boat launch sites, and 13 marinas (plus 5 more immediately adjacent on the Mississippi River).

(4) The entire Lower St. Croix river is also under the jurisdiction of the U.S. Army Corps of Engineers and U.S. Coast Guard for navigation channel maintenance and marking. The entire federal zone is identified as "an authorized 3-foot channel" but the Corps of Engineers has not dredged the reach since 1906 near the end of the steamboat and loggin era. The lower 25-mile State zone of the riverway is part of the 9-foot navigation system on the Upper Mississippi waterway allowing for full-sized tow boats and barge tows to navigate from the Mississippi as far as Stillwater,

Minnesota. Barge tows do ply the river as far as the large Allen S. King electric generating plant on the Minnesota side, carrying approximately 1.5 million tons of coal annually (U.S. Department of Interior 1975b , 1976).

One might well ask why such a complex area should even be nominated for inclusion in the National Wild and Scenic River System? The reason is that the Lower St. Croix still possess outstanding scenic and recreational amenities; even today, most of the valley appears to the observer to be relatively unspoiled.

In a political sense, it is commonly said in the local area that the citizens designated this river themselves years before the Federal and State governments did. Indeed there was a tremendous amount of spontaneous citizen activity directed at preservation of the exceptional qualities of the valley in the early 1960's when the largest electric utility in Minnesota proposed to construct the Allen S. King plant along the Lower St. Croix. This 500-megawatt coal-fired plant was the first major industrial intrusion into the valley since the end of the logging era in 1914.

Despite the great complexities of multiple ownership management of the Lower St. Croix, there are two fundamental reasons why this program is effective. The first reason is that *public support for riverway protection and management is still quite high.* The processes of formulating management plans for the riverway have been kept wide open; thus, there has been an unprecedented opportunity for local officials and interested citizens to participate directly in the shaping of the management of the Riverway the citizens designated.

There has been some lack of continuity among local leaders over the period of involvement. One of the reasons has been that many of those who were active in the "local governmental conference" in its formative years are no longer in office. This would be expected in any similar multiple ownership river situation. In addition, one of the greatest dangers in the implementation phase of river management in a multiple ownership situation is public apathy. Once river designation is achieved and management activities begin, there is a tendency on the part of the local and private partners to sit back and "Let the other guy do it". Therefore, consistent river management requires an effort to continually inform local riverway leadership, and to bring them in at the "action" level. The authors are convinced that without fairly widespread and articulate public support, a river management plan in a multiple ownership river corridor will be unsuccessful.

The second reason why this program is effective is that *the managing agencies have cooperated closely in the achievement of their management goals.* The fact that the river is "interstate water" is a blessing in disguise because the two States, in joint legislative action in 1965, established an interstate commission--known as the Minnesota-Wisconsin Boundary Area Commission--to be an unofficial coordinator and watchdog over river policies and issues. The commission has been heavily involved in the task of "tying together the loose ends" of Lower St. Croix River management.

Cooperation and coordination of managing bodies is essential. After 4 years of experience working together, the two State governments and the National Park Service easily saw the wisdom of developing a semi-formal managment partnership. In August of 1973, Governors Anderson of Minnesota and Lucey of Wisconsin joined with the Regional Director of the National Park Service in signing a cooperative agreement in which the three "partners" pledged to work together to protect the riverway under the umbrella of the joint master plan and the coordination of the Minnesota-Wisconsin Boundary Area Commission.

The Lower St. Croix Management Commission, composed of top representatives of the Minnesota and Wisconsin Departments of Natural Resources and the Riverway management of the National Park Service, has established a working technical committee which meets monthly under the chairmanship of the executive director of the boundary commission. All matters having to do with the management of the riverway are discussed at these meetings and if necessary, brought to the management commission for discussion. This tool provides for effective communication, promotes a spirit of cooperation, makes the program operate efficiently and provides for joint ventures, (such as an upcoming river use survey which could not be accomplished independently).

FUTURE PERSPECTIVES IN RIVER RECREATION MANAGEMENT

REGIONAL RIVER RECREATION MANAGEMENT

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ABSTRACT.--Describes the evolution of the Interagency Whitewater Committee; its present functions; and its potential for the future. Emphasizes the need for considering a regional approach to river management.

INTERAGENCY WHITEWATER COMMITTEE/CONFERENCES

History and Development

In February 1973, representatives of the Bureau of Land Management, National Park Service, and USDA Forest Service held a meeting in Salt Lake City to consider common river management problems and programs. They were impressed by the commonality of their problems, and the fact that commercial river outfitters were better informed on what was going on, regionally, than they were. Consequently, they met again the following August, at Dinosaur National Monument. As a result, an Interagency Whitewater Committee (IWC) of five agency representatives was established to develop Whitewater Management Guidelines.

In November 1973, the IWC was expanded to nine members: three from each agency to insure representation from a wider geographic area. It has since functioned as a sterring committee on a year-round basis, providing continuity of communication and informational services, and planning future conferences. A representative of the U.S. Coast Guard was added to the Committee in November 1974. Representatives of the Corp of Engineers, Bureau of Reclamation, and Bureau of Outdoor Recreation attended subsequent conferences. Although the committee functions as a Federal agency committee, State and local agencies as well as private organizations have participated in conferences.

Conferences have covered such diverse topics as noncommercial use, U.S. Coast Guard regulations, transfer of commercial permits, human waste disposal, food handling, State and Federal cooperative river management programs, safety, and season-end reviews at the fall sessions.

Half of the February 1976 session was devoted to river research programs. Managers were cautioned that researchers can not and should not attempt to provide all of the answers and write the manager's management plan. However, research can provide valuable, and probably essential input for management.

Management Guidelines

The Interagency Whitewater Management Guidelines "is *not* a policy statement, nor does it constitute or have basis in statutory authority, but rather it is a document which the managing agencies can use *as a guide when appropriate. Neither the IWC nor the guidelines decide local river management or operational decisions.* Such decisions are decided by the appropriate agency..."

The Guidelines cover management objectives, capacities and limitations, allocations and allotments, commercial operations, noncommercial permits, operational requirements, research, safety, and interagency cooperation. An appendix includes lists of about 125 managing agencies, commercial outfitters, and first aid and safety supplies; use statistics; a suggested commercial permit as well as noncommercial river trip

application and permit; public health standards; a review of current allotment methods and permit requirements for individual rivers; and information on navigable rivers.

State/Federal/Canadian Cooperative Efforts

Both State and federal officials attend sessions such as the Interagency Whitewater Management Conferences and the Western States Boating Administrators Association (WSBAA) conferences. Specific offices at both levels of government have pioneered in river management and much information is shared among State and federal land agencies. Management responsibilities are also shared on some rivers, demanding additional cooperation if the public is to be properly served.

Representatives of Canadian agencies are now on the IWC mailing list and are in communication with U.S. agencies in response to recent, noticeable increases in river-running on Canadian rivers. Regional meetings such as sponsored by the IWC and WSBAA should continue, both to benefit the newly appointed river manager and to provide additional insight into river management for seasoned managers. The casual one-to-one discussions in an informal atmosphere can be as valuable as the formal presentations. Such meetings should involve local, State, federal and Canadian representatives, along with researchers and river users.

FUTURE PROGRAMS

The following discussion anticipates some ways in which river managers may meet future challenges. The crystal ball utilized is the property of the authors and does not necessarily reflect the opinions of their agencies or other river managers.

IWC - The Future

The IWC has served managers as an informal forum in which to exchange ideas and experiences. Its Guidelines have provided needed consistency to management approaches. Should it continue in this limited capacity, be disbanded, or expand its role? The opportunities afforded by attending IWC activities have convinced us that only through such cooperative efforts are regional problems of river management to receive adequate, effective attention. As the use of one river becomes more restricted and the numbers of users increase, use pressures seem to shift to other rivers and to other regions. Existing problems on one river become the future problems on other "newly discovered" rivers. Hopefully, the management errors need not be repeated, and where appropriate, successful programs can be considered.

It is doubtful that the Committee can continue to exist very long in its present form. Higher levels of management in the member agencies are becoming increasingly hesitant to commit funds and manpower to such a group without a formal and recognized charter. But neither are river managers prepared to disband the IWC because of the unsolved challenges requiring their collective resources.

What roles might a formal and expanded IWC play? The spectrum could vary broadly from that of developing passive guidelines to providing management direction. It could serve as an information forum or to formulate policy. Its proper role probably lies somewhere between these extremes. If river managers are not able to cope with their problems through interagency cooperation, political decisions will certainly fill the leadership void.

East and West

The IWC presently includes only federal river managers from the western States and deals specifically with problems in these States. White-water boating, however, is growing throughout the United States. Therefore, should the scope of IWC be expanded to encompass eastern rivers under federal jurisdiction? It is doubtful that one national organization would serve managers as well as two regional ones, east and west. Because of differences in user populations, land ownership patterns, river character, climate and population distribution, many problems managers face are regional.

Eastern white-water river managers might find an eastern interagency committee as productive as the western one has been. If an eastern counterpart to IWC is organized, joint conferences would provide a stage for national coordination of information.

Policy and Planning

Certainly no agency can formulate

policy in a vacuum. It must consider input from both management and the public. The IWC can provide a sounding board for river management policy proposals from a regional viewpoint. The Committee could also enter such areas as management plan review if requested by agencies. Because of the mandates and policy differences between the three land agencies, the Committee should not be involved in decisionmaking on other than an advisory basis.

Public and State Involvement

The IWC should retain its identity as a federal organization of federal employees. The IWC cannot include interested people from the public sector or State authorities (as has been suggested by some State officials) without becoming an advisory committee within the scope of the Federal Advisory Committee Act of October 6, 1972 (P.L. 92-463). Management conferences sponsored by State and Federal organizations will continue to provide the public, State and local officials an opportunity to voice their opinions and communicate with individual federal river managers.

IWC Makeup and Function

The IWC is made up of field level river managers. Some managers fear that formal organization will mean a shift of membership to higher level agency people, thus losing close contact with day-to-day problems. This is certainly a possibility, depending on the Committee charter. However, any concern that formal organization would discourage a free exchange of ideas would seem unfounded. Managers will still be in contact at conferences during and after organized programs.

Services

A formal IWC could provide a vehicle for regional services that cross agency lines, such as a central reservation office, public information office, or management information clearinghouse. It serves the latter function now.

Role of Coast Guard

The U.S. Coast Guard is responsible for safety on all navigable waters of the United States. Until recently it has not actively pursued its responsibility on white-water rivers. This has changed, however, in response to the increase in white-water boating and the number of accidents associated with it. The Coast Guard is now developing rules for commercial passenger craft: construction standards, safety equipment, and boatman qualification. It will soon be enforcing them on rivers in its jurisdiction. The Coast Guard will likely become more active in private white-water boating also.

What does this mean to managers? It may be necessary to adjust permit requirements. Regulations and rules will have to be coordinated to avoid confusion and contradictions. Boat patrols and inspections may be combined and agencies may elect to adopt Coast Guard regulations so that they can do some of the enforcement work themselves.

The Coast Guard has arrived in white-water boating and will stay, possibly expanding its future role through coordination with land managing agencies. Although its presence is painful to some boaters, especially in the commercial sector, improved safety will probably result. Most agencies have recognized the need for better safety equipment and inspection; few have dared assume this responsibility. The Coast Guard has no such inhibitions.

Central Information/Reservation Office

The user finds himself submerged in a wave of State and Federal agencies at every bend in his quest for white-water recreation. A trip organizer's first problem is finding where and from whom he can obtain information on a given section of river. Is a permit necessary? Are there other special requirements? Who issues permits? When are applications due? The managers also have their problems of reaching members of the public who have a river running interest with information about available dates, areas, special restrictions, etc.

The IWC Guidelines introduced some structure into an otherwise chaotic situation by answering the questions of where and from whom information can be obtained. If the river user or manager is fortunate enough to encounter an agency person acquainted with the Committee he can probably get the information he needs. Otherwise he will likely be shuttled from office to office until he reaches someone who can

help him or gives up in disgust.

The private sector provides some sources of information. A few excellent books are available on river touring. Unfortunately, management requirements have changed so fast that material in the books may be out of date before they are published. A number of organizations, such as the American White-water Affiliation and American Canoe Association, publish periodicals and newsletters.

As of 1976 permits are required for all commercial outfitters on more than 50 river segments listed in the IWC Guidelines. Noncommercial permits for those who run rivers on their own without the servies of a guide, outfitter, or professional boatman are required on at least 18 of these rivers. Fourteen of these have some kind of use limitation rule pertaining to the number of permits to be issued during a single season and/or numbers of persons permitted in each float boating party. The greatest restrictions are on the most popular river sections.

Typically, permits are handled by a local agency. In most cases, the various agencies or unit officers with jurisdiction along a particular river section have agreed that one office will handle permits and reservations. No similar coordination has been developed between managers of different rivers on a regional basis.

The information dilemma might be resolved by a central information center, national or regional. It could be federally or privately sponsored. The Center would not necessarily be involved in issuing permits or making reservations, but could provide information supplied by each participating agency concerning their availability.

The permit and reservation problem is much more complex. The present system, where local agency offices make reservations and issue permits, offers flexibility to deal with each individual situation. However, this flexibility and the correspondence it generates is very expensive to the agencies and requires a great volume of mail. Few local offices can take advantage of such tools as computer programs for "no-repeater" rules that require individuals to wait one or more years between trips on the same rivers. Many floaters assure themselves a trip by applying on several rivers for the same dates. This practice and the high rate of "no-shows" it generates can only be avoided if reservation systems are coordinated between rivers.

A central office, national or regional, could utilize computer systems now being developed to manage no-repeater rules and coordinate permit requests on several rivers. This office could double as an information/reservation clearing house. Conceivably, if reservations were coordinated between rivers, the number of "no-shows" could be reduced and capacity more effectively allocated. Permits could still be issued by local offices. They could also make short-term substitutions to back up cancellations.

White-Water River Planning--a System Approach

We now do our planning on a river-by-river basis. Alternatives are usually selected without consideration of opportunities afforded by other rivers; the planning process is often locally oriented. If the manager, however, decides to broaden his approach he will be frustrated since no means is readily available to weigh alternatives on a national or even regional basis.

It is doubtful that our present river-by-river approach can effectively cope with an increasing demand for a decreasing resource. Should we evaluate viable management alternatives for a specific river without considering management on other rivers? We have opportunities to offer a range of experiences if the river system is considered as a whole. For example, some rivers may key on low density use, emphasizing solitude; others may allow high density use, keying on the white-water experience. Some may exclude motors; others welcome them.

Before considering a group of rivers in a region as a river system we have to answer some basic questions. What are people's needs and desires? What do they value most, a white-water experience even though it may be in a crowd, or a chance, however slight, to combine white water and solitude? What is the optimum mix? Researchers, managers, and public involvement should be able to provide some answers.

Another key to developing a white-

water river system is to find out what we now offer the boater. One approach would be to build a matrix of opportunities offered on managed rivers. This would provide a basis for evaluation of alternatives for new plans and revisions of existing plans. It could be developed by researchers, managers, or both.

Who should spearhead such an effort? The IWC might do the job. Such an agency as the Bureau of Outdoor Recreation could assume the leadership role. Management agencies have discarded any vestiges of provincialism on sections of river with multiple jurisdictions. Can a similar effort succeed on a regional basis with several rivers?

SUMMARY

We see continued growth in demand for river running opportunities. River managers must seek out that optimum level of use which will allow as many persons as possible to float a river, without destroying the very values for which the area was established and is being managed. Such values can vary from area to area. Whatever they might be, they should not be compromised.

As the prospect for use becomes more restrictive, management must seek out ideas, concerns, recommendations, etc., from the public and fellow managers. Consideration should be given to regional information centers; to improved, more efficient management efforts so as to afford more equitable opportunities for individual float experiences; a careful look at classifying rivers by the desired level of experience; closer working relationships between local, State, Federal and Canadian agencies; continued input from the public, using improved methods; and a recognition that river management must be considered in a regional context. A popular recreational activity involving limited resources such as river-running, will result in sensitive, difficult management and use problems. We believe that cooperative action and the integration of thoughts from many management and use sectors are essential to the resolving of these problems and the proper management of river resources.

INFORMATION NEEDS FOR RIVER RECREATION PLANNING AND MANAGEMENT

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ABSTRACT.--Information inputs to making decisions about recreational use of rivers are described. Major recreational decisions and possible inputs to them are identified. A future scenario for recreational use of rivers is given and the needed research on information inputs is identified within the context of the scenario.

So much planning and management information is being generated by river researchers and managers that to discuss information needs seems redundant. However, there appears to be a lack of focus and organization to present efforts and in that context the discussion might be productive. River recreation research seems to be going the way of most other recreation research--ignore all we have learned about recreation, start from scratch, and piddle for 5 years (or more) before we define the problem.

My own view of the future suggests that we cannot afford less than a focused, coordinated research effort right now. We need to determine the nature of the phenomenon and then seek the information that will allow us to manage it. In this regard, there is a tremendous cooperative role to be played by river managers and researchers. There is the opportunity to learn from past recreation research and to proceed with rivers research more effectively and efficiently.

Simply put, my view of the future which calls for urgency looks like this. Within the next 10 years, I see at least a doubling of demand for river recreation. This will raise issues of user conflict, user displacement, and resource damage--possibly beyond acceptable limits. Within this expanded group of enthusiasts, there will be more novices using new equipment that they do not know how to use. The result will be increased hazards and a greater public safety management program for river administrators. I see continued demand for special designations for rivers. Some of this will be for formal status within the Wild and Scenic Rivers System (Act PL 90-542). Some will be for administrative designation as special use areas. This movement will mean more public involvement and thus need for more information about rivers and their uses. It will also mean that regional systems of rivers will need to be designated and studied so that rivers can be allocated to uses in an efficient manner; efficient because the resource is presently scarce and will become more so. One of the things to avoid is the polarization of supply into wild, primitive rivers and into high use, developed rivers. A regionally specific, systematic approach to allocation may be helpful in avoiding this problem.

Finally, my view suggests that there will be continued pressure to turn many rivers into lakes. Dams will be desired for energy production, flood control, irrigation and domestic water storage, and flat-water recreation opportunities. Planners especially will be required to respond to these demands by justifying why river recreation is important. If they are unsuccessful, we will lose our ability to meet river recreation demands and the doubling of demand will completely overwhelm the remaining resource.

What kinds of information will enable river managers to deal with the challenges posed by my scenario? The following sections describe the kinds of information which may be useful and give examples of their relevance.

INFORMATION NEEDS

Recreation management decisions might be approached several ways. One way is based

on carrying capacity. It fits the purpose here because carrying capacity is an integrating concept and because it is familiar to many river managers who have specified river capacity to regulate use.

The decision model into which carrying capacity fits has been presented elsewhere (Brown *et al.* 1976, Roggenbuck 1975) and is only briefly reviewed here. Three basic decision points are shown (in boxes) (fig. 1, Brown *et al.* 1976): (1) selecting management objectives; (2) selecting management tools and practices to achieve objectives; (3) selecting modifications to make in the management system, if needed. General information input to each of these decisions is shown; at each decision point, only new inputs to the process are shown; data are assumed to be carried from one decision point to the next. Activities, like implementation, that occur between the decision points are also shown. The performance of each of these actions often produces information useful for making subsequent decisions. Therefore, the output of each action can be considered as an information input comparable to those inputs specifically identified. For instance, the actual calculation of carrying capacity produces a number (or range of numbers) which is a standard indicating the maximum amount of use to be achieved. This number becomes one of the many inputs to selecting management tools--one that may limit the range of alternatives considered.

While both the decisions and the intervening activities produce outputs which become inputs to the next decision or activity, our focus here is on the explicit inputs shown in figure 1; i.e., those inputs to decisions which are inputs to that process and are related to the basic decisions of the process. A somewhat more detailed listing of the relevant information inputs to selecting management objectives, calculating carrying capacity, and selecting management tools is given in the following tabulation:

SELECTING MANAGEMENT OBJECTIVES

User Preferences
- Activities
- Resource Attributes
- Social Attributes
- Managerial Attributes
- Desired Consequences

Resource Capabilities
- Functional Capability
- Assimilative Capacity
- Resiliency

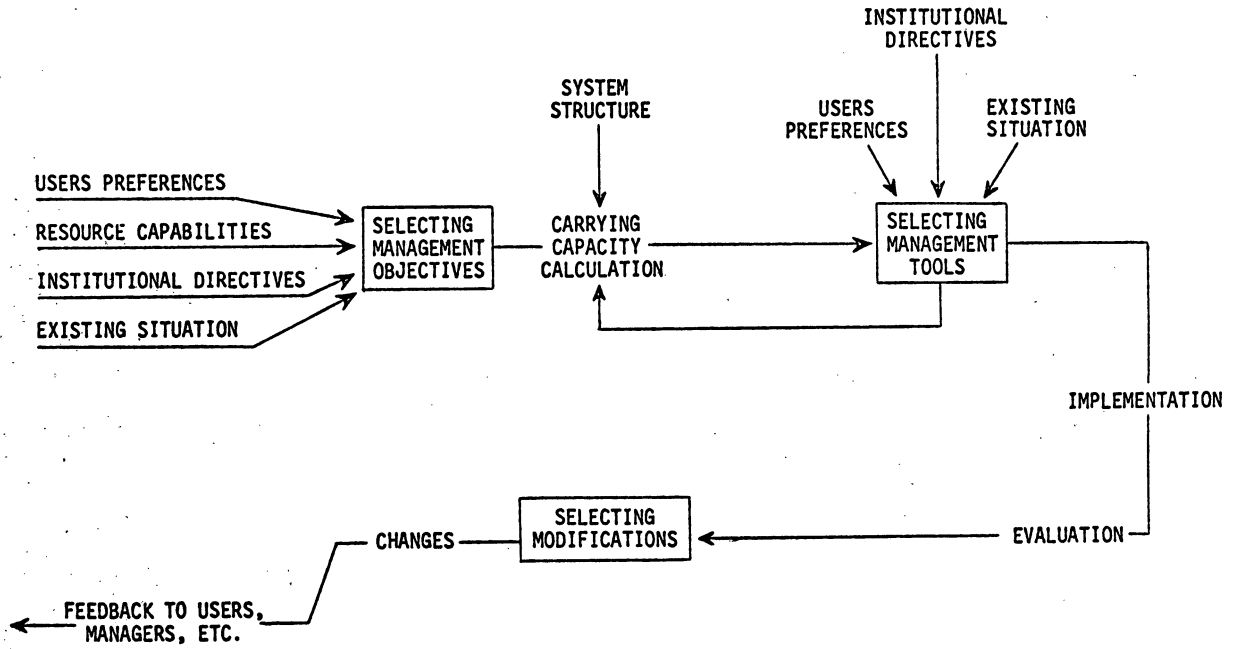

Figure 1.--*Decision points, with their inputs and outputs, for recreational management of rivers.*

Institutional Factors
- Laws
- Administrative Policy
- Budget and Personnel

Current Situation
- User Characteristics
- Resource Condition
- Management Practices

DEFINING THE MANAGEMENT AREA STRUCTURE

Facilities

Physiographic Elements

SELECTING MANAGEMENT TOOLS

User Perception of Management Actions and Behavior

Institutional Directives

Existing Situation

SELECTING MANAGEMENT OBJECTIVES

The kind and amount of information actually used by managers in selecting management objectives may be very limited, or it may be extensive. Specifying a set of information needs will not necessarily change the kind, or amount of, external information used, but it does indicate some of the kinds of information useful in the "decision calculus."

User Preferences

What users prefer for river recreation, environments, and experiences gives clues to the demands users have for river recreation and the forms it should take. Such information may indicate to managers the level of support existing for various recreational opportunities, the range of opportunities desired, and the nature of the opportunities that people seek. Preferences for several kinds of information, including those for activities, natural resource elements, social and managerial situations, and consequences of recreational engagement, may be considered.

Activities

User preferences for activities give a general indication of the things users like to do in an environment. It has been common to identify recreation as activities and to enumerate the activities in which people engage. To prepare management objectives, it might be useful to know what activities users would like to have offered. It may be that users are thinking of different sets of activities than managers, and information about such differences could be useful in selecting a set of activities to be included in specific management objectives. For instance, if users think of both rafting and hiking (at portages or around camp) as important components of a river excursion, the manager may want to consider both when developing management objectives because elements of the physical, social, and managerial environment may be different for each activity.

Resource Attributes

One category of things that the manager may manipulate is attributes of the resource environment. Users also exhibit preferences for different attributes which may facilitate their having satisfying experiences. If managers know what resource attributes are preferred by users, they will know what resource factors are perceived by users as being important to satisfaction and may then identify some conditions of the resource attributes to include in management objectives.

If users indicate that maintenance of a relatively natural environment along a river's edge is important to their satisfaction, the manager may then write an objective which emphasizes the riverside environment and what levels of disturbance are acceptable. Likewise, if users indicate that an invasion of trash fish lowers the quality of their river fishing experience, the manager may prepare an objective which specifies at what point the amount of trash fish is undesirable. These and many other resource factors have been dealt with by managers over the years. From the perspective of selecting management objectives, it might be useful to determine which of these factors are perceived by users as being important.

Social Attributes

The social attributes of the recreational situation may also influence whether or not users have satisfying experiences. Such items as the frequency and kinds of direct contacts between users and such indirect contacts as worn away vegetation and litter are important. Status-giving proper-

ties of recreational settings and experience may also be considered in this category.

Probably the most common expression of social characteristics in a management objective will be articulation of the kind, location, and amount of contacts acceptable for a quality experience. For river management, different kinds of contacts occur at the launching site, on the river, at campsites, and at takeout points. Also, the size and behavior of contacted groups may be of concern. In writing objectives, a manager might input preferences for different amounts of contact to his "decision calculus" and arrive at standards indicating either a desirable or acceptable number of contacts for a specific kind of recreation. Another condition for which users might have preference is the social status accorded certain areas and activities. Managers may be able to manipulate this status component by labeling or designating certain areas (e.g., Wild Rivers), or by advertising special opportunities or challenges (e.g., ratings of rapids). Preferences for these designations may be used by managers in writing management objectives which are designed for recreation opportunities that produce status outcomes.

Managerial Attributes

One other environmental attribute set, those of the managerial situation, may also influence the production of satisfying experiences. Management philosophy and approach, designation of area types, and the level and type of management activities (in terms of personnel and facilities) are all characteristics for which users might have preferences. For instance, in selecting management objectives it might be valuable to know how users feel about both regulatory and manipulative types of management. If users are opposed to regulation, the set of management objectives for consideration may be constrained. Alternatively, if users are indifferent to either type of management or are willing to accept either, there may be several options which the manager will want to consider.

Desired Consequences

Engagement in activities produces a set of consequences. Often these consequences are identifiable kinds of satisfactions and benefits; sometimes dissatisfaction results from the experience. Different users appear to seek different kinds of satisfaction and these different preferences can be identified.

In writing management objectives, there may be instances when it is desirable to have information about user preferences for consequences of the experience. If users are seeking opportunities to affiliate with others, if they are seeking achievement and skill development, if they are seeking escape from everyday environments, knowledge of such desires could be useful in selecting management objectives related to user desires. While the manager actually manipulates resource, social, and managerial factors to produce opportunities to provide these kinds of satisfaction, knowledge of desired consequences may provide a rationale for selecting specific standards to be included in management objectives and subsequent management actions. For example, if the river manager knows that users desire experiences which enable them to escape both their usual environment and many other people, he might consider management objectives which include standards dealing with length of trip, size of party, number and location of contacts between parties, and type of equipment used. These and several other variables will likely influence whether or not users have a satisfying experience.

Resource Capabilities

The capabilities of the resource base to support different recreational activities and to enable production of quality experiences can be integrated into decisions about management objectives. This information may indicate which activities are physically possible, some of the resource constraints on production of recreation opportunities, and the levels at which change in the resource may become unacceptable. Three categories of information which may be considered are functional capability, assimilative capacity, and resiliency.

Functional Capability

The simple notion that a resource base provides an intrinsic opportunity for a recreational activity describes what is meant by functional capability: the resource is capable of supporting functional use. We often say that if there is a river present, there might be river recreation opportunities; if a river is not present, there is no

opportunity for river recreation. This notion does not rule out the possibility that management might alter the landscape to provide river recreation opportunities where they once did not exist. What it does indicate is that some opportunities exist without alteration or with enhancement only.

Resiliency

An idea associated with acceptable resource change, and thus acceptable levels of use, is the ability of the resource to bounce back after being stressed. Included in resiliency is not only the bouncing back of existing objects, but also regenerative ability. Specific standards may be written into management objectives regarding resiliency, particularly for soils and vegetation, but also for other resource factors.

In considering changes in vegetation, visual deterioration may be acceptable if the ability of the vegetation to recover in a specified time is maintained; if the vegetation cannot recover, the change is deemed naturally irreversible. The management activity of site rotation is based on this idea. For river recreation management, the manager might consider items like vegetation, fish, wildlife, and riverside soil conditions as fitting into this category. The ability to predict at what level or point (threshold) conditions become irreversible is not well developed, but in cases where the outcome of different use and deterioration levels is known, the manager may gain valuable information for selecting management objectives.

Laws

The laws that guide management of land and water areas may have a large influence on the kinds of management objectives selected. Laws often set the boundaries within which decisions must be made and indicate the amount and type of recreational use that is acceptable. For river management a relevant piece of legislation might be the Wild and Scenic Rivers Act (PL90-542). This legislation sets the tone for recreational use of wild, scenic, and recreational rivers managed by Federal and State agencies. It provides general guidelines for condition of the adjacent shoreline environment, water quality, river impoundment, recreational and other facility development, and river access under each of the river classifications.

Another kind of legislation important to river management is Federal and State water quality statutes. These statutes often either specify acceptable water quality standards, or provide a mechanism to establish standards which are subsequently promulgated. Standards like these might be used directly in the writing of management objectives.

Administrative Policy

Like laws, administratively established policy may guide the selection of management objectives. Administrative policy plays the same role as law, though it is often more specific by focusing on one agency's management style or on a particular area. For instance, an agency like the Bureau of Land Management may eventually articulate a Bureau-wide interpretation of the Wild and Scenic Rivers Act and put forth specific management guidelines for each class of rivers. This would encourage consistent management throughout the Bureau while at the same time constraining the range of options for management objectives and practices which any one BLM river manager may consider.

Institutional Factors

Institutional factors often act to direct the kind of management objectives written for any specific area. Statutes, administrative policy, and budget and personnel situations often direct and constrain the choice of objectives. Such information may include things like the range of opportunities for experiences which are possible, the management philosophy which is appropriate, and the degree to which management activities can be effective in meeting certain objectives.

Budget and Personnel

Information about budget and personnel may constrain the kinds of management objectives selected. These factors are often viewed as limiting the effectiveness of management, and information about them may lead to selection of realistic management objectives. For example, if personnel are unavailable to regulate river use by administering a permit or fee system and checking compliance with the system, objectives which require that intensity of management may not be selected. Likewise, objectives which require facility development for their attain-

ment may be rejected if budgets are expected to be very low or to not contain construction money.

Current Situation

Information about the current situation identifies the state of the management system. Also, the current situation may be quite constraining on future management actions because some options may have been lost through present and past management, and because some present behaviors (both user and managerial) may be quite difficult to change. For these reasons, the set of realistic future options that the manager has to consider may be limited.

User Characteristics

Changes in type or amount of use suggested by certain management objectives, if realized, may have an effect on user activities, distribution, group composition, and several other factors. Knowledge of who will be affected by changes is valuable. Also, knowledge about behaviors to be changed and an estimate of how easily the changes can be effected may be important in selecting management objectives.

One example where current user data may be valuable is a river where there are long-standing traditional uses. Present users will probably consider the traditional use as normal and a right. Efforts to modify that use would likely be fraught with public relations problems, and benefits accruing from the change may be far less than the costs. In a case of this nature, the manager may rule out consideration of some objectives.

Resource Condition

Present resource conditions may influence the writing of standards contained within management objectives. If resources have been used up, and reclamation would be difficult, management options would be limited to no use or development alternatives. On the other hand, if the resources are in near natural conditions, the manager may consider preservation alternatives as well as many other options. In writing standards for objectives, the manager may look at things like vegetation condition. Then he may write a biologically oriented objective which indicates that an acceptable change in vegetation is removal of not more than x percent of the present amount of vegetation.

Management Practices

Management practices often become well accepted by user publics and eventually are articulated as the way things should be done; they become normative. Many possible management objectives will require changes in management practices which are difficult to implement because of the normative character of present management. Realization of this may influence the manager's selection of management objectives. Those objectives which require a change to more visible and possibly more coercive management may be rejected because of expected problems due to changing management. Likewise, objectives which require changing access to areas (providing access is viewed as a management practice) may be shunned because of expected disruption of user behavior. In both of these cases, knowledge of the existing situation and expectations of disruption caused by different management situations may influence the selection of management objectives.

DEFINING THE MANAGEMENT AREA STRUCTURE

In order to calculate recreational carrying capacity consistent with the management objectives for an area, it is necessary to have information on the physical features of the area which determine its physical structure. The features considered may be both man-made facilities and physiographic elements.

Facilities

Facilities such as trails and campsites are important elements of the structure of an area. They tend to channel users to specific locations and to regulate rates of travel. They are also elements which can be modified by management to increase or decrease the total physical capacity of an area, given user behavior patterns. For instance, in the case of rivers, the number of available sites for camping and the number and difficulty of portages may determine outside limits on carrying capacity at any given time.

Physiographic Elements

Terrain and distribution of vegetation are important factors of an area's structure. For example, the steepness and ruggedness of terrain and the river gradient affect rates of travel, the number of available campsites, and the number of portages required. Simi-

larly, vegetation patterns influence the amount of screening afforded campsites, thus dictating the number of sites which can be used under some objectives (e.g., solitude), and they influence rates of travel at portages and for other terrestrial activities. Another important element along rivers may be the incidence and size of tributary streams which may act both as barriers to travel and as creators of major features (e.g., major fishing holes, campsites, etc.).

SELECTING MANAGEMENT TOOLS

Several kinds of information may be useful in selecting management tools for a chosen objective. Some of the information can be carried forward from the activities of selecting management objectives and defining the structure of the management area. Some other information might be derived specifically for the purpose of deciding from among an array of management tools. Such information might be grouped into three classes: user perception of management actions and user behavior, institutional directives, and existing situation (fig. 1).

Perception of Management Actions and Behavior

Often users have feelings about both the general philosophy of management (e.g., coercive or light-handed) and specific management tools. Knowing how users feel about these things may indicate which tools will be received favorably or unfavorably by users, and thus be effective in achieving management objectives. In river management, for instance, the manager may have the option of limiting the number of permits available or adjusting user fees to regulate river use. Which option is best may depend upon many factors, one of which is whether the user perceives the tool favorably or unfavorably.

Some management tools have effects on user behavior. Knowledge of the effectiveness of different tools in changing user behavior would aid decisions about which management tools to use. For example, if it is considered necessary to distribute river users differently than at present, both controlling the starting time of users and providing them with information about attractions along the river are potential tools. In deciding between the two a relevant question might be, how effective is each in modifying user distribution along the river? An answer to this question would help the manager select the tool to use, if the two tools are differentially effective.

Institutional Directives

Institutional directives may play a role in the selection of management tools. If certain management approaches are favored, or required, by an agency, then they will probably be selected by managers. Likewise, if certain techniques are discouraged or barred from use, they will be eliminated early in the decision process. In river management, permits for float trip outfitters are a management tool required by some agencies. For other agencies, permits are discouraged as management tools. Whichever the case, selection of permits as a viable management tool will likely be affected by the agency posture toward permits. Other kinds of management tools may be similarly affected.

Existing Situation

As with selecting management objectives, the selection of management tools may be influenced by existing management. Both the effectiveness of tools and the current patterns of management are important. If presently used management tools are working, and management objectives have not changed, the decision of which tools to use will probably be simple; no change is needed. If, however, present objectives have changed, then the manager may search for a new set of tools. In doing so, it is possible that he will compare new tools against those he is already using.

The patterns of management that develop in an organization may also influence the choice of management tools to use. Certain tools may lead to a particular administrative routine. For instance, if river running permits are not presently being used, their introduction would lead to changed behavior of management personnel. Some employees would need to be assigned to issuing permits, some would need to keep records about the permits, and some would need to monitor compliance with the permit system. In effect, different patterns of management would develop within the organization. In considering which tools to select to achieve management objectives, information about the effect of tools on patterns of management may indicate whether or not implementation of a tool will be disruptive or beneficial to the functioning of the organization.

SELECTING MODIFICATIONS IN THE MANAGEMENT SYSTEM

The information which might be used in deciding how to change the management system is the same as that for selecting management objectives and tools. Modification of the management system becomes necessary when either the tools are not working or the management objectives are not relevant, or both. To decide on what changes to make, the kinds of information inputs previously discussed are relevant and need no further explanation.

NEEDS FOR PLANNING AND FUTURE MANAGEMENT

While several different information items have been discussed above, which ones will really be needed in the future? What information is needed to effectively respond to the future that we visualize? Some of the information needed can be simply obtained (from statutes, manuals, reports, etc.), while other information needs to be generated through research. It is these research needs which are addressed below.

As stated previously, within the next 10 years, there will be a doubling of demand for river recreation. There will be more novices using new equipment which they do not know how to use. There will be continued demand for special designations for rivers. There will be continued pressure to turn many rivers into lakes. This view of the future is one of increased demand for recreational use of rivers and one of continuing special interest demands for river allocation and possibly modification.

In responding to this future, there are several research needs to produce information for today's planning and tomorrow's management. First is the need to *identify the kinds of user demands* which might exist for river recreation. Information on what consequences are desired from recreational experiences and on what resource, social, and managerial attributes are perceived to help produce satisfaction is needed. Such information would help us understand the meaning of a doubling in demand, what expected consequences may be leading novices into river recreation, why new kinds of equipment are becoming popular, and why there is a desire for special river designations. Underlying this research need is the assumption that if we know about and understand the range of user demands, we will be able to prepare management systems capable of meeting the demands.

Second is the need to *describe the resource system.* What recreation opportunities is it capable of producing and how easily can it be modified to produce different opportunities? How capable is the resource system of assimilating waste products stemming from recreational and other use and how well does the environment assimilate temporary intrusive elements, like people? Also, how resistant is the resource to user-induced modification? These and similar questions need to be answered for a wide range of river types and classifications. Such information would be particularly useful in identifying the possibilities for special designation (or resisting designation) and for resisting modifications in river flow, such as creation of lakes. This information, when combined with demand information, can also be used in meeting the third research need.

This third need is to explore the possibilities for *developing regional systems of rivers* to meet recreational demands. If, as expected, there are several river recreation experiences which are demanded and there are both similar and different types of rivers within a region, how might river recreation opportunities be allocated to different river segments? In the Rocky Mountain States, for instance, there are several nationally prominent white-water rivers. Segments of these rivers are capable of providing wilderness, white-water recreation. Other segments are capable of providing other types of river recreation. But how should opportunities be allocated to meet demand? A region-wide study of the rivers as a system and a study of the demands for the region's river recreation opportunities would produce information useful for developing allocation models. The information produced from this research would be most useful in considering special designations and in finding rivers on which to accommodate the probable doubling of demand.

The fourth general research need is to *determine which management tools are effective in which situations and for achieving which objectives.* If managers are to effectively deal with a doubling of demand and with a lot of users who may not be skilled in recreational use of rivers, knowledge of which management tools are effective is necessary. There will not be enough time to go through a trial and error process to deter-

mine effectiveness on each river because the management demands will not wait. What is needed is a systematic evaluation of what practices are presently being used and an examination of any new practice as it is implemented. These evaluations then need to be made available to other river managers.

SUMMARY

This paper has focused on some of the information inputs to decisionmaking for the recreational use of rivers. Possible inputs to the three major decisions of selecting management objectives, selecting management tools, and choosing modifications in the management system were identified and discussed. Inputs presented dealt with the social, resource, and institutional (including managerial) dimensions of river planning and management. These possible inputs were then evaluated in the context of one scenario of the future recreational use of rivers to identify some categories of immediate research need.

RESEARCH FOR RIVER RECREATION PLANNING AND MANAGEMENT

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ABSTRACT.--Three research problem areas emphasizing social or people problems on rivers are described: (1) how patterns of river recreation use and characteristics of users vary on individual rivers, between different rivers, and with time; (2) how current and potential users define quality river recreation experiences; and (3) how patterns of river recreation use can be modified.

A recent article in *Northliner Magazine* referred to water as "Liquid Gold"--the basis for the multi-billion dollar tourism/recreation industry in the Upper Midwest (Sturm 1976). Similar observations have been made across the country, indeed throughout much of the world wherever recreation flourishes.

People "use" water for a wide variety of leisure activities. Many are directly water-based, such as swimming, fishing, boating, and waterfowl hunting. Other activities, such as camping, hiking, driving for pleasure, picnicking, and relaxing, are often pursued with water as an important backdrop.

The growth in recreational use of rivers and other wetlands is no surprise to those of us interested in planning and managing the leisure-use of water resources. All types of rivers--urban and rural, placid and fast-flowing, polluted and clean--are being used increasingly for recreation. Many of the papers in this Proceedings illustrate the rapid expansion in river recreation activity.

Public pressure is strong to preserve rivers and streams with high scenic, recreational, ecological, and cultural values. This is evident by the inclusion of many rivers under Federal and State river preservation programs. Principal management responsibilities for these rivers rest with the USDA Forest Service, National Park Service, Bureau of Land Management, and some State governments. Pressures to preserve more will likely continue, but not without controversy.

Some factors likely associated with the heightened interest in and use of waterways for recreation include: the seemingly crowded conditions associated with other recreational activities; the energy squeeze that has focused attention on close-to-home recreational pursuits; the reduction in pollution on many waterways resulting from legislation such as the Water Quality Act of 1965; the back-to-nature movement; the increased emphasis on physical fitness; a surge in interest by young people in challenging, even dangerous recreation activities; the growing number of books, magazines, films, and television programs on the out-of-doors and rivers in particular; and new technology in outdoor recreation equipment and related industries.

PROBLEMS RESULTING FROM GROWING POPULARITY

In spite of the manifold recreational and related *benefits* resulting from river resources, there are significant *costs*

as well. For example, frequent social and environmental problems have been created by the growing popularity of river recreation. Many streams are threatened by accelerated and unregulated shoreline development, which degrades water quality, restricts public access, and impairs beauty. Increased recreation use may adversely affect plants, animals, and soils along rivers. Erosion of streambanks, campsites, and landings is a common problem in some locations. Growing use also may result in more littering and vandalism to public and private property along waterways. Problems of maintenance and law enforcement may also increase.

Periodic crowding on some waterways may lessen the enjoyment of some users. Even small changes in the density or kinds of river use could greatly influence the quality of experiences for some visitors. In fact, people seeking low-density use and contact with nature may be displaced altogether. Conversely, crowds appeal to some people (Bultena and Klessig 1969 , Clark *et al.* 1971). Certain river users may also enjoy the sociability afforded by crowds.[1]

Recreational use often generates other conflicts in addition to crowding. Conflict has arisen between fly fishermen and boaters (Bassett *et al.* 1972 , Driver and Bassett 1975), between motorized and nonmotorized boaters (see Nielsen and Shelby paper in this Proceedings and Shelby 1975), and between recreationists and landowners.[2] As use increases, conflict will probably grow and so will debate over how to curb such conditions.

Probably the most serious and immediate river management problems involve conflicts within and between recreation and nonrecreation uses. These problems are changing fast, faster than techniques can be developed to cope with them, and probably faster than changes to the natural, biological system resulting from recreation use. Unfortunately, less is known about river use and users than about user impact on the physical resource (Stankey and Lime 1973).

In the absence of documentation about river recreation use, many decisions have been made intuitively by recreation planners and managers to minimize problems and to maintain quality recreation opportunities. Use rationing, limitations on camping and open fires, party-size restrictions, limitations on lengths of stay, and other use restrictions have been imposed or are anticipated on many waterways. Some management strategies seem to have worked well and have gained public support; others have not. Managerial actions frequently have been reflected both in dissatisfied recreation users and in litigation by a variety of river recreation interests.

THE RIVER RECREATION SYSTEM

The river recreation "system" is complex and many faceted. There are several key elements of concern to river recreation planners, managers, researchers, and often the public:

1. *The River*, which has both recreation and nonrecreation functions
2. *The Adjoining Land*, land in the river corridor and further removed that is part of the recreation environment and is impacted by recreation use, directly or indirectly
3. *The River Recreation User* (or potential recreation user), which includes both river and river corridor users, such as canoeists, fishermen, hikers, hunters, and cottage owners
4. *Nonrecreation River Uses* such as commercial fishing and trapping, transport, hydropower and irrigation, water supply, and waste-water treatment, that may conflict with recreation use of the river
5. *Nonrecreation Riparian Uses*, such as forest industry, mining, agriculture, and residential land use, that may benefit from recreation use (as in

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[1] *Habermehl, James M. 1973. Determining visitor perceptions of crowding on the Ozark National Scenic Riverways. 53 p. Unpublished M.S. Thesis, University of Missouri, Columbia.*

[2] *Wehunt, Eugene P., Jr. 1971. Landowner's perception of recreationist associated conflicts in the Salmon-Little River corridor of Idaho. 104 p. Unpublished M.A. Thesis, University of Idaho, Moscow.*

the case of local economies) but may conflict with recreation use of the river

6. *The Nonriver User*, who nevertheless is interested in the river, directly or indirectly (e.g., vicarious users), as a public resource

7. *The Entrepreneur*, who makes a living directly or indirectly from river recreation

8. *The Planner and Legislator*, who is responsible for assessing national and regional patterns of recreation resource needs

9. *The Manager*, who is responsible for onsite management to protect both physical resources and experiences of visitors

Some special features of river recreation resources that pose unique problems for effective management and research are: (1) the linearity and directional character of river corridors, (2) multiple access and egress points, (3) fragmented jurisdictions or absence of responsibility by any agency, (4) impediments to observing and monitoring resource change and user behavior throughout the system, and (5) the high degree of variability and irregularity in recreation use and in resource conditions of the river itself.

NEEDED INFORMATION ABOUT RIVER RECREATION SYSTEMS

Planners and managers of river recreation environments need better information to properly evaluate alternative ways of managing resources to provide the range and mix of experiences sought by visitors and to protect the physical environment. Below are nine types of information that would help in defining administrative objectives and guidelines:

1. *Classification of rivers as recreation resources.*--Taking into account physical, cultural, historic, and perceptual attributes, how can rivers and river corridors be classified as to their recreation potential? What physical attributes (e.g., instream flow, accessibility, soil, and vegetation) influence specific recreation activity patterns on rivers and adjacent land? What attributes of rivers do recreation planners, managers, and users believe to be important? What methods can be developed to synthesize and display such data for analysis and interpretation?

2. *Patterns of river recreation use.*--How do patterns of river use and characteristic of users vary on rivers, between rivers, and with time?

3. *A view of future river recreation use.*--What activities, use patterns, and user characteristics can be expected in the future?

4. *Understanding river recreation behavior and experiences.*--Why do people participate in river recreation? What influences patterns of river use? What conditions provide optimum satisfaction and benefits for users? What do river recreation users actually experience?

5. *Impacts of use on user experiences.*--What are the effects of various amounts and types of recreation use on the experiences of users? How is the experience sought by users influenced by (a) conflicts between various types of users, (b) the relative naturalness of a river, (c) consumptive uses and shoreline development (logging, mining, agriculture, private residences, etc.), and (d) availability of developed facilities such as campsites and landings?

6. *Impacts of use on physical resources.*--What are the effects of recreation and nonrecreation uses on physical resources, such as water, fish and other wildlife, soil, vegetation?

7. *Impacts of river recreation on economics and other social values.*--What are the effects of recreation use on local, regional, and perhaps national economies? Can methods be developed to assess the "value" of recreation experiences in relation to costs and benefits of alternative river uses?

8. *Managing physical resources of rivers.*--What management techniques will work best to minimize change in physical resources within acceptable limits?

9. *Managing experiences of river users.*--What management techniques will work best to improve the experiences of recreation users? What management systems

will ensure a diverse range of river recreation experiences that transcend administrative and jurisdictional boundaries?

SOME GENERALIZATIONS ABOUT RIVER RECREATION RESEARCH

There has been a recent proliferation of literature dealing with river recreation (as witnessed by the Literature Cited at the conclusion of this Proceedings). Nonetheless, serious voids remain in the information-need areas described above. Some reasons for this are that much of the research has:

1. Involved one-time studies without followup research, resulting in unique, noncomparable data
2. Consisted of one-river case studies devoted primarily to understanding local conditions, again limiting generality
3. Been poorly designed in terms of limited sample size, representativeness, and methodology
4. Emphasized description rather than detailed analysis of processes and specific interrelations
5. Focused on studies of a single river activity at one time of the year (usually summer)
6. Documented only on-water activities (e.g., canoeing, rafting, fishing) and ignored riparian recreation users
7. Been conducted on Western whitewater rivers that are unique both in location (usually remote from urban centers) and management (usually designated as a National Wild and Scenic River or within a National Park or Monument)
8. Been partially analyzed and/or inaccessible in that much of it is buried in environmental impact statements, agency management plans, informational pamphlets for specific rivers, Statewide outdoor recreation plans, academic dissertations, and unpublished manuscripts
9. Been funded and/or encouraged by land managers who frequently want one-time, one-river, single activity, descriptive studies that reflect local conditions. Seldom has research been funded to systematically study regional, even basin-wide rivers as a system so recreation uses can be better planned and allocated to reflect the mix of experiences desired by the public.

USDA FOREST SERVICE RIVER RECREATION RESEARCH

To assist in the general quest for information to aid river recreation planning and management, social scientists at the North Central Forest Experiment Station, St. Paul, Minnesota, are embarking on a new program of nationwide research on *backcountry* river management. *Backcountry rivers* range from virtually undeveloped, such as those located in the National Wilderness Preservation System, to those traversing agricultural or urban landscapes that nevertheless offer the recreation user a feeling of being in a relatively wild setting (Lime 1975a).

The Station's river recreation research project is particularly interested in the broad problem of managing river recreation systems to optimize visitor enjoyment, consistent with the limits set by management objectives, of course. Consequently, the research is oriented toward the study of human behavior under various river settings and conditions--the source of the "people problems" with which management increasingly must deal.

Although much of the river recreation research will be conducted in the Station's Upper Midwest territory, some studies will be carried out in other parts of the country. Through cooperation with various Federal agencies, universities, and State and local governments responsible for river planning and management, many opportunities exist for research in a broad range of disciplines. Some research has begun and plans for future studies are being made. The uncertainties of a new field will require that research plans be flexible enough to incorporate change.

The Station's recreation research unit will focus on selected research topics under the following three questions:

1. How do patterns of river recreation use and characteristics of users vary on individual rivers, between different rivers, and with time?

2. How do current and potential river users define quality river recreation experiences?

3. How can patterns of river recreation use be modified to achieve specific management objectives?

Answers to these questions will help provide, directly or indirectly, the nine types of needed information described earlier.

Patterns of Use and Users

Recreation planners and managers need to know *how* and *by whom* riverscapes are used. In a sense, basic descriptive information is analogous to timber and range inventories. In both instances, the data allow analysis of supply and demand relations, aid in facility planning, and assist in the development of regulatory and informational programs. Such data can also be used to supplement environmental impact statements and river classification studies, to aid future use projections, and to determine how management programs alter patterns of use.

A specific objective of this research is to develop comprehensive descriptive profiles of who the recreation users are and how they behave, both toward the environment and toward each other. River recreation users will be studied to determine their demographic characteristics (e.g., age, sex, occupation, residence); social characteristics (e.g., group size, social behavior, spatial tolerance); location-of-use characteristics (e.g., access, egress, intra-river activity, campsite locations); time-of-use characteristics (e.g., time, frequency, and duration of visits), and recreation activity characteristics (e.g., activities, kinds and sources of equipment, previous knowledge and skills).

As an important early step in this research, we plan to develop a classification system for river recreation resources that incorporates environmental, experiential, and managerial variability. The classification scheme will consider variations in: (1) environmental features and human use of rivers (e.g., streamflow characteristics, water quality, geographic location, corridor land uses, ease of access), (2) social, demographic, and psychological conditions that distinguish or characterize individual users and groups of users (e.g., use densities, sources of conflicts, residence, age, occupation), and (3) current and proposed management activities (e.g., site and facility management techniques, regulation of use). Such information will facilitate the selection of rivers for study so as to maximize research on a wide range of use conditions and river settings. It also could permit a more logical extension of research results from river to river.

Standardized data collection systems need to be developed so that followup studies on sample rivers can be made at appropriate intervals. Ideally, such recreation participation surveys would focus on *specific* river-related activities and would be conducted at the State, regional, and even national level to allow maximum comparability both within and between river systems.

Through such repetitive studies, it would be possible to answer such questions as: (a) Is the amount of use changing? (b) Are use conditions or activities shifting? (e.g., does fishing use drop off as canoe use grows?) (c) Are certain access points attracting more groups or more of certain visitor types than others? (d) Is the use season expanding into spring, fall, and winter? and (e) Is the river assuming greater significance as a regional or national attraction because more people are coming from greater distances?

The Station's recreation research project currently is involved in several efforts to describe the current state-of-the-knowledge regarding river recreation. An annotated bibliography of river recreation literature containing more than 200 citations has been completed.[3] Also, as noted above, a river classification scheme is being developed to identify key characteristics of selected recreational rivers in the United States.

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[3] *Anderson, Dorothy H., Earl C. Leatherberry, and David W. Lime. (In prep.) An annotated bibliography on river recreation. Manuscript on file at North Central Forest Experiment Station, St. Paul, Minnesota.*

Some research is planned or underway to develop better use measurement and monitoring systems. Michael Chubb of Michigan State University is cooperating with us on a study to test methods for estimating the geographic distribution of river use on several rivers in Michigan. He experimented with several automatic recording devices in conjunction with onsite visitor interviews. In a second study in Michigan, Chubb and Bauman developed a preliminary method to quantitatively classify a river's recreation potential for 16 different activities.[4]

With other research cooperators, we are testing methods to accurately measure the attitudes, activities, and background of sample populations of river recreation users. Studies are ongoing or completed on the Green (Desolation Canyon) and Colorado (Westwater Canyon) Rivers in Utah by Richard Schreyer of Utah State University and on the Kettle River in Minnesota by Lawrence Merriam, Jr., and Timothy Knopp of the University of Minnesota. The results of these and other methodology studies will be useful in later more comprehensive studies of a variety of rivers. We currently are planning a 1977 study of use and users of selected rivers under Bureau of Land Management administration.

Although our program must be flexible, some plans for future studies include: (1) further descriptive studies under a variety of recreational use conditions and river settings throughout the country; (2) a series of studies to test use measurement and monitoring systems such as aerial and ground photography, "electric eye" counters, and observation; (3) an indepth study of river activities and backgrounds of registered boat owners in Minnesota; and (4) a study of urban-suburban river recreation use patterns in the Upper Midwest.

Defining Quality Recreation Experiences

Resource planners and managers must define appropriate administrative objectives to accommodate the wide range of possible recreation uses for rivers. To aid in evaluating alternative objectives and management strategies to implement objectives, better information is needed about how present and potential users define quality river recreation experiences. To do this, resource administrators must know more than they do now about the motives that prompt people to participate, or not participate, in river recreation activities. We need to identify the range of activities people desire and the specific attributes of river environments and recreational use conditions that provide optimum satisfaction and benefits for them.

Such research must commence with appropriate measurement techniques and instruments. Some methods exist, but many will need to be developed to fit the specific questions and conditions under study. Such methods will need to measure the expectations, perceptions, awareness, behaviors, feelings, and moods of different recreational user groups across a spectrum of riverscape settings. River settings should be chosen to permit contrast among factors having major influences on recreational participation and satisfaction.

One application of such research methodology lies in refining the concept of *social carrying capacities* of rivers; that is, the amount and kind of use an area can support over a specified time without causing unacceptable change to the recreational experience (Lime and Stankey 1971). Such research would reveal how experiences sought by river users relate to: (a) amounts and distributions of use, (b) conflicts between various user groups, (c) commercial and other developments (mines, farms, factories, private residences, etc.), (d) level and extent of managerial intervention (campsite development, access point control, etc.), (e) type and abundance of flora and fauna, and (f) physical characteristics of the river (length, velocity, temperature, purity, etc.). Research should include both studies of present river users and studies of nonriver users to identify what prevents some people from participating in these activities.

These investigations should relate to and benefit from research on patterns

[4] *Bauman, Eric H. 1976. A method for assessing river recreation potential. 188 p. Unpublished M.A. Thesis, Michigan State University, East Lansing, Michigan.*

of use and users (described previously). An understanding of the decisionmaking processes and factors that shape users' decisions can also help determine how patterns of use can be modified.

The Station's research project is cooperating with social scientists from several universities to measure and evaluate how recreation users define quality experiences. Results of some of this research are reported in this Proceedings by deBettencourt and Peterson, Driver and Bassett, and Cherem and Traweek. Attempts to develop similar research methodology are included in the objectives of Schreyer's study on two rivers in Utah described earlier. Major outputs of this research will include profiles of what motivates various users to visit rivers and their preferences for particular river settings, types of facilities, and use-management strategies.

Our plans for further research in this area include: (1) more indepth studies to develop research strategies and instruments to identify basic satisfactions and benefits of river recreation experiences and to test promising methods on a spectrum of river settings, (2) further studies of social carrying capacities and how use affects the quality of experiences, (3) more indepth studies to identify factors that influence how users choose rivers or certain sections of rivers for recreational pursuits, (4) a preliminary study of satisfactions resulting from nonhunting wildlife encounters on rivers, and (5) a study of river managers' perceptions of how river *users* define quality experiences and respond to use-management techniques.

Modifying River Recreation Use

The third research area focuses on developing management techniques to accommodate the wide range of river recreation uses, while minimizing the conflicts that often arise between various interests. Of course, techniques are needed that do not violate the objectives prescribed for the riverscape under study. These objectives limit the options available to the planner or manager, but often there are several alternatives to solve a given problem.

Studies are needed to determine how various publics feel about techniques to control, modify, and redistribute use, and to identify opinions about site management techniques to minimize physical resource damage (Lime 1976). For example, how do people react to regulatory management techniques (e.g., reservations, limits on party size and lengths of stay, zoning) compared to manipulative techniques (e.g., information, fees, changes in access points)?

Studies also are needed to determine the impact of potential use management policies on the *behavior* of users because what people say they want may not be reflected in what they do. For example, studies in cooperation with river managers could measure changes in user behavior and experiences in response to varying methods to schedule daily use limits at river access points (see the Nielsen and Shelby paper in this Proceedings).

Additionally, studies need to focus on finding more effective ways to communicate with recreation users to enhance their outdoor experiences. Through studies of how users choose among alternative river activities and locations, further research can determine what information can best help them find areas that match their desires, expectations, and skills.

Related research is needed to determine how the destructive and inconsiderate behavior of some river users can be reduced. Some of this behavior undoubtedly results from people not understanding the full consequences of their actions, rather than from overt maliciousness. Attention should focus on identifying better ways of educating users to understand and appreciate the effects of their actions on the environment and on other users, and to provide users with the skills necessary to reduce adverse impacts. Communicative techniques are also needed to explain management objectives and the need for restrictive measures to protect river resources and visitor experiences.

One current study by our river recreation project is focusing on how and to what degree visitor distribution can be altered by information supplied to visitors. In the Boundary Waters Canoe Area of Minnesota, we are studying (in cooperation with Robert Lucas, Inter-

mountain Forest and Range Experiment Station) the extent to which information about patterns of use, attractions, and other factors can alter visitors' choices of routes, areas, and times of visit. Information supplied to visitors seems to be a highly desirable management technique because it is less authoritarian or regulative than many other techniques (e.g., restricting access).

Other research by the Project is focusing on a field test of the Wilderness Area Simulation Model (Shechter 1975) in a river recreation context. The Simulator provides a measure of the number of encounters (visual meetings) river parties have with other parties and the locations of these encounters along the river corridor (on the water, at rapids, at campsites, etc.). The method has been tested in a recent study in Dinosaur National Monument (see McCool, Lime, and Anderson in this Proceedings). An extension of this research is planned for 1977 for the Selway River in the Selway-Bitterroot Wilderness in Idaho. In related research, George Peterson of Northwestern University has cooperated with the Project on several studies to simulate visitor travel in the Boundary Waters Canoe Area (see Peterson *et al.* in this Proceedings).

Our future research plans include: (1) additional studies to determine users' attitudes and behaviors toward various regulative and manipulative use-management techniques in a variety of river recreation situations, (2) an indepth study of user attitudes toward existing use rationing programs, and (3) a preliminary study of depreciative behavior by river recreation users and ways to control it.

CONCLUSION

Information about the use and users of river resources seems woefully inadequate. Even for rivers supposedly "known" for heavy use, unhappy users, and resource deterioration, little is known about how these riverways are used, by whom, and what users are seeking in outdoor experiences. Much social research in designated Wilderness Areas, at reservoirs and lakes, in highly developed and concentrated recreation areas, and in other places has focused on many of the same questions raised here. However, it would be premature to assume that such results would have direct application to river recreation planning and management.

The availability of a wide variety of rivers and streams for recreation has, indeed, provided new and expanded opportunities for many people throughout North America. At the same time, such growth has caused critical management problems demanding thoughtful solution. In order to improve planning and management of river recreation use and to better evaluate management decisions, a host of recreation and related research needs are evident. There are unique and challenging opportunities for scientists from all disciplines to cooperatively apply their interests, expertise, and creativity to solving these problems.

ACKNOWLEDGMENT

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CITIZEN GROUPS: THEIR ROLE IN RIVER RECREATIONAL PLANNING

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ABSTRACT.--The two equal and essential components that the river recreation planner must consider in decision-making are the managed space and the user who will inhabit that space. River user conflicts arise as the result of territorial interests of citizen groups. Although the conflict between specific recreational users can never be fully resolved, the resource manager can adopt certain attitudes and actions to mitigate the conflict.

In order to understand the role of citizens in river recreational planning, it is necessary to understand the basic motivation behind their interest in the river. This motivation is based on a concern for the utilization of space that conforms to specific needs or perceptions. These needs and perceptions form the nucleus around which various citizen groups coalesce. The different aspirations, visions, or legitimate fears act as a bonding agent that is critical to group formation and stability because without it these groups would soon fragment.

The concern of citizen groups generally centers around one of two types of issues: image and space. This paper will deal only with the second type of issue--the utilization and competition for river recreational space.

Concern for space as a behavioral characteristic can be justified in a number of psychosocial ways; as a basic human drive concerning economics, self-identity, history, safety, health, or power. However, it will suffice here to describe this trait by reference to the territorial drive and sense of identity of the human being.

In the case of territoriality, the individual or group becomes familiar with, adopts, and utilizes space. If the individual's or group's use of the space is highly specialized, they feel threatened by any changes made to the area. If the individual's use of the area is not particularly specialized, or if it is not readily applicable to his type of specialty, he may seek ways to improve the area to make it more attractive to his use. This type of activity is called environmental modification and every animal does it to the degree which its ability and needs permit.

CONFLICTING PUBLIC DEMANDS

Obvious conflicts can occur between two groups when they utilize the same space or resource for different uses. This conflict is further compounded when the individual or agency legally controlling the area and the resources found within it is brought into the picture. He has responsibility for its long-range management and is faced with the decisions of what types of change or no change to allow to occur.

No matter what management decisions are made, they will have some impact upon people who pass through, visit, or pass in close proximity the managed area.

In the private sector of space management, the businessman needs only internal justification of his decisions and need not worry about external groups or organizations, unless his management areas are very large or his decisions carry a high degree of public risk (i.e., nuclear

power plants, toxic chemical plants, etc.).

However, when managing public space, our laws require that decisions be based on the good of the public and that citizens have a voice in the decisions. Unfortunately, the citizens' voice is never unified. There is no "public" speaking with a single voice who can give a general thumbs up or down to public management decisions. Instead, there are many citizen groups, each with its own ideas, fears, and desires concerning how and when changes should occur.

The conflict over river use is joined at two levels. The first is a general level dealing with allocation of the river and its watershed for general uses such as recreation, water supply, sewage dilution, timber production, streamside sites for homes, etc. It is determined at this level of conflict whether recreational, economic, or some other use prevails. The second level of conflict comes into play when the specific types of a general given use are worked out among citizen groups, private sector users, and managers; for example, the specific types of recreational use.

CITIZEN RIVER RECREATIONAL PLANNING GROUPS

Historically, in river recreational planning, three major types of citizen groups present themselves. They are the "nonspecialized users", the "specialized users", and the "preservers". Conflicts over appropriate river recreational use can occur as a result of these three different perspectives. For example, such specialized groups as canoeists might oppose major projects that would facilitate flatwater sports, fishing, motor boating and picnicking, yet support some small access-point improvements that would mean easier ingress or egress from the stream for them. At the same time, the preservers might be opposed to all of these improvements.

The conflict between different recreational user groups can be very disheartening and frustrating to the manager. He must make decisions that gain him friends and support from one group but cost him friends and support from another. However, there are attitudes, measures, and techniques the river planning manager can adopt to ease or eliminate the bad feelings associated with decision-making.

USES OF AN INFORMATION OFFICER

Probably the biggest asset to an agency in dealing with citizen groups is an information officer who truly believes in the involvement of citizens in the planning and management of their resources. If the official and his agency are not committed to citizen involvement, they may delay involving citizens in the planning process until the process has moved toward an image of the agency's wants. In addition, people can sense the insensitivity of officials not dedicated to the concept of citizen involvement.

EARLY CITIZEN INVOLVEMENT

Courage and self-confidence on the part of the planner and public officials are required if early involvement of citizen groups is to work. The concept of developing citizen input over an extended period basically goes against professional character, which dictates that the professional himself must produce something. Professionals feel that if they do not initially provide for a finished product, or at least know what they wish to accomplish, they are open to ridicule for not knowing their job. A professional must be courageous in the sense that a ship's captain must be courageous to set sail on an exploratory trip without any clear idea of where he is sailing.

When citizens are involved in a study that has no preconceived idea of what conclusions will result, the official runs the risk of losing control of the study and spending huge sums of money without accomplishing any clearcut objectives or of producing a totally unrealistic or unacceptable plan. However, if he can incorporate citizen input throughout a study and derive a workable plan, the rewards are great. If the citizen groups identify with the study, they can be a powerful force to aid in regulating, legislating, raising funds, and lobbying for long-term project maintenance. They can also help to combat any opposition that might arise late.

THE CHATTOOGA EXAMPLE

When it first became apparent that the Chattooga River would be considered as a National Wild and Scenic River, the USDA Forest Service began to involve the local residents, conservation groups, and other groups into the planning process. This early involvement forestalled a lot of antagonistic interactions, even though there are elements in the final plan that are not agreed upon by all.

One of the more interesting aspects of the Chattooga plan was the incorporation of commercial recreational users. This group was incorporated into the planning process and the design of the commercial contracts was based to a large extent on this and the conservation groups' input. The primary goal here was to keep commercial operation at a level that would not interfere with private recreational use. Commercial use of the river today is about 30 percent of the total use of the river corridor.

HUMAN FLEXIBILITY

Flexibility in human behavior is one of the major factors that can make good planning and plan implementation a reality instead of a pipe dream. A good example of a management program that resulted in extended multiple use and in cooperation between disparate user groups is the Hiawassee River in Eastern Tennessee. The Tennessee Valley Authority published water release schedules that told local fishermen what hours the stream flow would be low and suitable for wading. The schedules also tell canoeists and rafters the times that they can get the best rides so that they can plan their launch times.

CITIZENS AS A VALUABLE RESOURCE

Another important aspect of citizen input is their utilization as an important resource to assist professional staff in conducting research and physical surveys. By locating and utilizing active users, some of whom are experts in related recreational and nature study fields, public officials can incorporate useful data into the plan that will enhance use or avoid costly mistakes. For example, citizen involvement can aid in the proper location of recreational use areas. This can be exemplified by a discussion of the two choices a resource manager faces when he first decides to improve an area. There are two traps he can fall into in placing campsites or other recreational use facilities. One trap is to place the facilities where current use is not already occurring and the other is to place the facilities where current use is already occurring. This may seem mutually contradictory, but it can be explained by citing an example.

If, for instance, the recreational facility is not located in the areas where they logically fit with the use schedule, even though they might be attractive, they will probably not be used. We saw this on the Chattahoochee River in Atlanta. In this case, public launch points were provided but the users insisted on trespassing on private property to launch their rafts, canoes, and kayaks because the public use areas were: (1) not located in such a way as to enable them to take a good day trip; and (2) were not located over the segments of water the people desired to use.

The problem could have been avoided by citizen input.

If the facilities are located only where the use is presently occurring and other considerations such as soil type, geological suitability, vegetation cover, and citizen input are not considered, a badly damaged environment can result from overuse. A situation of this sort occurred with the placement of Chimneys Campground along the Little Pigeon River near Gatlinburg, Tennessee. Chimneys Campground began as a trail into the woods for backpackers. The trail was eventually upgraded into a dirt road and people began camping there out of the back of their cars. This soon developed into a looped gravel road and car camping became heavy. The road was next paved and gravel sites were put in for trailers and amenities provided. Finally, so much of the area was altered that during heavy rains flooding essentially destroyed the whole area to the degree that efforts have now been made to convert the site into day-use picnic area only.

In this case the site was simply not suitable for the high intense recreational

use which was encouraged to develop. Involvement of citizen groups in the decisions that led to this situation could well have avoided the impacts because many of the original user groups were opposed to any upgrading of the area as a result of their familiarity with it. This also illustrates that the desires and actions of the majority of the citizen users may not always be right and in a case like this, it is up to the professional to point out potential consequences.

SUMMARY

Although I have dwelled rather heavily on the need for citizen involvement at the beginning of a project, there is an equal need to continue that involvement into and beyond the completion of the project. It is important that at the beginning of a project, both potentially supportive groups and potential adversaries should be identified and their input solicited without a preconceived notion of who is right and who is wrong. Then by mutual dialogue and arbitration by the professional staff, it is possible to resolve conflicts and allow for flexibility in final implementation. If this is accomplished and if the citizen groups can claim some pride of ownership in the plan, they can be a strong force in securing funds and other backing. Citizen input and review in the detailed plan development can aid in avoiding placement of facilities in areas where they are not suited or will not be used. Finally, continued citizen feedback after full implementation has been accomplished is necessary to keep track of user behavior changes, environmental changes, misuse and abuse of facilities, or to identify mistakes made during the planning phase. Only by this continued monitoring and feedback mechanism can the planner and manager continue to provide the facilities that will result in a good, clean, safe recreational environment for the citizen.

COMMERCIAL RIVER OUTFITTING: ITS EDUCATIONAL ROLE AND RESPONSIBILITIES TO THE FUTURE

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ABSTRACT.--Two trends are postulated: (1) a decrease in the rate of demand for commercial outfitting services, and (2) increase in demand for "do-it-yourself" trips. The competition between commercial outfitters and private groups on restricted rivers is explored. Commercial outfitters can be justified for both their "educational" and "public access" services; the outfitter who so justifies his existence can enjoy a greater freedom from worry over future survival.

As managers and commercial outfitters we share a common mandate: to protect the resource and to provide the public with the best possible recreational and wilderness experiences that can be provided, now and in the future.

I have asked more than 20 of my colleagues over the phone and in questionnaires what their feelings are about the future of commercial river running activities. Some of the major trends they identified are in the following pages.

A DECREASE IN THE RATE OF DEMAND FOR OUTFITTER SERVICES

The demand for public outfitter services is decidely on the rise, but the rate of increasing demand for outfitter services will taper off in the next several years if it hasn't already. Several of my colleagues feel the rate in some areas has peaked and that demand is bound to level out. It is difficult to get a true measure of demand. My assumption of a decrease in the rate of demand is based on a closed market system, i.e., visitor use ceilings, but without any effective price regulations to date. This means that supply has been curtailed to protect the resource while prices in most areas have been allowed to increase to the point that the demand greatly in excess of supply has been stifled.

It is easy to suggest that if supply were not a problem or prices were controlled, the rate of increasing demand would again rise. There are demands for commercial outfitting, however, of two basic types: the guided tour kind where everything is done for the client including ice in his cocktails and staff to set up the tents and cots; and the kind in which individual participation (from helping in the kitchen to paddling one's own craft) is encouraged or even instructed. The first kind will fall off long before the do-it-yourself kind.

A CONTINUING INCREASE IN THE DEMAND FOR DO-IT-YOURSELF OUTINGS

It is safe to assume a continuing increase in the rate of demand for do-it-yourself outings as evidenced by several other papers presented at this symposium. The rapid increase in private permit applications in the Grand Canyon and other areas is further evidence of this trend. (I hesitate to cite the statistics since it is suspected that several individuals from the same proposed river party would apply in order to increase their chances of obtaining a permit.)

I intend to discuss private, do-it-yourself use, only as it competes with commercial outfitter services. In the light

of decreasing rate of demand for outfitter services but an increase in do-it-yourself outings, how do we determine priority among competing users? If priority use cannot be established, how will competing uses be apportioned?

A JUST ALLOCATION BETWEEN COMPETING USER INTERESTS

In the years ahead it is hard to imagine that most river recreation areas under discussion at this symposium won't be under some system of use restriction, with a certain portion alloted through commercial outfitters and another portion to "do-it-yourselfers". To date the ratio between these competing interests has been determined either by past use in a given year or is arbitrarily chosen. Examples are the Grand Canyon with a 92:8 (commercial to do-it-yourself) split, the Selway with a 20:80 split, and most Bureau of Land Management (BLM) administered lands in the west at 50:50. Clearly, conflicts between these two user groups will become more and more intense.

THE WILDERNESS PUBLIC RIGHTS FUND POSITION

The Wilderness Public Rights Fund (WPRF) is an organization that was formed in 1975 to advance the interests of the "do-it-yourself" user. "It is WPRF's contention that, when commercial and noncommercial user groups are required because of government edict to compete for the same public space, the qualified noncommercial category must be given priority" (Saltonstall 1976). WPRF bases their contention on their interpretation of the Concessioners Act (P.L. 89-249, 79 statute 969): "...no natural curiosities, wonders, or objects of interest shall be leased, rented, or granted to anyone on such terms as to interfere with free access to them by the public... (16 U.S.C. Sea. 3)" and "it is the policy of the congress that such development shall be limited to those that are necessary and appropriate for public use and enjoyment of the national park area in which they are located and that are consistent to the highest practical degree with the preservation and conservation of the areas" (Saltonstall 1976). WPRF does *not* necessarily assert that public noncommercial users have an unqualified "priority of right". However, they do feel that "concessioners profiting by use of public lands as their major capital resource are legally obligated to be the first to prove how, when, and where their services are unique or essential" (Saltonstall 1976).

THE WESTERN RIVER GUIDES ASSOCIATION POSITION

The opposing view is perhaps best represented by the position of the Western River Guides Association (WRGA) through its Private Permit Action Committee (PPAC) formed in 1974 for the purpose of drafting a position statement regarding commercial vs. noncommercial use. The seven-person committee was formed of three public outfitters, three private river runners (one of whom has guided actively for commercial outfitters) and one representative of the National Park Service. The committee's first recommendation (unanimously approved) follows (PPAC 1974):

"Qualified commercial and noncommercial river running are forms of legitimate public use of our national resources. Both serve the national interest; therefore, commercial and noncommercial use should co-exist on runnable rivers, neither to the exclusion of the other."

Roderick Nash, committee member, introduced a concept for consideration which has provoked much thought and discussion among outfitters and managing agents but which was not acted upon (PPAC 1974).

"The percentage of disappointment (or demand excess) should be the same on a given river in a given season for both commercial and noncommercial users. For example, if 3,000 qualified noncommercial persons applied for a permit but ceilings and allotments permitted only 1,000 to run, the percentage of disappointment is 2/3 or 67 percent. To justify such a denial there should be documented evidence that this same percentage of disappointment existed for commercial users."

And how do we go about measuring demand? The PPAC has suggested, "Paid deposits would suffice to document commercial demand; but commercial outfitters are unwilling to deliberately stimulate deposit payments greatly in excess of their allotment as they might be required to do in the

event of a high percentage of disappointment in the noncommercial sector" (PPAC 1974). "Outfitters can hardly be said to be competing for customers when most of their trips are filled six months or a year in advance [in the Grand Canyon]; there is no point in stimulating demand which already exceeds supply" (Litton 1976).

The noncommercial private river runners of course are quick to raise the question, "How much (of the commercial demand) is in part artificially created by widespread colorful advertising?" (Saltonstall 1976). Even though three of the largest commercial outfitters in the Grand Canyon have personally indicated to me that their advertising budget is less than 2 percent of their gross receipts (exceptionally low in comparison to most private industry) the private runners have a point: it would be almost impossible to quantify to what extent "artificial" demand plays a part in the total demand picture.

By the same token it would be almost impossible to quantify to what extent the demand factor for private permit applicants is artificially inflated through multiple applications from several individuals all intending to run under the same permit--whichever permit happens to come through. I personally know of 3 different private groups applying for Grand Canyon permits in 1976 which abused the system in the manner suggested. One individual told me everyone in his group of 10 applied for a permit; 9 were denied and 1 was granted. The system invites abuse; no one denies that.

One other interesting consideration that further muddies the issue is that many private runners were first introduced to the sport through participating in a commercial outing or through attending a "white-water school," many of which are sponsored by commercial river companies.

ACCOUNTABILITY AND PROTECTING THE RESOURCE

Who protects the resource more, the private user or the public outfitter? It is a tough question and there is no documentation that I know of which even suggests one category of user harms the resource more than the other. So we are down to who may be more easily held accountable for the resource.

Here are two opinions: (1) "I believe the commercial outfitters are more careful about using the river resource. There is an accountability factor that is present with the commercial rafters that is missing with private boaters. I am afraid that if we turn over our rivers to the private users, then we will lose them through abuse" (Huser as quoted by Evans 1976).

(2) "Public outfitters whose success in business depends, among other things, on maintaining tidy campsites, are at the same time under constant scrutiny by the controlling agency as well as by their clientele. It is easy for the [regulatory agency] to determine how an outfitter is treating [the resource], difficult to learn how private users are treating it, and next to impossible to penalize private users, after the fact, if indeed blame for misuse can be established" (Litton 1976).

I would like to add my own opinion--with a slightly different slant--in support of these two. I wouldn't consider most outfitters worrying about being under the scrutiny of their clientele so much as concerned about their responsibility and the unusual opportunity to educate their clientele to be more concerned about protecting the resource. Personally, I have found on numerous outings in the Grand Canyon and elsewhere that the trip participants seem unusually receptive to the example we set. They respect our point of view; they are generally impressed with how tidy a place the Grand Canyon is. They are a captive audience, and they go home with a little firmer resolve to emulate our care for the environment.

One of my colleagues carried it a step further. "We are a buffer between the public and the land. More and more I think an outfitter's justification is in generating and sustaining public sympathy against consumptive, destructive, energy intensive uses of the outdoor environment."

I am not suggesting, however, that the issues raised by the accountability problem should necessarily contribute to increasing or decreasing any one type of user's share of the river wilderness. Ultimately, accountability and protection of the resource is an adminstrative problem solved through greater education (by the agencies and the outfitters) and enforcement. Huser has suggested, as an example of one solution,

that "anyone who goes into the wilderness should have a wilderness use license. It would be much like a driver's license. This would not stop abuse, but it would present an accountability factor" (Evans 1976).

PRIORITY FOR MODES OF TRAVEL--NOT ACCORDING TO MEANS OF OUTFITTING

I believe priority should be based on mode of travel, not on whether the party is a commercially outfitted or a privately outfitted group. There are places where motorized travel should and should not be allowed. Motorized travel should be prohibited at the point at which there is damage to the resource or undue compromise to the wilderness values of a significant portion of users within an area of otherwise distinct wilderness character. At some point this calls for value judgments, courage to make those judgments, and (inconveniently at times) the law to back them up. I do not believe priority for using an area should be based on whether a user is commercial or private. If private use were favored over commercial use, there is the potential for completely excluding from the resource that portion of the public which lacks the capability for "doing-it-themselves". Those excluded might not have known someone with the requisite experience, or might not have had the time nor money to develop the necessary experience and amass the necessary equipment.

Let me explain further, again using the example of the Grand Canyon. Commercial and private users jointly expend about 89,000 passenger-days (p/d's) in a ratio of 92/8 percent respectively. Assuming a continuing increase in demand by both types of users, it is theoretically possible (some years hence) for private use to equal 89,000 p/d's even though in that same year it is theoretically possible (with the relaxation of all but cost constraints) for commercial demand to equal 300,000 p/d's representing a valid use of the resource which would be wholly frustrated. This situation would be totally unacceptable to me, not just because I am a commercial outfitter but because of all the excited, happy people I have seen come off of river trips who have said, "I came expecting a good time, but have come away with so much more than I ever thought possible." Their outlook has been expanded in a very subjective way that has a special meaning for them. Something has opened them up--the guides, the resource, or whatever--and made them receptive to the full breadth and depth a river experience has to offer.

That leaves us at a standoff, but with the need to do a lot more research on the private vs. commercial issue. For one thing, we need sound data on demand and use ratios (PPAC 1974). How do we get this information? Some ways might be through measuring Nash's "disappointment factor", or perhaps through periodic public opinion sampling of potential users, or through issuing all interested users a one-time use license (much like a hunting license) that could either be used privately, or through the services of a commercial outfitter. All options have been suggested and discussed, and are fraught with bureaucratic headaches, if not nightmares.

A second area of needed research is that raised by Lime (1975a): "How do current and potential users define a high quality river recreation experience?" How do users relate to the values of "doing-it-on-your-own" where there is an undeniable spirit of adventure or pioneering aspect to the river outing? There is a certain immediacy and challenge to the "do-it-yourself" outing that results in personal satisfaction. On the other hand, how do users relate to the values that can be gained through participating in a commercial outing--one that gives the user a full range of experiences, from learning to row, paddle, read river currents, to identifying flora and fauna?

JUSTIFICATIONS FOR AND RESPONSIBILITIES OF COMMERCIAL OUTFITTING

The Wilderness Public Rights Fund says it is not their objective to eliminate commercial outfitters "...and thus abridge the rights of that portion of the public that has neither the time, inclination, or capability to organize and participate in a noncommercial wilderness trip". Nevertheless, if they win in court, I believe their position could dictate the eventual phasing out of all commercial enterprise in the wilderness (or at least, within National Parks). I, for one, accept the WPRF challenge of commercial outfitters having to be the first ones to justify their own existence.

Every outfitter I've spoken with or received a questionnaire from in recent weeks believes that commercial river outfitting is justified at least because it provides access for those people who either cannot do it themselves or who choose not to make the necessary investment in time and money to develop the proficiency and accumulate the equipment necessary to do it themselves. (This choice that the user makes suggests an axiom: the more technically difficult and logistically involving a given river outing is, the greater is the justification for commercial outfitters.) To provide access, then, is a primary justification.

One way to answer the question, "how essential are these outfitter services?" is by suggesting that the current level of commercial river outfitting would not be what it is had the public not demanded it so, indicating that some essential need for outfitter services had been filled in the market place. So, providing access in response to public demand has given rise to a certain past business level measureable (at a bare minimum) in terms of the commercial allotments established on many restricted back country rivers today. But the question remains, within a closed market system facing competing user interests and fluctuating demand, can simply responding to public demand justify commercial outfitting in the future?

Some commercial outfitters--the ones who fail to see that a totally free enterprise system is not workable in an area of such limited supply--would assert that meeting demand *is* adequate justification. Alas, they are shortsighted and assure their own ultimate demise by failing to define their future responsibilities and opportunities.

I believe that commercial outfitters are justified for another reason besides simply meeting demand for access to a certain type of recreation. Commercial outfitters can provide a range of experiences that satisfy an inner need people have to grow, to gain something from their experiences. This "gain" is very elusive and ultimately subjective. It can not be made to happen; an outfitter can only set up circumstances which foster it. This gain becomes evident in many ways: a different perspective gained from solitude or a change in activity, respite from the increasing complexities of technological society, a gain in appreciation for a body of interpretive knowledge, a gain in closeness with family and friends; a gain in appreciation of the need to conserve more wilderness. We can call these gains "educational experience"; on many commercial river outings this experience is there for the passenger to the degree he or she wants and elicits it.

QUESTIONS RAISED BY THE EDUCATIONAL JUSTIFICATION

Justifying commercial outfitting services on the basis of their providing an educational experience raises some interesting questions. (1) Could permits to use rivers be alloted on the basis of the "educational" nature of the trip? Such a concept was tried by the Bureau of Land Management on the Green River in Utah a few years ago, but was dropped after a season. Most outfitters I have spoken with feel that an educational field trip on a river is inherently more commercial than private. Adopting an educational allotment would tend to take the educational justification away from the commercial operation, when just the reverse should be encouraged. In my own experience, most biology and geology field trips on rivers are no more educational than the better run commercial outings. Commercial guides are commonly as well informed about the river resource as the instructors sent by the educational institution sponsoring the field trip. (And commonly just as much beer is consumed on an educational outing as on a commercial trip.) College credit does not insure a greater educational content.

(2) Is the quality of the educational experience derived from a commercial trip different from that derived from a private trip? A private trip is just that, a private trip. As long as the resource and participants are protected from harm, it should just be allowed to "happen". The basic educational experience on a private outing will be found in just "pulling it off" and will be subjectively different for each group and each participant. On the other hand, the regulatory agency can encourage, expect, and evaluate the educational experience encountered on a commercial river outing. The commercial participant doesn't have to worry about "pulling the trip off". Once the boat departs each

participant may become receptive and involve himself as much in the experience as he is ready to become involved. Some passengers want to know very little; others can't be told enough. And who's to judge that either approach is right or wrong? Myriad facts about the resource are of little value unless the guide encourages the passenger (through itinerary, words, and example) to try to appreciate the overall picture--and to question man's relation to the environment.

(3) And how does the regulatory agency insure that the educational experience is there for the commercial passenger who wants it? That's a tough question that I can't answer except to say it's going to have to happen at some point. The answer will have to begin with defining an educational criterion relevant to each operating area. Then it will take more money than at present to evaluate compliance with educational standards. And lastly, it will take more "clout" than most agencies have at present (and no small measure of courage) to enforce compliance.

CONCLUSION

All these suggestions imply more regulations and raises the spectre of "Big Brother". How do we face up to the necessity of enough regulations to prevent chaos while at the same time preserving the freedoms and the very spontaneous quality that a wilderness river experience should have? Byron Shelby[1] of Human Ecological Research Services provides the best answer to this question that I've seen. "While some rules simply require better preparation or advocate one camp practice over another, others may become oppressive in imposing schedules or routes [or a specified educational format]. In the case of commercial river trips, such things affect passengers only to the extent that the boatmen make them apparent." The guide, then, may have to sacrifice the spontaneity of his own personal river experience for his passengers.

My contacts with commercial outfitters indicate that they fall into two groups, the pessimists and the optimists. The pessimists feel that there are already far too many regulations; realistic business projections are impossible to make and profits are bound to dwindle. The optimists, including myself, recognize that regulations are necessary and are not too worried about commercial outfitting being able to justify itself; plainly and simply, we just have too much to offer the public in the way of access and education.

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[1] *Shelby, Byron. MOTORS AND OARS IN THE GRAND CANYON; RIVER CONTACT STUDY FINAL REPORT, Pt.2. 41 p. Unpublished report submitted to National Park Service, Grand Canyon. June 1976.*

CONTRIBUTED PAPERS

SOME ECOLOGICAL CONSIDERATIONS ASSOCIATED WITH RIVER RECREATION MANAGEMENT

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(Grand Canyon National Park
Colorado River Series, Contribution No. 16)

ABSTRACT.--Drawing from an ecological study on the Colorado River, four river recreation management concerns are discussed: (1) river research vs. river management--their interrelationships and priorities; (2) extensive resource inventories--their role as indicators of environmental deterioration; (3) human impact--its identification and proposed mitigation; and (4) suggested guidelines for identifying unique and ecologically sensitive areas. Other environmental degradents not directly associated with human impact, but nevertheless a source of concern for river managers, such as habitat destruction by wild asses are also discussed.

River management is a new and challenging discipline. Within the last few years use of our wilderness rivers has increased explosively, creating a myriad of problems for the various State and Federal agencies entrusted with the care of these resources (Huser 1975). Many managers lack basic information about their particular river: for instance, what kinds of plants and animals occur in the river and on its beaches; what effect do river users have on wildlife; how many people can the beaches support without causing irreversible damage; how many campsites are there; and so on. Realistic management plans cannot be developed without this information. I would like to consider the development of such information as it applies to the Colorado River through Grand Canyon National Park, perhaps the ultimate in white-water travel.

Between 1967 and 1972, river running in the Grand Canyon grew from 2,099 users to 16,432, an increase of 682 percent. This alarming user-growth rate forced the National Park Service to limit the number of boaters. The commercial allotment for 1972 was set at 105,000 passenger days (pds). Of these, only 88,135 were used so for 1973 the allotment was lowered to 89,000 pds. In 1973, 86,264 pds were used, therefore the 89,000 figure has been maintained to date.

The National Park Service quickly realized that this tremendous increase in the number of river runners was damaging portions of the rivering environment. Another consideration was that the quality of the river experience was in jeopardy as a direct result of increasing numbers of users. Additionally, private users complained that permit allocations were prejudicial in favor of the commercial outfitters. These and other problems added to the complexity of determining an equitable management solution.

RESEARCH PROGRAM

In 1973 the National Park Service initiated a multidisciplinary research program designed to examine the physical, sociological, and ecological factors affecting the carrying capacity of the river environment (Aitchison 1976). From 1973 to 1976 investigators from more than a dozen research institutions par-

ticipated in this project (Johnson and Martin 1976).

The road from recognition of a problem through research to development of management alternatives and then, finally to actual implementation of a management policy is long and difficult. River recreation on the Colorado River within the Grand Canyon has proven to be no exception.

User Impact

Information concerning the spatial use patterns of the river runners was sought. Through a "visitor usage card" given to each trip leader, data on campsites used, number of people in party, whether or not a wood fire was built, whether or not the contents of the portable toilet were buried, etc., were obtained. Surprisingly, the results showed that more than 300 campsites were used along the 280 river miles between Lee's Ferry and Pierce Ferry. The next obvious step was to identify and categorize the types of human impact. Impacts or problems discovered included fire, littering, trampling of vegetation, and human waste disposal.

Fire is integral to any natural terrestrial ecosystem. However, man-caused fires are generally detrimental. In riparian systems impact may range from small sand-scarred fire-rings to entire stands of beach vegetation being consumed in a holocaust. In Grand Canyon, fires have been caused by careless burning of toilet paper. Short-term biological effects may include elimination of actual or potential wildlife nesting sites, foraging sites, and displaying sites. Large burns may kill or force movement of certain animals and may encourage the introduction of non-native pioneer species.

Littering, and this includes the practice of dumping juices out of canned food and leftover organic waste at campsites, may increase populations of certain noxious insects or vertebrates. In the Grand Canyon, heavily used campsites seem to have correspondingly higher densities of harvester ants (*Pogonomyrex californicus)*, commonly known as red ants. Because of its painful, toxic sting, this species presents a minor health hazard to the camper. The flesh fly *(Sarcophagidae)* and blow fly *(Calliphoridae)* populations also show this increase at "messy" campsites. These insects could become a source of fly-vectored diseases.

The increases in insect populations have also caused an increase in certain vertebrates. Lizards congregate near dirty campgrounds. Two exotic bird species, house sparrow *(Passer domesticus)* and starling *(Sturnus vulgaris)*, have been introduced in remote areas, specifically the Deer Creek and Granite Park areas, primarily through the improper disposal of garbage. Four species of mammals (skunks, *Spilogale gracilis;* ringtails, *Bassariscus astutus;* rock squirrels, *Citellus variegatus;* and mule deer, *Odocoileus hemionus)* have increased in high-use areas, probably as a result of an increased food supply. Unfortunately these unnaturally high densities have caused these mammals to be in poor health, creating a potential human health hazard.

An outstanding direct impact caused by the river user has been vegetation trampling. In many areas multiple trails, all with the same ending and beginning place, are maintained simply through large numbers of people trampling the vegetation. This condition invites accelerated soil erosion and dramatically changes the flora of these areas. On the other hand, some beach areas would probably become uncampable if the vegetation (such as the exotic salt cedar, *Tamarix chinensis)* were not held in check through this trampling.

Human waste disposal is a concern everywhere but even more so when the number of campers is high, the areas for burial of sewage are limited, and decomposer bacteria are scant. This is the situation in the Grand Canyon. Even after a year fecal coliform bacteria were still viable in the beach sands (Knudsen *et al.* In press). Because of this and limited burial areas, it is not uncommon to unearth a previous human waste dump when digging a hole to empty your portable toilet. A potential health hazard exists with a solution still in the future.

Of great interest are our rather surprising results concerning the amount of impact versus the number of users. No significant correlation was found between the number of campers and the total amount of impact. It appears that small to large

groups are capable of producing about the same amounts of impact. Perhaps Grand Canyon beaches have a very low threshold of tolerance for users. Or more probably the camping practices play a more important part in determining impact than total numbers of campers. For managers this implies that setting carrying capacity limits based simply on total users may not alleviate environment degradation; modifying visitor behavior may be the solution (Lime and Stankey 1971).

Along with delineation and quantification of the various types of human impact there is also a need to identify biologically unique or ecologically sensitive areas. The guidelines for doing this would vary somewhat for each specific river. For example, along a silt-choked desert river, clear side tributaries become an important habitat to much of the native wildlife; whereas, on a mountain river, a quiet pool may be biologically important for breeding fish. The point is, the expertise of the ecologist is needed to decide what areas in or adjacent to the river must receive top priority in terms of protecting the biotic resource.

The biologist working in Grand Canyon is greatly handicapped by a lack of previous research. Even though John Wesley Powell did his pioneering geologic investigations more than 100 years ago, the first extensive, systematic biological work did not begin until 1970, seven years after construction of Glen Canyon Dam (Wertheimer and Overturf 1975). Without extensive resource inventories there is no way to discern whether or not changes are taking place. Biological inventories of plants and animals, their types and numbers, their location and habits, and other pertinent information all aid in establishing a bank of data to be drawn upon by the field ecologist.

Impact of Glen Canyon Dam

Probably far exceeding any damage the river runner could inflict upon the Canyon have been the effects of Glen Canyon Dam. In 1963, the gates of Glen Canyon Dam were closed and the river ecosystem was altered by the hand of man as never before. Instead of a river of mud and silt, "too thick to drink and too thin to plow", a clear, cold green flow was released from the dam. Indigenous fish species were reduced in numbers because of cooler water (Suttkus 1976). Annual scouring and replacement of beaches by high volume flooding has been eliminated. An entirely new, primarily exotic riparian community has developed.

For Colorado River rafters, the hydroelectric dam presents mixed blessings. On the one hand, daily river level fluctuations now occur in response to power demands in distant cities. Sometimes these fluctuations make certain rapids unnavigable. Commonly a boat moored at "high water" is left high and dry by next morning's "low water". On the other hand, controlled release of water makes trips possible during dry years when natural runoff would have been insufficient to float a boat. Also, the relatively clean, clear water is welcomed for drinking and bathing.

The river manager is essentially dealing with a man-made ecosystem, a somewhat ironic situation when one remembers that the National Park Service is charged with the protection of our natural and supposedly native habitats. How does the manager confront this dilemma? He or she has two alternatives: (1) lobby for the removal of Glen Canyon Dam, that would return the Colorado River ecosystem to its native state, or (2) manage the existing river environment as if it were the native condition. At the present time, alternative 1 is not practical (however, future environmental conditions and political considerations may change this). Therefore, at this time, alternative 2 is the only choice the manager has. He or she must consider the management of the changing Colorado River ecosystem with the conservation ethic of the National Park Service as the prime guideline.

Animal Impacts

In the Grand Canyon, the presence of Glen Canyon Dam and the numbers and activities of river recreation enthusiasts are not the only problems facing the manager. Recent investigations (Carothers *et al.* In press) have demonstrated that the feral ass (*Equus asinus*), descended from released or escaped domesticated stock of early explorers and prospectors, is causing serious damage to the river

resources and to some extent interfering with the quality of the river recreation experience. For the most part, the impact of the feral ass is concentrated in the western portion of the Grand Canyon and the damage is mediated in the form of overgrazing, trampling, soil compaction and the fouling of campable beaches. Many areas within the National Park are suffering irreversible damage. The management implication here is clear: these animals must be removed from the Park.

RESEARCH IMPLEMENTATION

Once research has been completed, management alternatives can be proposed. Sometimes these recommendations conflict with current management policy; sometimes they require the manager to reexamine his goals.

River research can *only* answer *how* impacts are being made and then suggest appropriate mitigation. River managers, on the other hand, in addition to considering ecological factors, must also consider certain political and economic constraints before deciding what becomes an "acceptable" level of impact. This, of course, is a complex problem and not necessarily based on resource impact. Priorities must be examined. What becomes acceptable impact in the middle of a crowded campground may be totally unacceptable in a primitive setting. Perhaps a partial solution lies in defining the resource (Leonard 1976). For example, if an area is defined as Wilderness and to be managed as such, then legal constraints serve as guidelines for the manager.

Unfortunately, implementation of the management policy may be the weakest link in the chain, especially if the new policy differs greatly from previously enforced regulations. The river user stubbornly refuses to accept new regulations, preferring to stick to "old and accepted ways". Some openly defy managers; others are simply ignorant of the new rules. Education of the river runner may be one solution, because regulations are usually easier to accept when the rationale behind them is understood.

Specific management objectives, purposes, and regulations must be devised for each river system. A generalized plan does not work because each river is unique. What may be applicable to a slow-moving desert river may not be appropriate or practical on a rampant mountain torrent.

SUMMARY

We have seen then, that the ecologist's role in river management is an important one. He or she must inventory this biotic resource, identify the types of river running and related impacts on the biota, and recommend appropriate alternatives to the river manager. Additionally, the ecologist can suggest guidelines for identifying unique and sensitive areas to help in preserving the naturalness and wilderness aspect of our National Parks.

Then the manager must establish and implement policies. Time is short; these management decisions must be made now, tempered with continuing ecological research. If management procrastination persists and bureaucracy red tape prevails, we may lose our wilderness rivers.

COLORADO RIVER CAMPSITE INVENTORY

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(Grand Canyon National Park
Colorado River Research Series, Contribution No. 19)

ABSTRACT.--Shoreline beaches along the Colorado River in the Grand Canyon are regularly used by river-running parties as overnight campsites. The availability of campsites in river sections where they are scarce, small, or both, limits the number and size of river-running parties that can be permitted without risking unacceptable environmental degradation. Because this upper limit depends on the number, size, and distribution along the river of campsites, a comprehensive inventory of usable campsites was needed. We made such an inventory of campsite locations and capacities and found 345 campsites usable for overnight camping by river-running parties.

With the influx of river-running recreationists into undeveloped sections of rivers, the wilderness aspects of these environments may be endangered by overuse. The greatest impact of river-running is in the use of shoreline beaches for overnight camping. Beaches on many sections of western rivers are not continuous, as on a seashore, but are discrete entities and limited in number. Visitor carrying capacity of a river section for river-running is a function of the number of beaches for campsite use, their locations, and their individual capacities. Therefore, the first phase of a project to assess the overall carrying capacity of the Grand Canyon river-running system was the campsite inventory described here.

The carrying capacity of any single beach is a function of the physical characteristics of the beach, the number of campers, group size, and the frequency and manner of use. By definition, the carrying capacity is the maximum number of camper days per year, or season, for which a beach can be used and not suffer unacceptable degradation under the management and maintenance procedures that are employed. The carrying capacity of a beach may be changed by changing the management or maintenance practices or by other factors, such as erosion, encroachment by vegetation, or irreversible degradation by overuse.

Campsite capacity, in contrast to carrying capacity, is the number of campers that can occupy a campsite overnight. The campsite capacity for undeveloped sites, although not an absolute number, limits the mean daily carrying capacity and, therefore, is one of the factors determining the carrying capacity of the system.

River-running on the Colorado River in the Grand Canyon region is managed by the Grand Canyon National Park mainly on a concessionaire basis. Use of the River has reached a plateau of about 120,000 passenger-days per year with the limit on passenger-days per concessionaire set by the National Park Service. Nonconcessionaire trips are accommodated but are a minor portion of total use. The river-running parties use the beaches along the river for overnight camping. There has been no campsite development, so all support for camping must be carried by each party. Selection of campsites has been primarily left to the discretion of the trip boatmen. Prior to

this inventory, neither the number of campsites and potential campsites nor their capacities were known; estimates of the number of sites ranged from less than 100 to more than 200.

OBJECTIVES

The primary objective of the project was to determine the carrying capacity for river-running parties on 240 miles of the Colorado River from Lees Ferry, Arizona, to Separation Canyon, by locating campsites and estimating their capacities.

A secondary objective was to collect data on factors that affect the carrying capacity of the river system for river-running parties: (1) the suitability of campsites for camping and related activities, such as bathing, campfires, sanitation disposal, and boat mooring; (2) the status of vegetation on campsites, particularly its potential for encroachment into the campsite; (3) the present and potential influence of wind and water erosion on beaches; and (4) the effects of camping activities on the campsites.

A tertiary objective was to construct a baseline data bank, including aerial photography augmented by ground truth data.

METHODS

Preinventory Preparation

Photointerpretation was begun using U-2 high-altitude photography, furnished by the National Park Service, to gain an initial assessment of the magnitude of the low-level photography photointerpretation task. Low-altitude aerial photography of the river, the shorelines, and beaches was obtained by the Remote Sensing Branch of the USGS (United States Geological Survey) at Prescott, Arizona.

For each mile, beginning at Lees Ferry, a mile mark was made on the appropriate photograph, and the photograph was labeled for easy reference in the field. All potential campsites that could be identified by photointerpretation were annotated on the photographs.

Inventory Field Procedures

General Procedures

Three types of field evaluation were made for each visited site: campsite characteristics; vegetation ecology; and shoreline, beach, and water characteristics. Campsite evaluation included camper capacity estimation, type and stability of the footing, status of the firewood supply, shelter, use, open fire sites, and hazards. Evaluation of the vegetation was limited to that growing in and near the site and emphasized the identification of species, vegetation communities, and the assessment of selected species that can invade campsites. The shoreline and water were evaluated for landing and mooring of river craft and bathing. The beaches were evaluated for slope, erosion, and nature and bearing of the beach material. In addition to the evaluation, notation was made of specific features concerning the campsite. One to four panoramic ground photographs were taken of each campsite.

Progress was tracked continuously using the aerial photographs to make sure sites were not missed. During transit or after a cursory visit, a determination was made whether the site should be evaluated or eliminated from the inventory because of inaccessibility or inadequate camping area. In addition, for those sites to be evaluated by photointerpretation instead of by a visit, landing and mooring characteristics were annotated on the aerial photographs during transit.

Sampling of Beaches

The pretrip photointerpretation yielded more than 400 identifiable potential camping beaches. Because it was not possible to visit all of them, it was decided that beaches in the section from mile 8 to a point to be determined in transit would be visited. The point where this complete sampling would end would be determined by the ability to gain the desired data by *a posteriori* photointerpretation, the rate of progress of the fieldwork, the concentration of beaches, and the degree of proficiency the research team gained in transit.

Complete sampling was done through mile 40. Beaches in the section from mile 40 through 73 were relegated to *a posteriori*

photointerpretation primarily because they were numerous, large, and well exposed on the aerial photographs. About four beaches were visited for a sample in this section.

All potentially acceptable beaches were visited from mile 74 to mile 166. In this section beaches are scarce and small. Thus, they are likely to seriously restrict river-running carrying capacity if you consider only the number of campsites as a factor.

In the section from mile 167 through mile 240, numerous large beaches exist. About 15 beaches were visited in this section and the remainder were analyzed by photointerpretation.

Postinventory Analysis

Reconciliation of Data

All data were cross-checked and compared with the displayed ground photographs, aerial photographs, maps, and other related literature such as river runners' guides. By doing this for each campsite, it was possible to resolve most anomalies, fill in occasional missing data, appropriately name campsites, and record the verified data on a single data form. Subsequently, these encoded data were entered into a computer-accessible disk file and a computer program was prepared to print out the description of each campsite.

RESEARCH PRODUCTS

Four major types of data resulted from the inventory: (1) computer-printed written descriptions in tabular form of each campsite (fig. 1), (2) ground photography, (3) annotated aerial photography, and (4) strip maps.

The Campsite Inventory

The inventory does not include the beaches that were determined to be unsuitable for camping by river-running parties. In order to qualify as a campsite, the camper capacity above the 24,000 ft^3/s water level countour had to be 8 or more. That water level was considered to be the minimum safe high-water mark and it was reasonably well-defined by shoreline vegetation and erosion scars. The landing and mooring location had to be within 50 yards of the camping area,

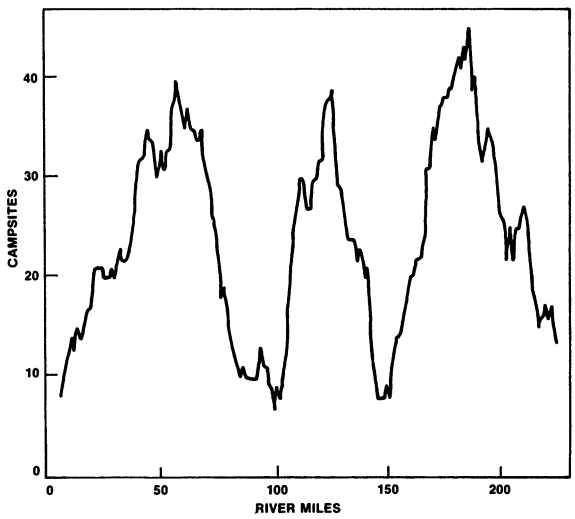


Figure 1.--*Campsites with a capacity of 20 or more in 20-mile sections of the Grand Canyon River.*

and landing and mooring had to be possible for all types of river-running craft presently in use. Sites that had been overgrown by vegetation or for which the campable area was blocked by a broad, dense band of shoreline vegetation were excluded. Sites that occurred in wash channels from tributary canyons were also excluded.

Campsite Characteristics

Location and name.--Each campsite location is given in miles and tenths from Lees Ferry according to the 1923 USGS. The tenth of a mile means the campsite occurs within that tenth. The L or R symbol indicates the shoreline, left or right, respectively, on which the campsite is located looking downriver.

Campsites that were visited in the survey were named predominantly for significant local features. If no such feature existed, it was named by the mile number rounded off to the nearest half mile.

Type.--Three types of campsites are defined: sand, ledge, and sand-ledge.

Capacity.--The campsite capacity is given as the approximate maximum number of people the campsite can accommodate for an overnight stay. The numbers are reported as 8, 10, 12, 15, 20, 25, 30, 35, and 40, where 40 means 40 or more.

Method of evaluation.--Evaluation was made by either a visit or by interpreting the aerial photographs. Only the capacity could be estimated by photointerpretation and is not as reliable as that obtained by a visit.

Use.--Evaluation of the degree of use was based primarily on evidence of long-term human impacts such as the condition and number of fire sites and the magnitude of vegetation disturbance. The following categories were used: no apparent use of the site for camping, light use, moderate use, and heavy use.

Stability.--Erosion by foot traffic and subsequent wind erosion of such disturbed material occurs in campsites that are located on unstable sand deposits. Such erosion may not degrade the area as a campsite, but it will change its character and cause it to lose its natural appearance and characteristics.

Campsite stability was rated by the following: (1) stable campsite with a flat or gently sloping surface and with a firm bearing, (2) moderately stable campsite with moderate slopes within the general use area and based on loose sand, and (3) unstable campsite with steep slopes within the general use area and based on very loose sand.

Fire sites.--The evaluation of fire sites employed the following categories: no fire sites evident; a single, neat fire site evident; more than one neat fire site evident; and one or more dirty, messy fire sites spread over a wide area.

Firewood.--The evaluation of firewood employed the following classes: none present, a little present, some present, and plentiful.

Shelter.--Shelter was classified as follows: None, some campers could shelter, most campers could shelter, all campers could shelter, and most campers could sleep under shelter.

Hazards.--All of the campsites have hazards that are typical of the wilderness environment of the Colorado River. For those campsites in which unusual hazards were present, but not so dangerous as to disqualify the site for camping, the hazards were identified.

Shoreline, Beach, and Water Characteristics

Landing and mooring.--Landing and mooring evaluations, which apply to rowing as well as motorized craft, were classified as follows: (1) good approach with no off-shore rocks or shallows exposed at low water; (2) adequate approach but requires careful planning and maneuvering for rowing craft due to currents, or mooring requires care because of sharp rocks, off-shore rocks, or shallows; and (3) poor landing approach for any craft, or dangers exist for people or crafts while moored, such as swift shoreline currents or many sharp rocks on and near shore. Potential campsites were disqualified if the landing approach was exceptionally difficult.

Water stage.--Water stage pertains to the hours from 9 p.m. to 6 a.m., the time during which a boatman must tend the moored craft to avoid grounding, etc. Water stage was classified as follows: increasing flow at night, decreasing flow at night, increasing flow to high flow followed by decreasing flow during the night, decreasing flow to low flow followed by increasing flow during the night, and variable flow pattern depending on day of the week and released volume.

Bathing.--Bathing classifications were as follows: safe for bathing with a firm, gently sloping beach, shallow water, and weak currents; adequate for bathing with a steep or soft beach face, rapid off-shore drop, or rocky beach but with only weak currents; and dangerous for bathing due to rapid off-shore drop and swift shoreline currents.

Beach.--Beach characteristics apply to the area between the campsite and low water level. Although beaches are commonly considered to be sandy deposits forming shorelines, rocky shorelines have also been included. These characteristics were composed of three parts as follows: (1) material--coarse to medium sand; fine sands or silts; and rocks composed of exposed bedrock, angular bedrock debris, or rounded river cobbles or boulders; (2) slope--gentle (less than 10°), moderate (10° to 20°), and steep (greater than 20°); and (3) bearing--firm footing and soft footing (feet sink more than 3 inches into deposit).

Erosion.--Erosional conditions were classified as rapid, indeterminate, or none.

Vegetation Characteristics

A number of species are serious invading plants because they encroach into campable areas or beaches and exclude the beach for camping. These were the only ones inventoried and are given with their inventory names: tamarisk *(Tamarix pentandra)*, arrowweed *(Pluchea sericea)*, camelthorn *(Alhagi camelorum)*, coyote willow *(Salix exigua)*, Russian thistle *(Salsola Kali* var. tenufolia), and foxtail brome *(Bromus rubens)*.

Invading species present.--For each of the species tabulated above that was present in or near the campsite, the corresponding name is given.

Predominant invading species.--If one or more species predominate in ground coverage over all others present, the corresponding names are given.

Invasion assessment.--The invasion assessment categories were defined as follows: the beach has been completely invaded by the species in otherwise campable areas or access to campable areas has been blocked entirely by encroaching vegetation; the species are well established on the beach and are vigorous with regeneration strongly evident, but campable areas have not yet been invaded to exclude camping, although encroachment into camping areas appears imminent; the species are well established on the beach, but exclusion of camping because of vegetation encroachment has not occurred, and the potential for this occurrence cannot be determined; the species are well established on the beach in or around the camping area and camping activity appears to control further encroachment; the species are present on the beach but are not well established and the potential for encroachment into camping areas cannot be determined; and invading species are not present or, if present, are not encroaching into campable areas and do not present any evidence for potential encroachment.

Comments

Local features of interest and river-running considerations, such as the proximity of major rapids and accessibility by hikers, are given.

Cross-Reference Data

Ground photography.--One to four ground photographs were taken of each campsite visited. A caption was made stating pertinent information.

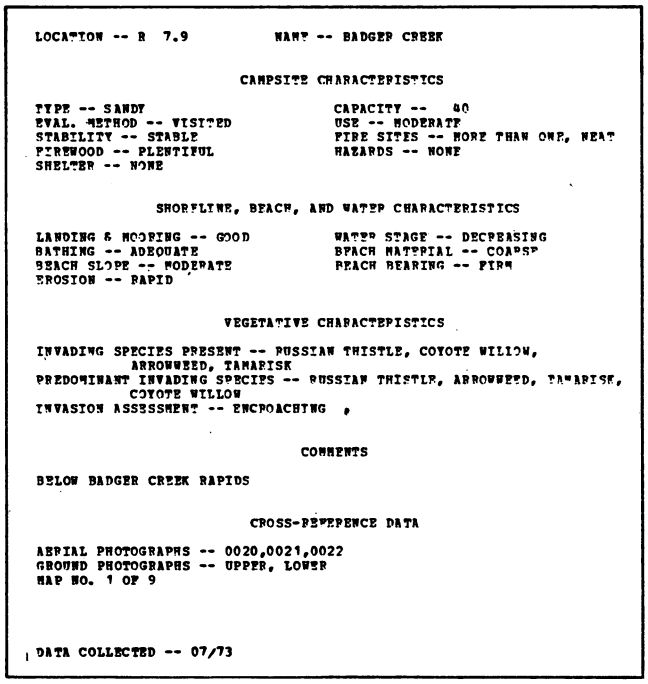
Aerial photography and maps.--Aerial photographs taken just prior to the campsite survey have been annotated showing the location of inventoried campsites by the location conventions used in this inventory. The reference numbers of the aerial photographs on which the campsite is shown are given for each campsite. Strip maps of the river have been annotated showing the mile point down the river from Lees Ferry. The center point for every fifth aerial photograph has been annotated on the strip maps for cross-referencing aerial photographs to river locations and campsite inventory data.

Collection Date

The month and year of data collection are given for each campsite. For expediency, the inventory has already been updated by additional information gathered in conjunction with a followup investigation. In continued updating, the collection date that refers to the last update for a campsite becomes important.

RESULTS

The inventory was conducted to determine the user carrying capacity of the system. The total number of campsites was found to be 354, of which 26 percent had capacities of 8 to 15 campers, 35 percent had capacities of 20 to 35, and 39 percent had capacities of 40 or more campers. Overall, then, smallness of campsites is not a limiting factor for use. The average number of campsites per mile from Lees Ferry to Separation Canyon is 1.48. For campsites with capacities of 20 or more, the average is 1.09 per mile, or 21.9 per 20 miles. Rowing rafts can cover about 20 miles in a day. The average of 21.9 campsites per 20 miles suggests a deceptively large carrying capacity. It does not take into consideration the distribution of campsites, which is extremely nonuniform (fig. 2). The range is from less than 10 to greater than 40 per 20-mile section. The most important feature of the distribution is that three critical stretches exist which will limit the carrying capacity. If rafts cannot travel more than 20 miles per day, the number of campsites in the 20-mile section with the smallest number will set the use limit on the whole system. The three river stretches are all nearly the same in this regard. Besides the influence on carrying capacity, these three stretches will be the most critical for monitoring, maintenance, and scheduling.



LOCATION -- R 7.9 NAME -- BADGER CREEK

CAMPSITE CHARACTERISTICS

TYPE -- SANDY
EVAL. METHOD -- VISITED
STABILITY -- STABLE
FIREWOOD -- PLENTIFUL
SHELTER -- NONE
CAPACITY -- 40
USE -- MODERATE
FIRE SITES -- MORE THAN ONE, NEAT
HAZARDS -- NONE

SHORELINE, BEACH, AND WATER CHARACTERISTICS

LANDING & MOORING -- GOOD
BATHING -- ADEQUATE
BEACH SLOPE -- MODERATE
EROSION -- RAPID
WATER STAGE -- DECREASING
BEACH MATERIAL -- COARSE
BEACH BEARING -- FIRM

VEGETATIVE CHARACTERISTICS

INVADING SPECIES PRESENT -- RUSSIAN THISTLE, COYOTE WILLOW, ARROWWEED, TAMARISK
PREDOMINANT INVADING SPECIES -- RUSSIAN THISTLE, ARROWWEED, TAMARISK, COYOTE WILLOW
INVASION ASSESSMENT -- ENCROACHING

COMMENTS

BELOW BADGER CREEK RAPIDS

CROSS-REFERENCE DATA

AERIAL PHOTOGRAPHS -- 0020,0021,0022
GROUND PHOTOGRAPHS -- UPPER, LOWER
MAP NO. 1 OF 9

DATA COLLECTED -- 07/73

Figure 2.--*Extended computer-printed form for campsite at Badger Creek.*

Of the visited sites, 9 percent had apparently not been used for camping, 75 percent had been used lightly to moderately, and 16 percent had been heavily used. Open fire sites were not evident on 18 percent of the campsites; 63 percent had only a single, neat fire site; and 19 percent had two or more fire sites or had messy, dispersed fire sites.

Campsites are typically exposed with 84 percent having little or no shelter. Shelter, where it existed, was usually under tamarisk and this was the most frequently encountered species; 84 percent of the campsites had it. Tamarisk was also the predominant invading species on 43 percent of the campsites. Considering all invading species, on 18 percent of the campsites, complete encroachment by vegetation appeared imminent; whereas on 10 percent of the campsites human impact appeared to be controlling the encroachment. On 41 percent of the campsites, there was no threat of encroachment by vegetation.

Uses for the Inventory

The inventory can serve as the basis for managing the use of campsites. Additionally, it can be the basis for use-monitoring and maintenance programs. The inventory must be considered to be dynamic, and must be kept current with respect to both management data and changes in the physical resource.

The inventory can be used for selecting campsites and associated areas for research sites. The inventory and its supporting ground and aerial photographs constitute a baseline for a number of features on which temporal comparisons may be based.

Educational use of the inventory can be made in acquainting new Park personnel with the inner canyon and river-running system and in the training and workshop sessions for river-runners, boatmen, etc. The ground and aerial photographs can be particularly valuable for this purpose.

NEW INITIATIVES IN HERITAGE PRESERVATION: THE AGREEMENTS FOR RECREATION AND CONSERVATION PROGRAM OF PARKS CANADA

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ABSTRACT.--To ensure the preservation of a broad range of human and natural heritage resources and to meet the changing leisure time needs of Canadians, Parks Canada has created a new Program--Agreements for Recreation and Conservation (ARC). In full cooperation with federal, provincial, and other agencies, the ARC Program will jointly identify, plan, preserve, develop, and manage historic waterways, historic land trails, wild rivers, and heritage areas.

We have seen in the last decade in Canada an unprecendented growth in visitation to all types of parks. For example, the Federal National Parks and Historic Parks and Sites saw in 1966-67 over 13,000,000 visitors. In 1975-76 this figure had increased to over 20,000,000. During this time, all levels of government actively have pursued the establishment of new parks and sites to ensure the preservation of human and natural heritage resources and to relieve the increasing pressure on existing park systems. The National Parks system alone has grown to nearly 13,000,000 hectares from 7,500,000 hectares in 1966.

We have also seen significant changes in the leisure time activities of Canadians--wilderness canoeing and hiking, cycling and cross-country skiing have become pastimes for many. And never before has there been such an awareness of the past and such a movement to preserve it.

The creation of further traditional natural parks and historic sites is only part of the solution to ensuring the preservation of our heritage and to providing for new leisure time activities. New initiatives in heritage preservation and a broader range of recreational opportunities are required.

To that end, Parks Canada announced in 1972 the creation of the Agreements for Recreation and Conservation (ARC) Program. It is the aim of the ARC Program to ensure the preservation and presentation of routes and areas that contain nationally significant natural and human heritage resources. Implementation of the mandate is accomplished through cooperation with federal, provincial, and other agencies in the identification of land and water routes and heritage areas, and through agreements on the planning, development, preservation, and management of the agreement area's resources.

PROGRAM ELEMENTS--HERITAGE ROUTES AND AREAS

Heritage Routes

Three types of routes have been included in this category--historic waterways, historic trails, and wild rivers.

Historic Waterways

When looking at the history of Canada, we realize that our vast systems of water routes were vital in the development of the country. Many have been used successively by native peoples, explorers, coureurs-de-bois, and more recently by merchants as

transportation routes. Some of these routes such as the eight historic canals transferred to the ARC Program, have been bypassed by faster transportation methods. Certain significant historic waterways will now be reoriented to provide insights into Canada's past and to offer a variety of water-oriented recreational activities (fig. 1).

Historic Land Routes

Similar in role to the historic waterways, many inland routes were trails of the native peoples and fur traders and later became the settlement roads of the 19th century. They too will be developed to provide Canadians with a greater understanding of their history. They also offer excellent opportunities for activities such as hiking, cycling, or horse riding.

In certain cases, routes will be developed which are not historic in themselves, but will serve as links to significant heritage resources.

Wild Rivers

Canada's rivers represent not only the human heritage of the Canadian people but also their natural heritage. Some, such as the Nahanni River, provide a dramatic illustration of a particular natural region of Canada. Rivers flowing through barrenlands, prairies, mountains, plateaux, and the Precambrian shield represent distinct types and figure in the interpretation of particular physiographic regions.

To evaluate a selection of Canadian rivers for possible development as wild

Figure 1.--*Following in the tradition of the coureur-de-bois, French River, Ontario (Credit: Dolan).*

river parks, Parks Canada has undertaken a technical inventory of some 65 rivers (fig. 2).

Heritage Areas

Heritage areas are unique or representative rural or urban landscapes which reflect Canada's human heritage. Ensuring their preservation involves the conservation of groups of buildings, structures, and cultural landscapes.

The Process of Establishing a Heritage Route or Area

The establishment of a heritage route or area is at all times a joint process with the participating governments and agencies. At several stages in this process, the participants have the opportunity to evaluate their involvement, to ensure that their objectives are met, and to decide whether or not to proceed to a further stage of commitment in the process.

To initiate the study of a proposal, an exchange of ministerial correspondence is sufficient, committing participants to shared costs and manpower. This feasibility study identifies and assesses the heritage resources and themes, as well as complementary government programs, constraints, and opportunities for development of a heritage route or area.

Upon a positive evaluation of the results and recommendations of this study on the part of the participating governments and agencies, a concept plan is jointly prepared.

The concept plan further analyzes the resources and proposes development and management concepts with cost estimates of the route or area, and suggests a division of responsibilities.

Upon acceptance of the concept plan, a formal agreement between the participants can be concluded. This formal agreement sets out the purpose and objectives for the heritage route or area, management structures and roles, administrative and financial arrangements, implementation procedures, individual developments, costs and time frame for development.

The management structure consists of an Agreement Board, representing participating agencies. It has authority to make decisions required for orderly development of the heritage route or area. A small secretariat is attached to the Agreement Board.

The primary mechanism for public participation is an Advisory Committee composed of knowledgeable individuals representing an agreement area. The Advisory Committee ensures that the information enabling the public to enter into the process is made available in the appropriate style, quantity, and form. It advises the Agreement Board of public concerns and opinions related to development proposals and provides feed-back to the public.

Implementation of specific developments can proceed immediately following the signing of an agreement if resources are endangered, or if sufficient planning has already taken place. However, an overall master plan will be prepared for the heritage route or area by a joint planning team representing the participants to the agreement.

Progress to Date of the ARC Program

This joint approach to heritage preservation is a new one in Canada. Although the advantages of such an approach may have been obvious to its originators at Parks Canada, it is one which can only be successful with the full support of other government agencies, in particular the Provinces.

The reaction of the Provinces to the ARC Program has been favorable in general. Since its creation two agreements have been signed. A Federal-Provincial Agreement between Parks Canada and Ontario was signed in 1975 to develop the 425-mile historic canal-waterway running from Georgian Bay to Ottawa (fig. 3). Similarly, an agreement between Saskatchewan and four federal departments including Parks Canada has been signed to conserve and interpret the historical and natural resources of the Qu'Appelle Valley and to provide complementary recreational activities.

Joint Federal-Provincial studies are now underway on the Avalon Peninsula in Newfoundland, the Shubenacadie Canal-Chignecto Peninsula of Nova Scotia, the historic Red River in Manitoba, and

Alexander Mackenzie's route to the Pacific in British Columbia. We are optimistic that these studies will eventually lead to formal agreements with the Provinces to be developed as heritage routes and areas.

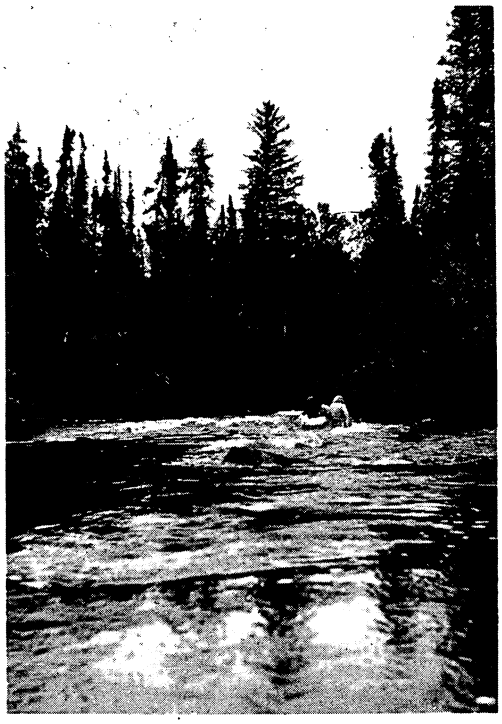

Figure 2.--*Student survey party on wild river survey by Parks Canada (Credit: P. Juurand).*

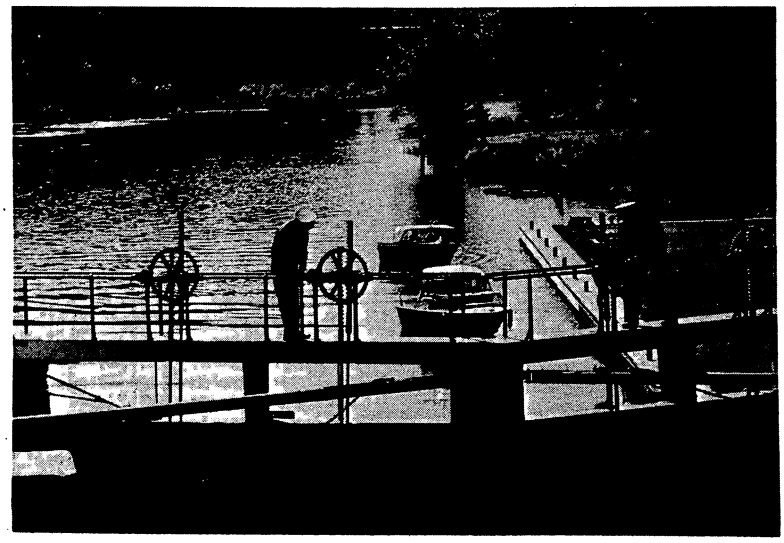

Figure 3.--*One of 95 locks on the unique 425-mile Rideau-Trent-Severn Waterway (Credit: A. Current).*

VISITOR EMPLOYED PHOTOGRAPHY: A TOOL FOR INTERPRETIVE PLANNING ON RIVER ENVIRONMENTS

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ABSTRACT.--The methodology of "visitor employed photography" is explained as a device to inventory public perception of natural environments. A current VEP study on the Huron River in Michigan is summarized and the use of VEP findings in the development of interpretive services and programs for river environments is discussed.

Recreation resource managers often face the quandry of how to involve the public in the management process. Further, more and more managers are beginning to ask themselves whether their perceptions of resource quality are in concert or in conflict with those of the general public. Finally, the interpretation of the resource to the visitor public has garnered much interest and attention in recent years. A recently developed methodology, termed "visitor employed photography" (VEP), can provide valuable assistance in each of the above three areas.

THE METHOD

Visitor employed photography involves the dispensing of simple instamatic cameras to recreationists at the start of their trips. The instructions are basic: "Please photograph anything you wish during your experience today". The recreationist is also asked to write a few words of explanation on a tally sheet immediately after taking each photo. At the end of the recreation experience, the camera is reclaimed and the visitor is asked to complete a brief questionnaire. VEP is a method particularly suited to linear--or corridor--recreation environments such as trails, roads, and rivers.

Four VEP studies have been conducted since 1971, three in Michigan and one in Colorado. Of these, three involved trail hikers (Cherem 1972, Cherem and Driver 1976) and one involved river canoeists. The river study is reviewed later in this paper. The publications *Kodakery* (1974) and *Human Behavior* (1976) carried popular summaries of the VEP studies to date.

THE "UNIVERSAL PHOTOGRAPH" CONCEPT

In each of the VEP studies, a number of distinct "consensus" photographs emerged: certain identical scenes along the environments in question were photographed over and over by recreationists of different backgrounds, on different days, and in different weather conditions. The consensus photos were labeled "universal photographs" (UP) and, by definition, were photographed by from 10 to 51 percent of all recreationists passing a particular scene (figs. 1 and 2).

The 10 percent figure is arbitrary; consensus photographs of certain scenes also occurred in frequencies of less than 10 percent. They were termed "transitional photos" and represent an intermediate measure of public consensus on certain scenes. A third type of public-taken photo, the "thematic

Figure 1.--*"Marsh scene" was the top UP of a Michigan VEP study. Fifty-one percent of all trail hikers photographed it.*

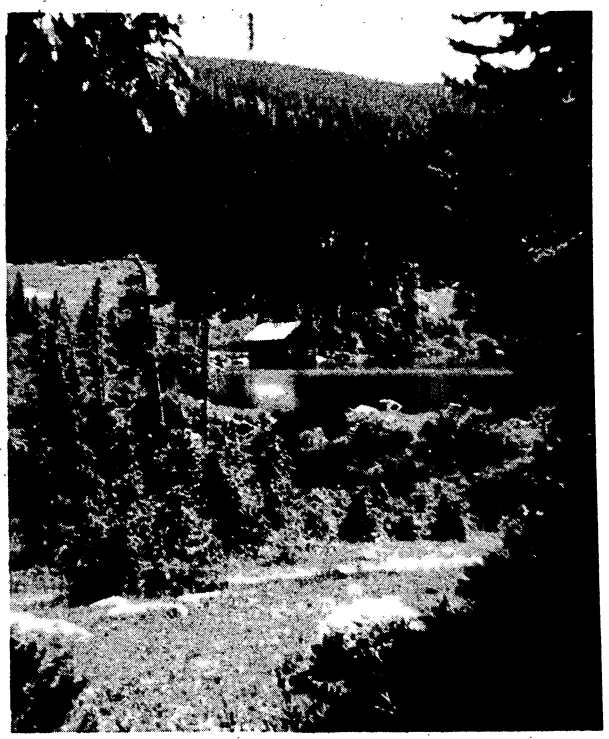

Figure 2.--*This cabin UP was photographed by 29 percent of the hikers on a trail in Colorado.*

photograph", rounds out the story. Thematic photos are not tied to a specific scene or location but rather are of generic topics such as flowers, trails, and wildlife.

At first, it was apparent merely that UPs represented agreement of public interest in certain scenes. The universality concept gained more strength, however, when it was statistically determined that all demographic categories of visitors took the same percentage of UPs in their total mix of photos (Cherem and Driver 1976). In other words, the probability that a visitor would take an UP seemed related to the "perceptual excitement" inherent in a scene itself rather than to the background of the visitor.

The "Perceptually Exciting Node" Concept

It became increasingly apparent that certain spots along the studied environments were being experienced and perceived in common by large numbers of people. Further, the percentage scores (10 to 51 percent) indicated that certain of the spots were perceived more in common than others.

The explanation for the occurrence of these universally photographed spots lay in the tally sheets that the visitors filled out. The more sensory and landscape diversity there was at any one spot, the more likely it was to be photographed. For example, an area that contained a bed of yellow wildflowers, a dead snag, and an abundance of birdlife was more likely to be photographed than an area with a dead snag alone.

Human perceptual excitement is heightened when a number of sensory and landscape contrasts occur simultaneously (Cherem and Driver 1976). We have termed those spots that "excite" 10 percent or more of the passers-by into the behavioral response of snapping a photograph as "perceptually exciting nodes" (PEN).

The Concept of a "Perceptual Excitement Profile" (PEP)

When all the PENs along a particular environment are expressed as sequentially ordered photographs, we have what may be termed a "perceptual excitement profile" (PEP) of the environment. In short, we have a composite "public-eye-view" of the recreation resource involved.

This graphic representation can be transposed onto a base map to represent the relative intensity of public perceptual excitement along the recreational resource. Such a map may prove to be as valuable a recreation planning tool as a cover-type or soils map. The concept of a PEP must be refined a bit, however, before this can happen.

The PEN, and thereby the perceptual excitement profile, is still lacking the dimension of positive or negative value. We may be excited in a negative as well as a positive manner by contrasts in the recreational landscape. A VEP study conducted recently on the Huron River in Michigan explored the issue of positive vs. negative perceptual excitement.

VEP ON THE HURON RIVER

In June of 1976, a VEP study conducted on Michigan's Huron River investigated both the positive and negative aspects of a river's perceptual excitement. With support from the USDA Forest Service and in cooperation with the Huron-Clinton Metropolitan Authority, the study was conducted on the 4-mile stretch of river between Dexter-Huron Metropark and Delhi Metropark near Ann Arbor. This was the first attempt at utilizing VEP on rivers, so several unique problems arose that required special consideration.

Considerations Unique to Rivers

Canoe travel on a river involves some restrictions: travel is fairly rapid and in one direction, movement in the canoe is restricted, and there is the constant threat of dunking both subject and equipment. All this makes taking photographs and filling out a tally sheet awkward. These potential problems were minimized by making the VEP procedure as simple and convenient as possible.

Cameras were issued where access was easy even for inexperienced canoeists. It was necessary, however, to ask subjects to come to the researcher, who hailed them from a designated spot on the riverbank. This was the only major modification made in the VEP method for use on rivers. Participation was voluntary of course and the effectiveness of this method of contacting canoeists is reflected in a refusal rate of 37 percent.

For visitor convenience, to reduce the possibility of dunking, and to aid the research assistant in subject identification, cameras were provided with a neck strap of inch-wide, bright red ribbon. Tally sheets were placed on clipboards and secured with an elastic band. Moreover, the research assistant's downstream location was marked with colored flagging tape and the subjects were given the opportunity to complete the post-trip questionnaire without leaving their canoes.

Study Method

Cameras were handed out at 5-minute intervals throughout the day. One hundred and seventy-two canoeists were given cameras and tally sheets at Dexter-Huron Metropark. Half were asked to photograph anything they considered appealing or positive and the other half were asked to photograph anything they considered unappealing or negative, as they canoed the same 4-mile stretch of the Huron River. All participants returned their cameras and tally sheets and completed questionnaires at Delhi Metropark.

Preliminary Findings

Although data analysis is incomplete several preliminary findings have surfaced. The mental set (positive vs. negative) given to canoeists seems to have been very effective. Canoeists in the negative mode tended to travel the river faster and take fewer photographs than canoeists in the positive mode. In the negative mode, the mean average trip time was 68 minutes and the mean average number of photographs taken was 7. In the positive mode, the mean average trip time was 77 minutes and the mean average number of photographs taken was 9.

If, as mentioned earlier, a high degree of diversity or contrast is important in defining universal photographs and PENs, then one would expect those elements most highly contrasting to the natural landscape to be most photographed as negative. Indeed, such appears to be the case. To date, 11 universal photographs, 3 positive and 8 negative, have been identified that meet the previously established criteria. Apparently canoeists agree more on what is negative than what is positive about the Huron River and this tends to support an earlier finding by Morisawa (1972). Thus, it appears that what is "ugly" or negative is easier to define than what is "beautiful" or positive.

Canoeists in the positive mode photographed such things as distant river scenes, dead or fallen trees, living trees with distinctive shapes or forms, houses nestled among trees along the river, rapids and fast water, and developed recreational facilities along the river. The most popular scene was photographed by 22 percent (19 out of 86) of the canoeists in the positive mode (fig. 3). The river scene depicted in this photograph was one of the first scenes visible to canoeists after they had received a camera and tally sheet. This scene appears to reflect a certain excitement in anticipation of shooting the rapids visible near the center of the photograph. Canoeists indicated they took this photograph because "rapids are fun", "it's an exciting riverscape", "action", "fast water". Moreover, canoeists reported sensations of "tranquility except for the sound of rushing water", the "sound of white water rushing over rocks", the "inspiring roar of churning water", "saw sunlight glistening on the ripples", and "I dig the reflective sun off the water". Thus, there seem to be several elements of contrast and diversity operating at this location that enhance its positive universal appeal to canoeists.

Canoeists in the negative condition photographed metal pipes in and along the river, powerlines, bridges over the river, concrete bridge abutments, graffitti on bridges, developed recreational facilities along the river, fallen trees in and along the river, and industrial sites. The most unappealing scene, a water tower and factory (fig. 4), was photographed by 28 percent (23 out of 82) of the canoeists in the negative mode. Canoeists indicated they photographed this scene because the water tower "looked out of place", "was the funniest looking tree I ever saw", "wrecked the view", and "it is distracting of the natural beauty and peace of nature". "Construction noise and fumes", "factory hum", "train horn", "stinks", and "buzzing noise" were reported as being typical sensations experienced by canoeists at this location on the river.

Figure 3.--*The top UP in the positive mode, this scene was snapped by 22 percent of the Huron River canoeists sampled.*

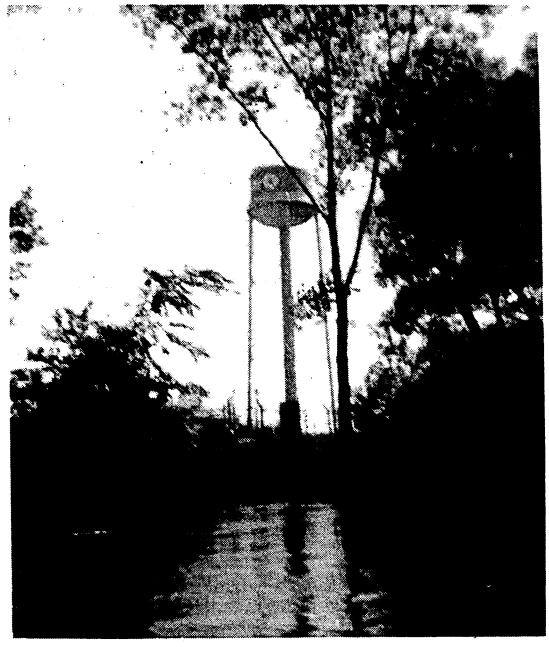

Figure 4.--*The highest negative concensus photograph, this water tower UP was taken by 28 percent of Huron River canoeists.*

In addition to those scenes photographed only by canoeists in the positive or negative mode, some scenes were photographed by canoeists in *both* modes. One scene was photographed by almost 12 percent (10 out of 86) of the canoeists in the positive mode as well as by 17 percent (14 out of 82) of the canoeists in the negative mode (fig. 5). Canoeists in the positive mode photographed this scene because it was "interesting", "different", "nice scenery", an "interesting

Figure 5.--*This photo bears the distinction of being the only UP to be perceived in both the positive and negative modes. The bridge scene was considered positive by 12 percent and negative by 17 percent of the canoeists.*

shot", and "picturesque". Canoeists in the negative mode felt this scene was "ugly", "distracting", "detracts from natural scenery", "unsightly", "noisy", and "clutters nature". The primary sensation experienced by canoeists in the positive mode was the "sound of water splashing". In the negative mode, the sensations experienced were "loud motor" and "cars nearby". Thus, it appears that one's perception of this scene depends on his orientation. If one perceives the elements of the scene as being basically natural, the scene tends to connote something positive; if he perceives the elements of the scene as being more man-made or man-associated, the scene takes on a negative connotation.

To investigate the effects of seasonal variation on the positive UP's isolated in the main summer study, a brief autumn pilot study consisting of ten samples was conducted during October 1976. The negative condition was not used in the autumn pilot study because it was felt that autumn would have a positive rather than negative influence on visitor perception.

The findings of the autumn pilot study support those of the main summer study. All of the positive UP's isolated in the main summer study appeared. Moreover, an additional UP was isolated in the autumn pilot study: nine canoeists photographed the same brilliantly colored maple tree along the river's edge. Furthermore, of the nine canoeists who took this picture, five listed it as one of their top three preferred photographs on the tally sheet.

It is of interest that certain of the landscape scenes photographed in both the main summer and autumn pilot studies presented themselves for only a brief moment. This makes the presence of universal photographs even more remarkable. The fact that the general public has consensus perceptions of fleeting landscape scenes has important implications for application of the VEP technique by resource managers, and we shall now turn our attention to some of these applications.

General Applications to River Recreation Management

We stated earlier that the PEPs produced from VEP studies could be used as another type of base map to aid recreation planning. In general, management strategies would probably aim to maximize the positive and minimize the negative PENs along a river. For example, a particular PEN could be strengthened or intensified by the introduction of more elements of landscape diversity at that spot. What is more, it should be possible to create a PEN along an otherwise neutral or monotonous stretch of river. The introduction of a vista by judicious riverbank clearing and the introduction of swift water through naturalistic wing dams would be two examples.

Visitor employed photography may also promote the most efficient use of budget and manpower. The generation of a PEP for a particular river can help in establishing and isolating priorities not only for development but also for maintenance of that recreation resource. A knowledge of what the public perceives as positive and negative could greatly improve the planning process by allowing more complete evaluation of *all* the impacts of a proposed action. For example, the establishment of positive and negative perceptual excitement data would seem to be of value in preparing environmental impact statements.

SPECIFIC APPLICATIONS TO INTERPRETIVE PLANNING

The Process of Interpretation

While there are minor variations in defining and modeling the interpretation process (Alderson and Low 1976, Brown 1971, Cherem 1975, Sharpe 1976), most conceptions of interpretation are built upon three major components: resource, interpretive media, and visitor.

Peart and Woods (1975) developed a simplified version of the interpretive planning process based upon a communications model. They conceptualize the interpretive planning process in terms of the basic questions: (1) What (the resource); (2) Who (the visitor); and (3) How, when, where (the interpretive media). In addition, their model contains a basic and prerequisite "why" (objectives) component and a final "so what" (evaluation) component. Visitor employed photography can be helpful in all five components of the model.

The Objectives (Why)

Putney and Wagar (1973) state that "explicit objectives at the policy level will not only define program direction and priorities but will also facilitate public involvement and review in setting such direction and priorities". It is in this capacity of obtaining public involvement in setting interpretive program directions and priorities that VEP can be of great use. Tilden (1967) emphasizes that interpretation must relate to the personality or experience of the visitor. What better way to relate to the visitor than to involve him in the planning process? The documentation of the potential high points of the river visitor's experience through VEP would seem a tremendous step in this direction.

The Resource and the Visitor (What and Who)

There is a physical reality and a perceived reality; there is a physical resource and a perceived resource.

At the purely physical level, we can inventory biota, map the topography, and document historical facts. Through ecological sampling, aerial photos, and tape recordings we can document the "what", that is, the stories and themes that the area has to offer.

Measuring the "visitor" component of the interpretive planning model can be far more complex, however. At the "perceived" level of the visitor's experience, resource and visitor become inextricably tied (Field and Wagar 1973). "We look, but do we see?" as the adage goes. What part of what we look at do we see? What part of what we listen to do we hear? What part registers? In other words, what part of the physical resource do we perceive? The interpretive planner needs to know what the visitor is perceiving in the resource before he can direct the visitor's attention toward or away from those aspects, sites, or themes. Visitor employed photography offers a measure of the perceived resource.

VEP gives the interpretive planner an indicator of the current level, composition, and focus of visitor perception of the resource. It yields an imageable profile of the perceived interpretive resource. As an example, let us take a recreational river for which an interpretive program has been earmarked but not yet planned. A VEP study run on such a river can: (1) help designate those sites (PENs) currently perceived as negative or positive, and (2) help isolate interpretive stories or themes through analyses of the thematic photos taken by the visitors. (For a more detailed examination of interpreting a river environment, see Anne Harrison's paper in this proceedings.)

If a particular PEN is viewed as negative, it can be dealt with in several ways. If it is easy to correct the situation (e.g., as unsightly sewer pipe), this can be done. If it is not possible to remove the negatively perceived feature (as the water tower in figure 4), then an interpretive message can be structured to minimize the feature's negative aspects (an intrusion on the riverscape) and maximize its positive features (a point in the hydrologic cycle). In other words, use the immovable negative PEN as a potential interpretive resource.

If the negative PEN is a naturally occurring phenomenon that is currently perceived in a negative fashion (e.g., a duckweed-covered eddy), then interpretation can be applied to reverse this inaccurate perception of river ecology. Indeed, Solomon and Hansen (1972) found that more canoeists perceived eroding streambanks on the Pine River positively as "dramatic cliffs" than perceived them negatively as disturbed areas.

An interpretive message could go a long way toward correcting this ecologically inaccurate perception.

If a particular PEN is perceived as positive (fig. 3), the interpretive planner can utilize this information to good advantage. The perceptual excitement and physical activity at that spot may be so intense (e.g., rapids) that the PEN should not be interpreted through onsite but rather through offsite interpretive media; or it might be decided that a particular PEN should not be interpreted at all. Perhaps the visitor should be left to experience the immediate excitement of the site for himself. With such a PEN, interpretive messages (on- or offsite) might only get in the way. Interpretive media should augment, but never compete with, the resource itself. Further, it should be understood that the PEN is a basis for reaction only. It might be decided that interpretation should occur at intervals between PENs, or "internodes", rather than at the PENs themselves, particularly if current visitor perception is totally missing a potential interpretive resource.

Thematic photographs can often suggest interpretive themes never perceived by the planner. The appearance of painted and soft-shell turtles as a heavily photographed summer item on the Huron River indicates their great interpretive potential. In addition to turtles, a wealth of photographs and comments dealing with ducks, geese, herons, and other waterfowl suggest that interpretive programs with a waterfowl theme would have high appeal and would be well received by Huron River canoeists.

As a corollary finding, the fact that most canoeists in the autumn pilot study photographed the same brightly colored maple tree as well as autumn foliage in general suggests that certain landscape elements that are perceived as more or less ordinary for most of the year may take on added significance during certain seasons. Additional VEP studies conducted at various seasons throughout the year could help to isolate and identify these seasonal variations.

The Interpretive Media (How, When, Where)

Once the visitor-perceived interpretive resource of the river has been documented, appropriate interpretive media can be selected and developed. Such a selection must take into account not only the PEP of the river but also: (1) the capabilities and potential of the physical resource; (2) the numbers, demography, and psychological characteristics of the present and projected visitors; (3) interpretive program mandates and objectives, as well as (4) budgetary, staffing, and logistical realities.

Sharpe (1976) presents an excellent system for categorizing interpretive media. Utilizing his classification scheme, we will give examples of how VEP might be useful in each potential service area. Certain of the services are more appropriate to interpretation of river environments than are others.

Personal Services

Information Services.--Information dispensed at information desks or entrance stations or put-in points for river travel can alert the visitor to the positive PENs as areas deemed exciting and leave other PENs to be discovered by the visitors themselves. Further, information leaflets or river maps could use PENs as emphasized reference points to strengthen the visitor's sense of orientation, hence his feeling of comfortability with the river experience.

Conducted Activities.--On conducted shoreline boat trips, or float trips, a good deal of interpretation might occur at the more neutral internodes, leaving the visitor to experience the positive PENs, particularly where a PEN coincides with an area that demanded high physical involvement such as a rapids. If the "interpretor" (spelled with an "or" to distinguish him/her from the foreign translater) does stop to talk at the positive PENs, he must be sure that his words augment, and do not compete with, the milieu. If the interpretor wishes to stop at a negative PEN, he may interpret why it is there (e.g., a water tower), hence using the site as an interpretive resource.

Talks to Groups.--Not only should talks (particularly those aided with slides) address some PENs as reference points, but they can also address thematic photos and themes not perceived, possibly emphasizing the latter, thus developing the visitor's perception of the resource at a finer level. Further, it might be possible to break the interpretive talks into imageable sections based upon the occurrences of PENs.

Living Interpretation.--While it would at first seem apparent that old mill sites, building ruins, and historical artifacts along rivers would very likely be PENs themselves, the greatest potential for living interpretation may exist along the more perceptually neutral internodes. History is difficult to visualize and living interpretation demonstrations might occur best against a neutral backdrop where the site is not competing for attention. Such locations might be ideal for "ephemeral living interpretation". Imagine seeing an Indian encampment of the 1830's in a small clearing along the river where you had not expected to see it. Imagine a fur trapper stepping out of the shoreline foliage in full regalia and asking if you've any news of the Indian uprising. Moments such as these need not be tied to a specific location or time and they could enhance a visitor's experience tremendously. To carry the living interpretation one step further, PENs could even be created along original internodes, particularly along those internodes where it is documented that certain events took place.

Nonpersonal Services

Audio Devices.--In general, interpretive-audio stations would seem out of place on the river. These devices could be utilized to good advantage at a wayside exhibit or interpretive center, however. It might be possible to orient the river traveler to the auditory milieu (e.g., cottonwood leaves fluttering just before a rapids) of certain PENs that he will experience on the river trip. Conversely, the opportunity to hear a post-trip recording of audibly distinctive PENs might reinforce reminiscence and recall of the river experience for the visitor.

Printed Material.--The positive PENs, when expressed pictorially in a publication, are not only an excellent orientation device but are invaluable in aiding the reader to picture in his mind the visual totality of the river and the experiences it has to offer. With this "map of alternatives", the visitor could select those sites, experiences, and thereby river stretches, he wished to explore and those he did not wish to explore because of interests or physical limitations.

In relation to brief interpretive signs, it may be possible to include verbal markers (e.g., rapids view) on the more heavily used recreational rivers to alert river travelers to a high excitement area well worth watching for. (It might even be preferable to use nonverbal markers or symbols to alert the visitor to upcoming experiences.)

Self-Guided Services.--Here again, the PENs can be reference points to help the visitor orient himself. An even greater possibility exists in the establishment of a "landmark" self-guided leaflet, encouraging the river traveler to watch for the PENs. The leaflet would contain a short, easily read interpretive message for each PEN landmark to be "digested" at or after the PEN.

Exhibits.--Particularly in a post-trip situation, the photographic recurrence in exhibits of areas deemed exciting could reinforce the memory of the trip and give the visitor a greater and more coherent sense of closure. The comments "we saw that" or "we were there" would probably ensue.

Visitor Centers.--If a visitor center were placed at a documented PEN, the planner would have to be careful that the center augmented rather than detracted from the site. The placement of a visitor center at an internode might also be a possibility. Not only might this serve as a physical rest spot between PENs but also such a center could be a point of overlap between auto access and river access, and thereby a point of articulation between, the land-oriented and river-oriented segments of the interpretive program. Indeed, the placement of a visitor center at an internode would likely have the same effect as opening a vista along a monotonous stretch of river. Site reinforcement focuses perception and attention at that site, as has often been the case in outdoor recreation settings (Tocher and Hunt 1964).

Interpretive Program Evaluation (The "So What")

Visitor employed photography can be used to help evaluate both proposed and existing interpretive programs and facilities focused upon river environments.

Once the PEP for a river has been established, it can be remeasured at periodic intervals to determine and isolate changes in the profile. Changes in the PEP for a particular stretch of river will most likely be attributable either to changes in the riverscape itself (e.g., a forest fire) or, more likely, to the effects of recreation

management along the river (e.g., the establishment of a new riverside campground or picnic area) or to the effects of a river-oriented interpretive program. Segments of such a program may have sharpened visitor perception of subtleties at the internodes (e.g., unusual plantlife) through, for example, a pretrip slide program. With properly designed questions on the tally sheet and followup questionnaire, it should be possible to determine why the river PEP has changed, thus enabling one to verify, support, or reject the effectiveness of an instituted interpretive program or facility.

The establishment of a PEP for a river with an existing recreational management or interpretive program can also be useful. Such a PEP becomes a view of public perception at that point in time. An additional VEP study conducted later, particularly after the establishment of certain interpretive facilities, can indicate or measure the change in public perception brought about by the introduction of that interpretive facility. In other words, did the visitors see what you, the interpretor, wanted them to see along the river? If not, did they see something you missed altogether?

SUMMARY

Visitor employed photography is a new concept. Time and effort will refine the method and its application, not only for use along river environments but also for other linear recreational environments such as trails and roads. Experience may prove certain of the applications we have proposed useful. In addition, new applications for VEP and the resultant perceptual excitement profile will emerge. We are confident that such a visitor-generated view of the resource will be a valuable tool in recreation resource management.

STANDARDS OF ENVIRONMENTAL QUALITY FOR RECREATIONAL EVALUATION OF RIVERS

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ABSTRACT.--Explores the possibility of developing evaluative criteria and standards based upon the individual and group threshold functions by which alternative sites are accepted or rejected. Explains experimental procedures used to develop the threshold functions. Presents illustrative results of pilot studies. Suggests applications and needs for further research.

When an individual selects a location for an intended recreational activity, he uses stable and describable "rules" to evaluate and accept or reject alternatives. However, these "rules" may be implicit or covert, and not readily explainable through introspection. Thus, special experimental techniques may be needed if the rules are to be extracted, described, and used to develop evaluative criteria and standards.

In this paper, we focus exclusively on the environmental characteristics or attributes of recreational sites--as they influence the decision to accept or reject a site for an activity. The hypotheses are (1) recreational decisions and satisfactions are strongly sensitive to the environmental attributes of alternative sites, (2) an individual can recognize and differentiate between acceptable and unacceptable sites for an activity when those sites are described in terms of their environmental characteristics, (3) the boundary between acceptable and unacceptable sites for an individual can be described by means of a mathematical function of environmental variables, using suitable experimental and statistical methods, (4) the boundary will be probabilistically distributed for a group of individuals, and the tendency for a site to be acceptable to the group can be described in terms of probabilities, and (5) criteria and standards of perceived recreational quality can be developed, based on individual acceptance thresholds and/or group acceptance probabilities.

To date only pilot studies have been completed as part of the process of developing the experimental methods. Large-scale data collection was conducted during the past summer (1976) at the Pine River in Michigan. Comparatively small samples also were collected from other locations.

To develop criteria and standards of perceived environmental quality from the recreationist's point of view, it is first necessary to define a model of the process by which people choose among alternative sites for a given recreational activity. For want of something better, we have chosen to adopt a utility theory of behavior, or what economists call the rational model of choice (Arrow 1958). This is to say that when choosing among a number of alternative sites for a given recreational activity, an individual will always choose the alternative perceived to have the greatest value or utility for him, subject to whatever constraints might influence the feasibility or availability of alternatives. We further assume that the utility perceived to be offered by an alternative can be expressed as a mathematical function of the perceived environmental attributes of that alternative, other things being equal. Let the quantity of environmental attribute i, say water quality or wildness, perceived to be present at a site be X_i, and let V be the total utility of the site contributed by its environmental characteristics. We assume that there exists some implicit utility function,

$$F[V,X_1,X_2,\ldots,X_i,\ldots,X_n]=0, \qquad [Eq.1]$$

which describes the rational choice process. If this function could be described for an individual, his site choices then could be predicted by measuring the environmental characteristics of alternative sites, calculating the value or benefit, V, and selecting the alternative with the greatest V. Environmental attributes, of course, are only part of the choice process. Therefore, we are dealing with a partial analysis of the problem. Constraints on feasibility, if any, must also be considered.

The most direct approach to the development of individual criteria for site evaluation would be to describe the utility function represented by equation [1]. Individual functions then might be combined either probabilistically or analytically into group criteria for site evaluation. However, this approach may not be feasible at this time because of the complexity of decision processes. The problem has gone far beyond the simple theory and experiments first reported by Thurstone (1931). This is understood by referring to a recent review of utility models by Farquhar (1976). Hauser and Urban (1975, 1976) and others clearly identify many of the conditions implicit in direct modeling of utility functions. Even with this understanding, many utility modeling efforts could still produce idiosyncratic utility functions that are generally not comparable between individuals because individuals differ in value concepts.

Given the complexity of the utility function problem, the difficulties encountered when direct modeling is attempted, and the limitations from which the products suffer, this would appear to be an impractical approach to the development of site evaluation criteria and standards. However, if we restrict the question to one of site adequacy, as opposed to absolute site quality, the problem is simplified and becomes manageable.

By site adequacy, we mean a measurement of the acceptability or unacceptability of a site to individuals or groups. To predict choice completely, and, thus, to evaluate sites completely, we must be able to deal with the competition among acceptable sites. However, in line with the concept of a "standard", it would seem useful to have rules for determining whether and for whom a site is adequate or acceptable for a given recreational activity in terms of its environmental characteristics.

The utility function concept can be used as the basis for the development of such rules. In equation [1], if V is held constant at some value, say V_o, all combinations of environmental variables that satisfy the equation define the V_o "isoquant", i.e.,

$$F[V_o,X_1,X_2,\ldots,X_i,\ldots,X_n]=0. \qquad [Eq.2]$$

This equation for the V_o isoquant is a more specialized and simplified relation than the more general utility function of equation [1]. All sites having combinations of environmental characteristics that satisfy this equation produce perceived benefits equal to V_o, and the recreationist is indifferent among them.

Assume that there is an isoquant for which $V_o = 0$: that is, alternatives satisfying the equation

$$F[X_1,X_2,\ldots,X_i\ldots,X_n]=0 \qquad [Eq.3]$$

are neither attractive nor unattractive because the perceived utility they generate is zero. This isoquant must be a boundary between acceptable alternatives that generate $V > 0$ and unacceptable alternatives that generate $V < 0$, or disbenefits. If equation [3] can be estimated for an individual, it can be used as a criterion or standard for discriminating among acceptable and unacceptable sites for that individual. This equation is much simpler than the total utility function because the utility variable, V, does not appear in it. It is essentially the mathematical "intersection" between the utility function and the plane $V = 0$. Simple experimental techniques can be developed for estimating equation [3] for individuals and the concept can further be developed for groups of individuals.

For example, consider a hypothetical person who wants to go canoeing for the weekend and is looking for a good place to do it. For the sake of simplicity, assume that such a person is only concerned about the following: water quality and degree of development. Depending on the nature of the individual's preferences, many combinations of water condition and development will be unacceptable. Others will be acceptable. Presumably, there is a boundary or threshold between the acceptable combinations and the unacceptable com-

binations that can be described (fig. 1). This threshold might be described mathematically by specifying equation [3]. If the function can be specified, it becomes a rule for judging the adequacy of alternative sites for this person. In figure 1 we have shown a nonlinear boundary in order to illustrate the possibility of nonlinear substitution relations.

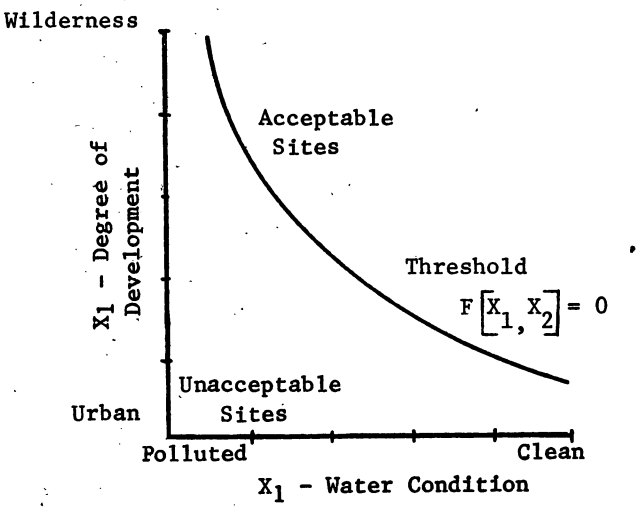

Figure 1.--*Hypothetical threshold function.*

This threshold function, $F[X_1,X_2]=0$, can be used as an evaluation standard as follows: Given the site to be evaluated, we measure its environmental variables, X_1 and X_2. These values are substituted into the threshold function, and the function is evaluated. If the site is on the acceptable side of the boundary, the function will have a nonzero value with a positive sign. Sites on the unacceptable side will have values less than zero. The farther a site is from the boundary, the more positive or negative its value will be. Thus, the threshold function can be used to discriminate between acceptable and unacceptable sites. It can also be used to diagnose the environmental reasons why the site is acceptable or unacceptable in terms of distances from the threshold and the changes that would be required to bring an unacceptable site into the acceptable region.

The boundary is specified only in terms of objectively measurable environmental variables. Utility does not enter the function directly and need not be measured. Thus, most of the difficulties presented by utility modeling are circumvented. Comparisons can be made among individuals because of the objective nature of the variables. This reduces experimental problem to one of (1) physical description of alternative sites, (2) having the subject sort sites into acceptable and unacceptable categories, and (3) mathematical estimation of the boundary between the two sets.

Assuming that the threshold function exists for individuals, a way must be found to combine individual functions into aggregate or group rules if the method is to be useful for management purposes.

A homogeneous population, for example, is a group of similar individuals. If it is possible to identify such a group, for example white water kayakers, it would seem reasonable to expect that individuals would have similar threshold functions because of common interests, tastes, etc. We might expect the threshold functions to cluster together as illustrated in figure 2, again in terms of a two-variable example.

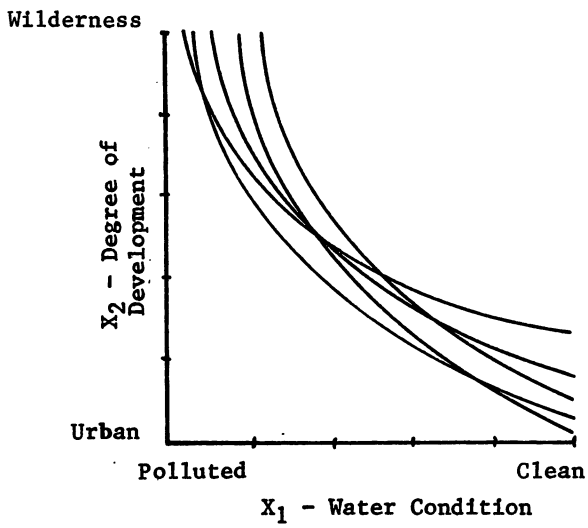

Figure 2.--*Hypothetical distribution of thresholds for a homogeneous population.*

Given such homogeneous clustering of individuals, the group could be regarded as an individual, and a single threshold function might be used to represent the group. If we have a group of recreationists that we hypothesize to be homogeneous, the hypothesis can be tested by measuring individual threshold functions and comparing

among individuals. However, this would be a very laborious process.

The tight clustering of threshold functions shown in figure 2 would not be likely for a heterogeneous group of recreationists consisting perhaps of a mixture of avid canoeists, wilderness enthusiasts, people interested in partying out-of-doors, and others simply trying to get out of the city. The dispersion of thresholds in a mixed group would probably be much greater (fig. 3).

Obviously it is desirable to stratify the users of a recreational site into homogeneous types, vis-a-vis their evaluative criteria, but it may not always be feasible. There may be many situations in which it is necessary to have aggregate criteria that represent the dispersed individual rules shown in figure 3. It might be possible to calculate an "average" threshold function for such a group; this would not be very meaningful, however, because it would not preserve the diversity that exists.

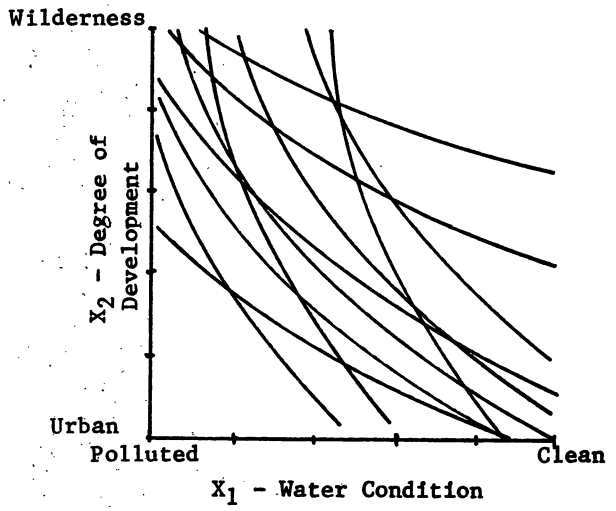

Figure 3.--*Hypothetical distributions of thresholds for a heterogeneous population.*

An alternative and more representative approach would be to describe the probability that each combination of environmental variables would be judged acceptable by a person sampled randomly from the population. These probabilities might be used to estimate "centours" or lines of equal probability (fig. 4). Given a probability function of this sort, it could be used as an aggregate evaluative criterion to measure the acceptability of a given site to the population in question. For a very heterogeneous population, the centours would be quite evenly spread over the range of alternatives, and there would be no region of unusual "steepness" or rapid change in probability with changes in the environmental variables. However, with a very homogeneous population, the centours might be clustered in a region of rapid probability change (fig. 5). This region of steep gradient would serve to identify the location of a single threshold function that represents the group.

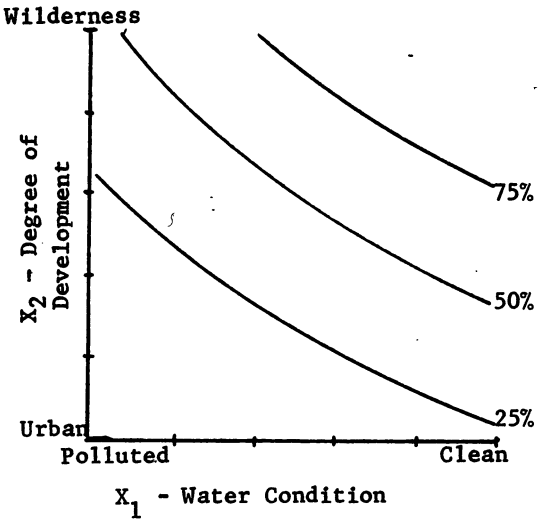

Figure 4.--*Hypothetical acceptability centours for a heterogeneous population.*

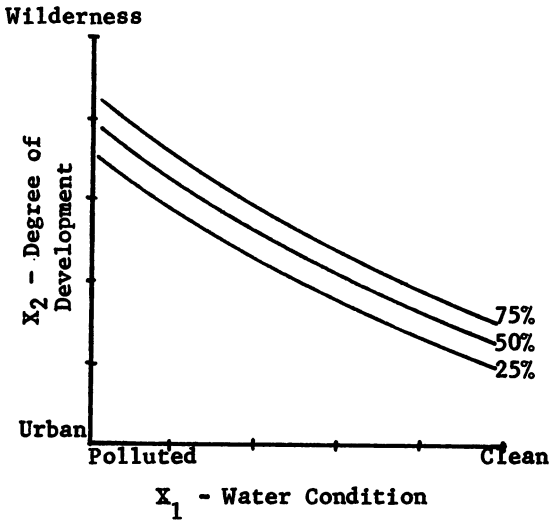

Figure 5.--*Hypothetical acceptability centours for a homogeneous population.*

EXPERIMENTAL METHODS

The technique used for measuring the individual threshold function is similar to approaches advocated by Craik (1968) to use when appraising physical environments. Directly, it can be better described as an adaptation of methods used for "policy extraction" by Hammond (1974). In our experiment, an individual is presented with an environmental display descriptive of a river site, and asked to decide whether the site is considered to be acceptable or unacceptable for a specified activity. The display used is a written description of the environmental characteristics of the site, although a variety of display techniques might be used. The written description method has often been used in consumer behavior studies and seems to be valid and flexible.

There are many environmental variables that might be important for various recreational purposes. To identify and define these variables is a major research undertaking. Rather than to attack this question, we elected to experiment with the threshold theory using the following set of five variables known to be important to canoeists: (1) water condition, (2) degree of development, (3) level of crowding and use, (4) trash and litter, and (5) skill level required. The tabulation shows how the scales were defined; figure 6 shows how they were used to generate synthetic alternatives for the Pine River research. The scales and the survey form were developed through a series of pilot studies, based on literature review and the author's prior experience.

The environmental alternatives were randomly generated by computer. Five scales with four categories on each scale define a sample space of 1,024 alternatives. To define an individual threshold function, it would be necessary for the individual to sort several hundred alternatives sampled from this larger set. This was done in pilot studies and found to be feasible, although rather tedious. In the final experiment, we presented many individuals (ca 400) with 15 randomly generated alternatives. Part of one set is illustrated in figure 6. Each subject received a unique random set, and was asked to sort each element or alternative into acceptable and unacceptable categories.

There are at least two limitations on this method: (1) on the number of variables that the human mind can manage in synthesizing an image of the alternative being described; and (2) the more variables used and the more categories on each scale, the larger is the sample space of plausible alternatives. This may cause a sparse sampling rate because the number of individuals that can be interviewed and/or the number of alternatives that each individual can process are limited. Such a sampling rate might not be sufficient to determine the threshold function.

Once the alternatives have been sorted by the subjects, there are several methods that might be used to estimate individual or aggregate threshold functions. We focus on the individual threshold function because aggregate estimation techniques still are being developed.

Discriminant analysis (Cooley and Lohnes 1971) is a very powerful technique for estimating the individual threshold function. Using metric variables (measured on interval or ratio scales), nonlinear discriminant functions can be estimated and tested based on hypotheses about the functional form. One form that has proven to be particularly successful is the general quadric function (deBettencourt and Peterson 1976). Using nonmetric or categorical variables (See *Scale Definitions*) dummy variable discriminant analysis can be used. Discriminant analysis is applied to the two populations of alternatives obtained by the sorting procedure, the acceptable alternatives, and the unacceptable alternatives. The resulting discriminant function is an estimate of the equation of the boundary between the two sets, with appropriate adjustments. This is a nonconventional application of the method and many of the conventional statistical interpretations of the discriminant analysis may not be strictly applicable.

Bayesian classification methods (Miller and Freund 1965) have also been applied with some success to model the threshold relations. One advantage of using such an approach is that you don't directly specify the functional form of the threshold function.

RESULTS OF ILLUSTRATIVE PILOT STUDIES

The experiments conducted using two individuals with six scales each having six

WILD RIVERS PROJECT NORTHWESTERN UNIVERSITY EVANSTON, ILL. 60201

ON THE FOLLOWING PAGES, YOU WILL BE PRESENTED WITH A NUMBER OF DIFFERENT RIVER RECREATION SITE DESCRIPTIONS. WE WOULD LIKE TO KNOW IF YOU WOULD FIND THESE SITES ACCEPTABLE LOCATIONS FOR THE SAME ACTIVITY WHICH BROUGHT YOU TO THIS AREA. MARK YOUR ANSWER BY CHECKING EITHER THE BOX LABELED ACCEPTABLE OR THE BOX LABELED UNACCEPTABLE BELOW THE SITE DESCRIPTION.

1---------- 2499

WATER CONDITION	FAIRLY CLEAN, DRINKABLE IF NECESSARY
DEGREE OF DEVELOPMENT	WILDERNESS
CROWDING/USE	FEW OTHER USERS
TRASH/LITTER	MODERATELY LITTERED
SKILL LEVEL REQUIRED	PRACTICED BEGINNER

THIS SITE WOULD BE ( ) ACCEPTABLE ( ) UNACCEPTABLE

2---------- 2499

WATER CONDITION	UNDESIRABLE QUALITY, UNDRINKABLE
DEGREE OF DEVELOPMENT	RURAL AGRICULTURAL/RECREATIONAL
CROWDING/USE	FEW OTHER USERS
TRASH/LITTER	LITTLE VISIBLE LITTER
SKILL LEVEL REQUIRED	BEGINNER

THIS SITE WOULD BE ( ) ACCEPTABLE ( ) UNACCEPTABLE

3---------- 2499

WATER CONDITION	UNDESIRABLE QUALITY, UNDRINKABLE
DEGREE OF DEVELOPMENT	NON-WILDERNESS BACKCOUNTRY
CROWDING/USE	NO OTHER USERS
TRASH/LITTER	HEAVILY LITTERED
SKILL LEVEL REQUIRED	BEGINNER

THIS SITE WOULD BE ( ) ACCEPTABLE ( ) UNACCEPTABLE

4---------- 2499

WATER CONDITION	UNDESIRABLE QUALITY, UNDRINKABLE
DEGREE OF DEVELOPMENT	RURAL AGRICULTURAL/RECREATIONAL
CROWDING/USE	A LARGE NUMBER OF USERS
TRASH/LITTER	NO LITTERING AT ALL
SKILL LEVEL REQUIRED	PRACTICED BEGINNER

THIS SITE WOULD BE ( ) ACCEPTABLE ( ) UNACCEPTABLE

5---------- 2499

WATER CONDITION	PURE, CLEAN, DRINKABLE WATER
DEGREE OF DEVELOPMENT	URBANIZED AREA
CROWDING/USE	NO OTHER USERS
TRASH/LITTER	NO LITTERING AT ALL
SKILL LEVEL REQUIRED	EXPERT

THIS SITE WOULD BE ( ) ACCEPTABLE ( ) UNACCEPTABLE

6---------- 2499

WATER CONDITION	PURE, CLEAN, DRINKABLE WATER
DEGREE OF DEVELOPMENT	RURAL AGRICULTURAL/RECREATIONAL
CROWDING/USE	FEW OTHER USERS
TRASH/LITTER	MODERATELY LITTERED
SKILL LEVEL REQUIRED	BEGINNER

THIS SITE WOULD BE ( ) ACCEPTABLE ( ) UNACCEPTABLE

7---------- 2499

WATER CONDITION	CLEAN ENOUGH TO USE, BUT UNDRINKABLE
DEGREE OF DEVELOPMENT	RURAL AGRICULTURAL/RECREATIONAL
CROWDING/USE	A MODERATE NUMBER OF USERS
TRASH/LITTER	MODERATELY LITTERED
SKILL LEVEL REQUIRED	BEGINNER

THIS SITE WOULD BE ( ) ACCEPTABLE ( ) UNACCEPTABLE

Figure 6.--*Sample questionnaire format.*

categories; thus, a sample space of 46,556 alternatives was generated. The two individuals each were given 100 randomly sampled alternatives to sort. Stepwise discriminant analysis available in the SPSS package (Nie *et al.* 1975) was used to estimate the threshold functions. The discriminant analysis was used under three different variable transformations: (1) linear, (2) quadric, and (3) dummy variable (binary).

The following tabulation shows the relative ability of the three functions to correctly separate the sorted alternatives for the two subjects:

	Individual ZH	*Individual DK*
	Percent	
Linear	85	93
Model Quadric	93	93
Dummy Vbl	93	93

Figure 7 shows some two-variable partial plots of the threshold function for the two individuals. The plot for individual ZH's dummy variable function demonstrates discontinuity problems that might arise either from improper scale definition or from sparse sampling. Nevertheless, the dummy variable and quadric functions were able to predict 93 out of 100 decisions correctly for each of the two individuals.

Based on these and other pilot studies, the scales and variable sets shown in the box below were developed.

In another pilot study intended to help refine the actual questionnaire design, 15 people participating in white water kayaking were interviewed on the Wolf River in Wisconsin. Each of the 15 individuals was presented with 20 randomly generated alternatives, using the variables and scales shown in the box. Because of the specialized nature of the activity in which they were engaged, these kayakers were assumed to comprise a homogeneous population. Their combined responses comprise a set of 300 alternatives from a sample space of 1,024 possibilities (29 percent).

Discriminant analysis again was used; this time in an attempt to estimate a single threshold function for the group of 15 individuals, based on their combined responses. Linear, quadric, and dummy variable transformations were used. Two Bayesian classification techniques also were tried out.

The following tabulation shows the percent correctly classified:

Continuous models	*Correctly classified* (Percent)
Linear	72.3
Quadric	73.0
Discrete models	
Dummy var.	74.3
Bayes	72.7
Bayes with Interaction	73.3

These results indicate that (1) there is not much difference in this case, the five methods don't differ much, (2) the concept of a group threshold function does exist, but (3) the boundary is less well defined for this group of 15 individuals than it is for a single individual. This indicates that the group is not perfectly homogeneous, but that there is considerable commonality among the individual decision rules.

Scale Definitions

Scale 1: WATER CONDITION
1. Pure, clean, drinkable water
2. Fairly clean, drinkable if necessary
3. Clean enough to use, but undrinkable
4. Undesirable quality, undrinkable

Scale 2: DEGREE OF DEVELOPMENT
1. Wilderness
2. Nonwilderness backcountry
3. Rural agricultural/recreational
4. Urbanized area

Scale 3: CROWDING/USE
1. No other users
2. Few other users
3. A moderate number of users
4. A large number of users

Scale 4: TRASH/LITTER
1. No littering at all
2. Little visible litter
3. Moderately littered
4. Heavily littered

Scale 5: SKILL LEVEL REQUIRED
1. Expert
2. Intermediate
3. Practiced beginner
4. Beginner

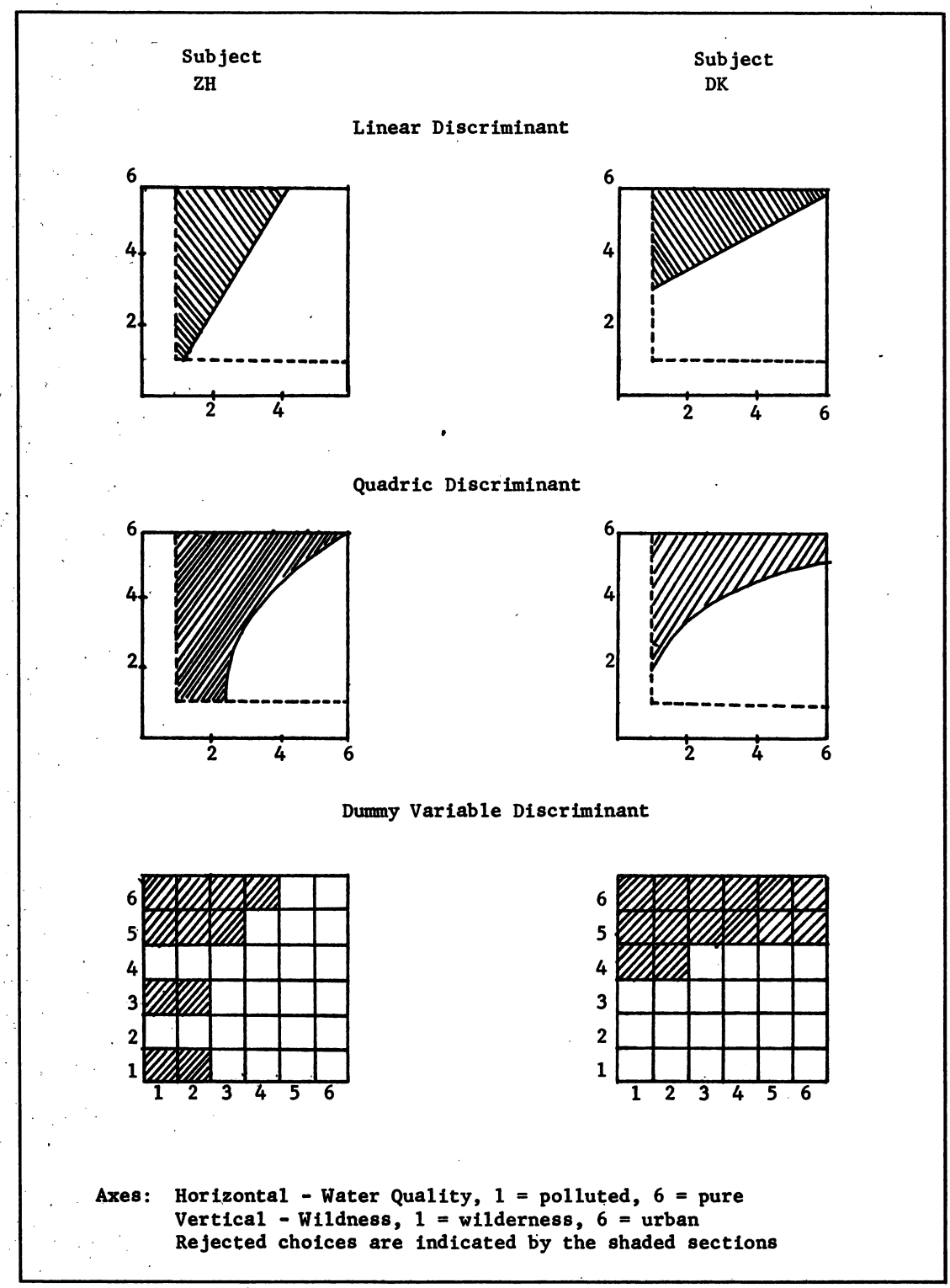

Figure 7.--*Conditional threshold diagrams for experiments with two individuals.*

Figure 8 gives partial plots for the five functions. These plots are two dimensional slices of five dimensional functions. Despite the apparent dissimilarities, there are significant common characteristics. The differences can be explained mathematically.

All of these results are presented by way of illustration only, and should not be interpreted or applied beyond that purpose. The work at the Pine River this summer (1976) has produced a data set of approximately 400 individuals who have responded to unique sets of 15 alternatives. When those data have been analyzed, we will be able to report more conclusive results, both by way of evaluating the methodology, and by way of reporting specific criteria that can be used for river evaluation.

APPLICATIONS AND FURTHER RESEARCH

The formulation of user-based criteria and standards for evaluation of recreational facilities is an important part of the planning, design, and management of recreational environments. The techniques discussed show considerable promise of usefulness if they can be adequately defined, developed, and validated. Potential functions include the following:

(1) User-based standards of adequacy, in terms of environmental variables, for various recreational purposes and types of users. Such standards would be helpful in the designation and management of recreational sites.

(2) Diagnostic information on the environmental reasons for a site's attractiveness or unattractiveness to various groups for different recreational purposes. Such information provides useful contributions to the problems of predicting demand, designation, modification, and design of sites, management of demand, and user education.

(3) Information on the relative availability of specific sites or kinds of sites vis-a-vis the requirements of social groups and demand sectors.

(4) Explanation of the relative importance of different environmental attributes from the user's point of view. The threshold function, whether individual or aggregate-probabilistic, gives an indication of the shape of the utility function, especially the substitution or trade-off relations among the significant environmental variables that enter the site choice process. The marginal rate of substitution defines the relative importance of the variables at the threshold and indicates the existence of hierarachical dominance, if any. The techniques presented here allow nonlinearities to be described, thus preserving variable rates of substitution.

We have applied these concepts successfully to fishing, cross-country skiing, rafting, and shopping center destination choice. More research is needed, however, if these kinds of user-based evaluation standards are to be accepted and used by managers.

Pertinent research topics can easily be identified. In the context of the experimental technique, the methods of environmental display need to be studied, improved, and validated. Our selection of scales and variables to describe the site, although based on extensive conceptual and empirical research, does not necessarily represent the universe of important variables, nor are the scales necessarily the best. What is the "mental language" used by recreationists to think about their recreational environments? Have we adequately captured that language, or are there more or different variables and must the scales be reconstructed? How do we translate these "macro-level interpretive" variables of mental language into tangible site characteristics that managers can understand and work with? Actual stream management must be done in terms of streambank erosion, physical measures of water quality, etc. The user's perceived quality is defined in rather different, more general and interpretive terms. Fortunately, the Pine River research has been designed to cooperate with some rather extensive physical inventory work (Chubb and Bauman 1976), so we have some opportunities for "bridge building".

Another important issue concerns the possibility that the experimental process may force the subject into an unrealistic decision situation, thereby distorting his evaluative rules. Can thresholds actually be identified, and if they can be identified, do they realistically describe actual de-

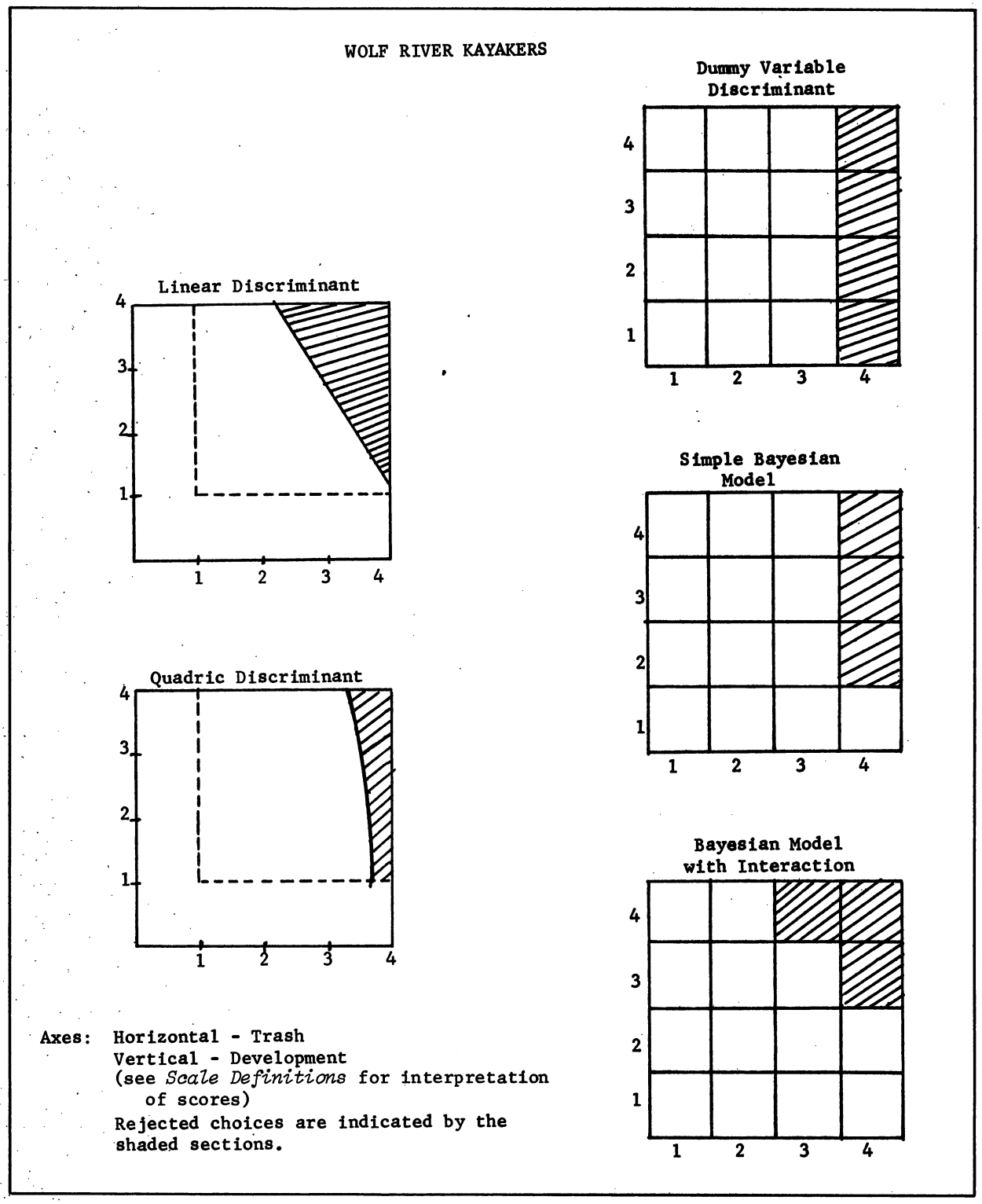

Figure 8.--*Conditional threshold diagrams for a single group experiment.*

cision-making behavior, or are they artifacts of a contrived experiment?

Assuming that the threshold function concept is a valid way to describe recreational site choice, do the locations actually being used by recreationists fall into their acceptable resource category, or is acceptability dependent on the richness of the set of available alternatives? When "acceptable" sites, as defined in the threshold function experiment, simply are not available, do people accept "unacceptable" sites rather than forego a desired recreational activity.

These and other questions about statistical methodology can be resolved only through empirical research of the type we have been conducting. Our studies at the Pine River and at other locations are expected to shed light on many questions.

Even if the proposed methods and concepts prove to be valid, there remains two other questions that are not really research issues. Is there a real need for user-based evaluative criteria. If there is, will managers and decision-makers be willing or able to make use of them? Surely, there are valid arguments against basing resource management exclusively on the preferences and perceptions of users. In recreation, this could lead to the destruction of irreplacable opportunities and interference with competing but important activities. However, the point is not that management of recreational resources should be determined by users' criteria but that management understanding the users' point of view is more enlightened and can do a better job, whatever the mission and whatever decision criteria actually end up being used.

A SURVEY AND ANALYSIS OF RECREATIONAL AND LIVESTOCK IMPACT ON THE RIPARIAN ZONE OF THE RIO GRANDE IN BIG BEND NATIONAL PARK

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ABSTRACT--Visitor usage patterns, biological conditions, and selected parameters of recreational impact (including litter, trampling, tree cutting, and human waste) were measured over a 12-month period. Use and impact were shown to be strongly and positively correlated. However, recreational impact was not significantly related to biological health of the area. Cluster analysis was used to group areas into three categories based on degree of impact; only one of every four sites was indicated as heavily impacted. Principal components analysis identified human impact parameters as best discriminators between sites.

In recent years, the Rio Grande of the Big Bend National Park (BBNP) has experienced dramatic increases in recreational and water resource use. Thus, the National Park Service (NPS) has found it necessary to secure information concerning the actual and potential impact on the river and on associated land area ecosystems from present levels of human usage.

The primary goals are to assess the impact upon the Rio Grande Floodplain in BBNP to provide baseline data for determining the "carrying capacity" of the area, use management alternatives, and strategies that may be employed to ensure that use remains within this carrying capacity.

Four factors are being investigated as follows:

1.--Resource

(a) Preliminary biotic survey of the riparian areas along the Rio Grande.

(b) The identification, distribution, and relative abundance of plant and mammalian species in riparian areas along the Rio Grande.

2.--Users

(a) To identify the extent, character, and patterns of recreational use along the Rio Grande corridor.

(b) To identify the geographic and descriptive characteristics of recreational users by user group.

3.--Impacts

(a) To determine the direct and indirect impact of human use upon plant and mammal life and other natural resources.

(b) To formulate recommendations for short-term and long-term monitoring programs of biological resources.

4.--Management

(a) To formulate recommendations for additional research needs.

(b) To suggest alternatives for management schemes aimed at maintaining and perpetuating the natural ecosystems in consonance with current NPS natural area policies.

APPROACH

After study of aerial photographs, float trips were conducted from Lajitas to La Linda and 64 major riparian areas were identified and recorded on a map. For statistical analysis purposes, each was treated as a distinct sampling entity, although they tend to form a continuum along the river (fig. 1).

Most of the riparian areas are accessible only by river. However, 26 riparian sites may be reached by roads: 18 of these are reached by a dirt road called the River Road, which becomes impassible during rainy weather. These 18 have been designated as primitive campsites. There are also eight sites that are accessible via paved roads; two (Cottonwood and Santa Elena Picnic Area) are small campgrounds and a third (Rio Grande Village) is a major campground.

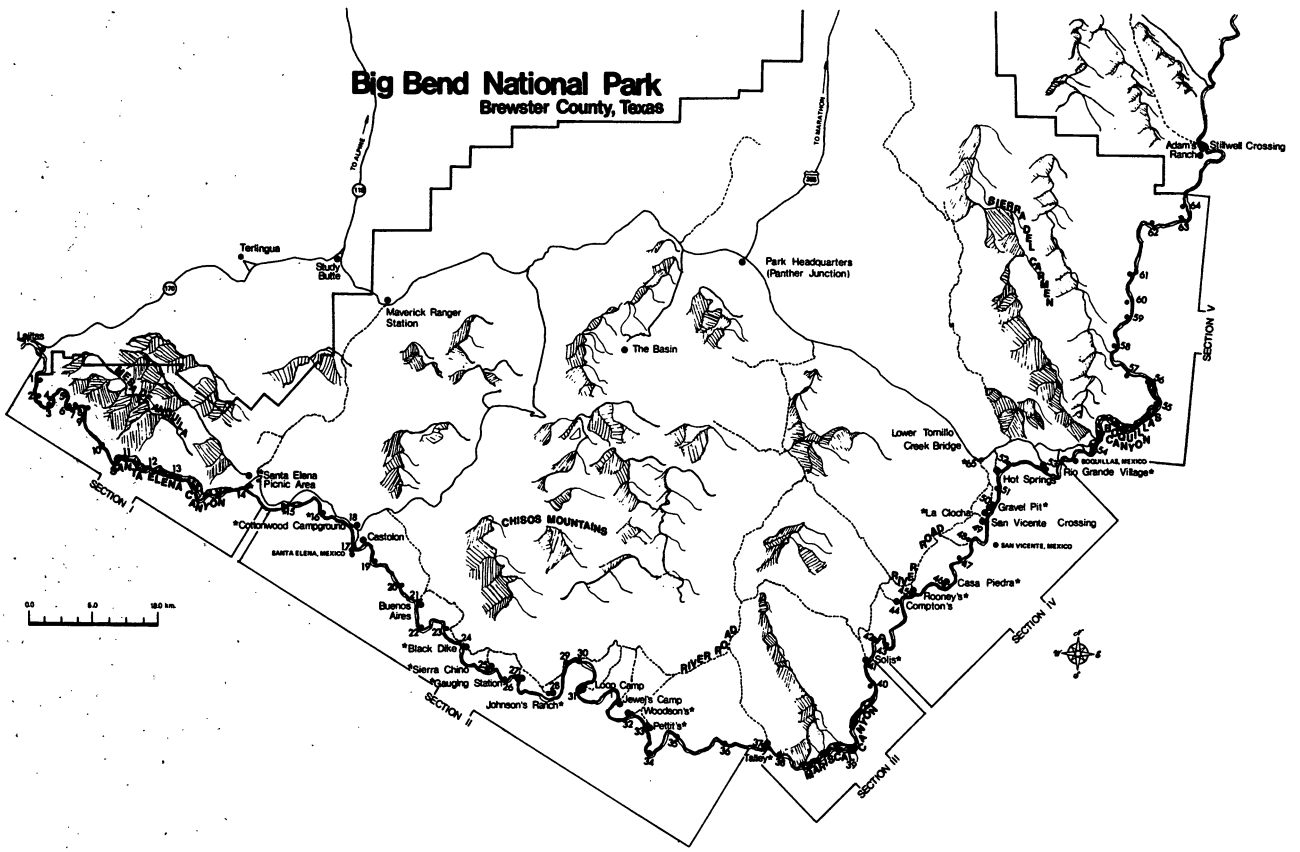

Figure 1.--*Map of the Rio Grande River corridor in BBNP showing the 64 riparian sites investigated during this study. Name places along the river represent backcountry campsites as designated by park officials. Sites with stars represent places where the rodent fauna was sampled. The five river sections discussed in the text are labeled.*

The river was divided into the following five sections based on the location of the three major canyons (fig. 1): I from Lajitas to the mouth of Santa Elena Canyon (including the canyon itself); II from Cottonwood campground to Talley; III from Talley to Solis (including Mariscal Canyon); IV from Solis to Rio Grande Village; and V from Rio Grande Village to the eastern border of the park (including Boquillas Canyon).

RIVER USE

Use occurs both throughout the park's backcountry and at three developed campgrounds where use is already carefully monitored. Use of the backcountry areas, however, is not clearly described by existing record-keeping procedures.

Because almost all of the river corridor lies in the backcountry, our analysis of visitor use patterns focused on backcountry use. Visitors to Big Bend are required to obtain a free permit from park headquarters or any ranger before camping at any backcountry area or floating the Rio Grande, which they turn in at the conclusion of their trip. The primary purpose of this backcountry information system is to facilitate visitor protection.

This system was used as the data base for establishing the extent, character, and patterns of use. The Park Service compiled these data monthly in three categories; nature road use (i.e., camping at primitive campsites with road access); backcountry use (nonvehicular); and boating use (including all forms of water craft). In our analysis, we separated backcountry use of the river from backcountry use of other areas and divided river use into float trips and nature road (River Road) use. Within these two categories, analysis yielded user group-, time- and place-specific information.

We recorded the data using three units of measure: (1) number of parties, (2) number of individuals, and (3) number of man-days. This provided a comprehensive view of use as well as insight into the best measure for establishing human impact. During the project study year (1975), the distribution of backcountry use is shown in table 1.

Table 1. *Distribution of visitors within Big Bend National Park backcountry areas in 1975*

	Parties	Total parties	Man-days	Total man-days
		Percent		*Percent*
Float trip	727	18.7	7,405.5	25.0
River road camping	849	21.8	7,151.0	24.1
Nonriver-oriented camping	2,318	59.5	15,124.5	50.9
Total	3,894	100.0	29,681.0	100.0

Table 1 shows that the Rio Grande attracts approximately 40 percent of total backcountry use (parties) while the desert and mountains account for nearly 60 percent. Using the man-days measure, however, the amount of river-oriented backcountry use is almost equal to the nonriver-oriented camping category.

Float trip and River Road camping patterns were analyzed further because these activities account for nearly all of the recreational use that is associated with the Rio Grande corridor in BBNP.

Float trip activity was broken down according to the functional river subsystems (fig. 1). The distribution of float trips across the 5 river subsystems in 1975 is shown in table 2.

The three canyons accounted for 69 percent of the total float trip parties visiting the Rio Grande Corridor in 1975 (table 2). The 25 percent figure for IV can be explained largely by short day-floats. Using the man-days measure, the three canyons collectively account for 81 percent of all float trips within BBNP. This is a better measure of the distribution of use and related impact on the river corridor because it reflects both the actual number of visitors and the time they spent on the river.

A seasonal dimension was obtained by breaking down use by month because of its value for on-site decision making. This time-and place-specific monitoring of data should signal management as to when use problems are likely to occur.

Table 2.--*Distribution of float trips throughout the Rio Grande subsystems in BBNP in 1975*

Section[1]	Parties	Total parties	Man-days	Total man-days
		Percent		*Percent*
I Santa Elena Canyon	186	22.1	1,637.7	22.1
II (between canyons)	50	5.9	278.7	3.7
III Mariscal Canyon	258	30.7	2,464.5	33.3
IV (between canyons)	210	25.0	1,130.4	15.3
V Boquillas Canyon	137	16.3	1,894.5	25.6
	841[2]	100.0	7,405.5	100.0

[1] See map (Fig. 1)

[2] Total does not agree with total number of float trip parties in table 1 because parties could have floated more than one river section.

The River Road camping category also was broken down on a site-by-site and monthly basis. Camping at designated primitive River Road campsites in Sections II and IV was concentrated at very few sites. Two River Road sites (Gravel Pit and Solis) accounted for 39 percent of total annual River Road site use (man-days) in 1975. Four more sites (Johnson Ranch, Black Dike, Talley and San Vicente Crossing) accounted for an additional 32 percent of total annual River Road use (man-days). Eight of the more remote River Road sites received less than 2 percent each.

Float trips occur mainly in Sections I, III, and V and River Road Camping is limited to designated areas in Sections II and IV except at two of the River Road campsites, Talley and Solis, which also serve as the put-in and take-out points, respectively, for the popular Mariscal Canyon Float Trip. Thus, these sites are the most heavily used areas of the entire back-country riparian corridor. In addition, they are areas where floating and car camping activities overlap.

SUBJECTIVE SITE EVALUATION

A subjective site evaluation sheet was developed as shown in figure 2. The four basic categories are: human impact (six different variables); livestock impact (two variables); site description (three variables); and wildlife characteristics (four variables). Each of the 15 variables is rated on a scale from 1 to 5: 1 represents the most desirable condition; 5, the least desirable condition. For example, 1 is assigned if no litter is present; 3 if litter is apparent; and 5 if litter is obvious everywhere. Scores of 2 and 4 are also possible. Totals were obtained for each of the four major categories. Thus, the total score for the human impact parameter could range from 6 to 30; 6 would indicate no human impact; 30 very heavy impact.

Data were obtained by visiting each of the 64 riparian sites. The number of visits per site varied from one to four and the number of persons filling out the impact forms varied from two to six. Scientists, students, and park personnel filled out the impact forms separately.

Statistical analysis of data provides a powerful "tool" upon which to base managerial recommendations. In working with large data bases, analyzing each variable individually becomes cumbersome and fails to account for the fact that variables often act together to affect a particular condition. For example, tabulation of the site evaluation sheets resulted in a large data base in the form of a 64 X 15 matrix (64 sites, 15 variables), which would be difficult to analyze by considering each variable separately. Multivariate statistics, however, allows one to analyze such a matrix by considering each variable for each site simultaneously. We used two multivariate approaches (cluster analysis and principal components analysis) to structure the site evaluation data base. The following two examples illustrate the utility of multivariate statistics in analyzing data for use in formulating managerial recommendations.

A cluster analysis was used to produce a phenogram that represents a grouping or ordering of sites (based on all 15 variables) closely connected by some relation and separated from other such groups by gaps. The cluster analysis (fig. 3) reveals three major clusters, A, B, and C. Cluster A includes those sites with high impact values; cluster B, those with intermediate impact values; and cluster C, those with

Observer: _____ Profession: _____

Date: __ __/ __ __/ __ __
day month year

River site (no.): _____

River side: M or A

Site class: A, B, C

PARAMETER	RATING	COMMENTS
A. MAN'S IMPACT		
Litter		
Trampling		
Rock moving		
Campfire		
Human waste		
Wood cutting		
TOTAL		
B. LIVESTOCK IMPACT		
Trampling		
Waste		
TOTAL		
C. SITE DESCRIPTION		
Access		
Shoreline vegetation		
Campsite potential		
TOTAL		

D. HABITAT TYPES (check those present)

_____riparian
_____dune
_____gravel beach
_____bench
_____talus slope

E. WILDLIFE CHARACTERISTICS	
Habitats	
Unique combinations	
Modifications	
Values and needs	
TOTAL	

Figure 2.--*Rio Grande ecological survey riparian community evaluation sheet.*

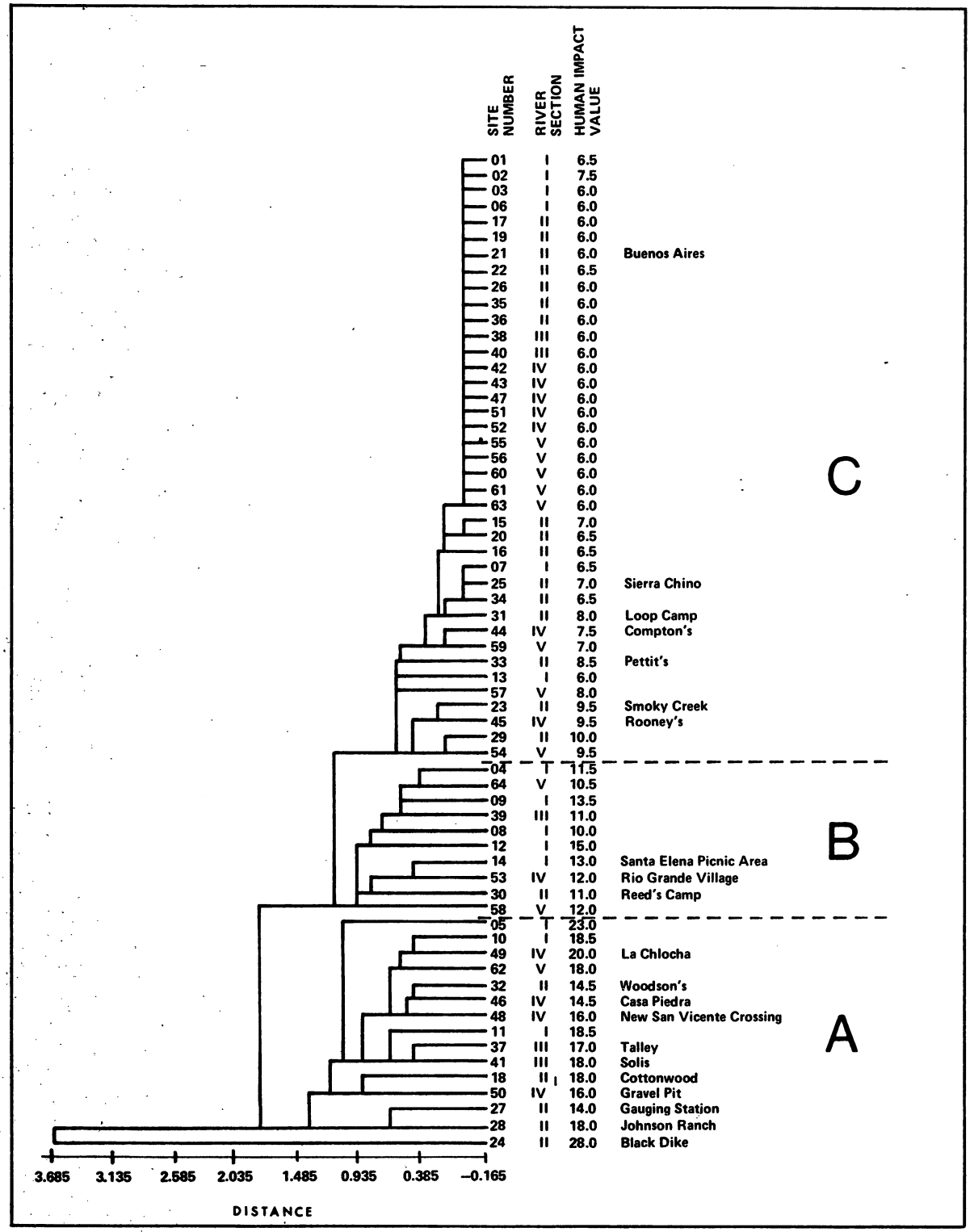

Figure 3.--*Phenogram of numbered riparian sites computed from distance matrices clustered by unweighted pair-group method using arithmetic averages (UPGMA). The major breaks in the phenogram are labeled A, B, and C. The river section and total human impact value for each site are also provided.*

low impact values. Of the 64 sites, 15 (23 percent) fall within cluster A; 10 (16 percent) within cluster B; and 39 (61 percent) within cluster C. Of the 15 sites in cluster A (heavily impacted sites), 11 (70 percent) can be reached by the River Road; whereas of the 39 sites in the least impacted cluster (C), only 7 (18.0 percent) are accessible by the River Road. So the cluster analysis reveals that (1) very few of the riparian sites may be considered heavily impacted; and (2) the majority of the heavily impacted sites are those that may be reached via the River Road.

Principal components analysis (PCA) was used to identify linear combinations of the 15 variables that account for the greatest amount of variation among sites. Principal components I and II account for 56 percent of the total variance and each of the sites is plotted with respect to these components in figure 4. Variables that load heaviest on component I (that is, those variables which account for the greatest amount of variation among riparian sites on this component) are those that relate to human impact and modification (table 3). Component II loads heavily on variables that relate to site description. The loadings for those variables reflecting livestock impact are very low on the first two components. This indicates that livestock impact accounts for very little of the differences among sites: hence, it is a constant along the entire river corridor. The major breaks along component I are depicted by lines A and B in figure 4. Sites to the right of A are the most heavily impacted ones and they correspond exactly with the heavily impacted sites in the cluster analysis. Sites between lines A & B include those that fall in the intermediate impacted category of the cluster analysis. Sites to the left of line B are those that fall into the lightly impacted

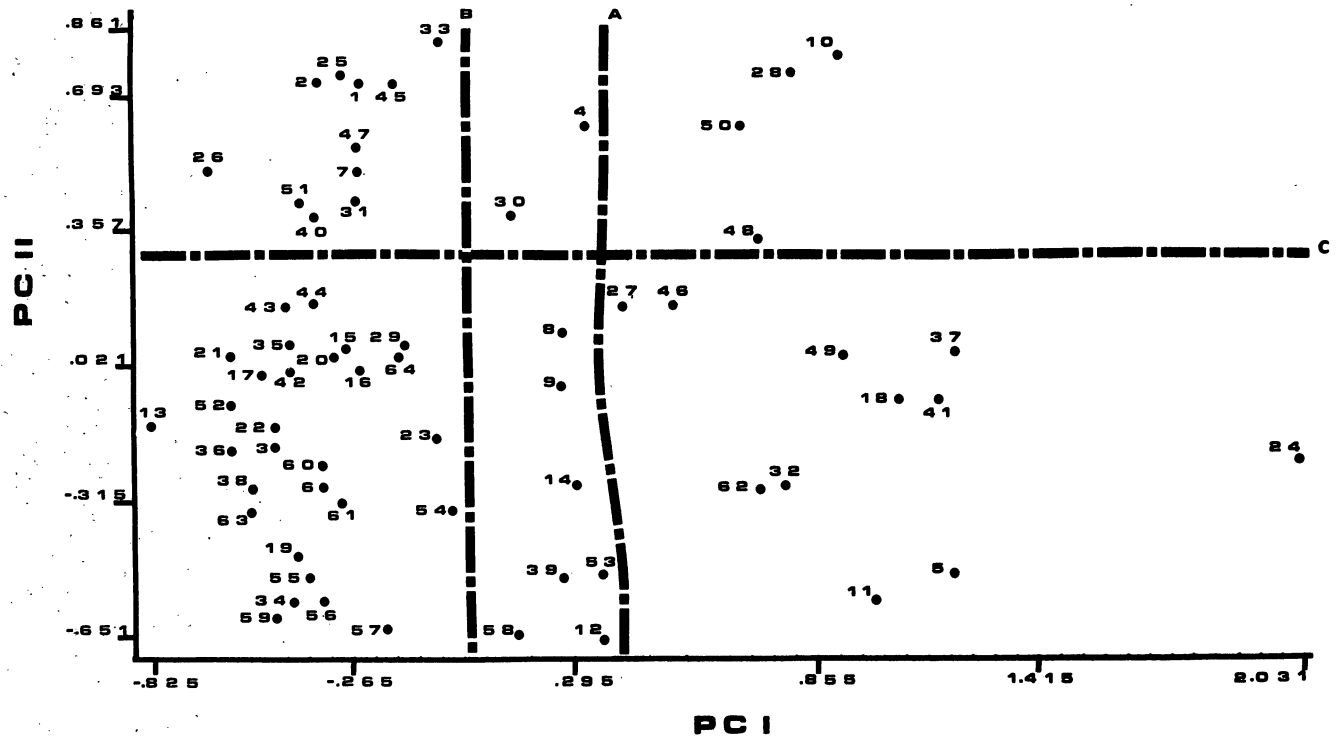

Figure 4.-- *Two-dimensional projections of the first 2 principal components illustrating the position of the 64 riparian sites. Each component represents linear combinations of all 15 variables in proportion to their importance in distinguishing sites. Lines A and B are positioned where the major breaks occur along component I; line C demarks the major break along component II.*

Table 3.--*Factor matrix (or loadings) from correlation matrix among 15 variables for the first two Principal Components. The higher the value for a particular variable the more important that variable is for distinguishing sites.*

Variables	Principal components I(37.44 percent)	II(17.92 percent)
Man's Impact		
Litter	.882	-.136
Trampling	.900	.064
Rock Moving	.864	-.077
Campfire	.868	-.110
Human Waste	.838	-.047
Wood Cutting	.821	.054
Livestock Impact		
Trampling	.305	.475
Waste	.351	.264
Site Description		
Access	.068	.865
Shoreline Vegetation	.148	.797
Campsite Potential	-.279	.763
Wildlife Characteristics		
Habitats	-.106	-.099
Unique Combinations	-.066	.432
Modifications	.851	.181
Values and Needs	.300	.390

cluster. The major break along component II is indicated by line C. Sites above this line have excellent campsite potential; sites below this line have poor campsite potential. Considering the two components together reveals a group of eleven sites in the upper left-hand quadrate of figure 4 that are characterized by having excellent campsite potential and low human impact.

Combining the results of the cluster analysis with that of PCA reveals the following: (1) Those variables that best discriminate riparian sites are those relating to human impact and modification. The sites may be segregated into three basic groups (lightly impacted, moderately impacted, and heavily impacted) on this basis. (2) Variables pertaining to livestock impact are poor discriminators of riparian sites; this indicates that this impact is a constant along the entire river corridor. (3) Very few of the riparian sites may be considered heavily impacted; of these, the majority are distributed along the River Road. (4) A group of sites can be identified that have excellent campsite potential yet very little human impact.

BIOLOGICAL RESOURCE

The biological resource monitored along the river corridor was the rodent fauna and vegetation. Rodents were chosen because: (1) the riparian habitat is the

only major vegetation type in the park in which rodents have not been intensively studied; and (2) rodent densities should be sensitive indicators of significant human and livestock impact. Rodent densities are strongly influenced by vegetative "cover" (spacing and size of the plants). Many types of human and livestock impact (especially trampling) tend to reduce cover. Hence, if severe enough, they could greatly influence the diversity and density of rodents. We sampled the riparian rodent fauna at 18 different sites along the river that exhibited varying degrees of human and livestock impact. Seventeen of these sites were designated as backcountry campsites along the River Road; the other site was located at lower Tornillo Creek bridge. Each site was trapped for 6 nights using 120 Sherman live traps (720 trap nights per site).

Twelve species of rodents occur in the riparian habitats of BBNP and the majority of these (9) are members of the families Heteromyidae and Cricetidae. The remaining three (porcupine, spotted ground squirrel, and beaver) either occur in numbers so small that they are seldom encountered or they are so large they cannot be adequately sampled with the techniques available to us. The total number of cricetid and heteromyid rodents captured at a particular site was used as an indicator of rodent density. Rodent densities (total catches) were then correlated with human and livestock impact values as follows (values represent Pearson Product-Moment Correlations):

	Human Impact	*Livestock Impact*
Heteromyid	-0.177	-0.321
Cricetid	.088	.152
Total	-.071	-.133

None of the correlations between rodent density and human or livestock impacts are significant. Hence, our data suggest that the present extent of impact along the river has not been great enough to significantly affect rodent densities.

MANAGEMENT IMPLICATIONS

Analysis of recreational use patterns or subjective impact alone is of little managerial importance. They need to be campared to determine if a significant correlation exists. The Pearson Product Moment Correlation Coefficient statistic was used to relate total subjective impact ratings by site to annual camping use by site (man-days). The analysis was only possible where we have permit data on use, namely, for the River Road sites. However, these sites are the only locations where significant use of the river corridor occurs. Analysis revealed a positive correlation significant at between the 0.02 - 0.05 (R=0.459) levels. This verifies that subjectively evaluated impact increases as use increases.

When impact and use data were related to biological data (rodent fauna studies), no significant correlations were yielded. The upshot of these two correlation analyses taken together is that site impacts have occurred as a result of recreational use, but not to the point where ecological conditions, as indicated by the biological health of rodent fauna, are in jeopardy.

This suggests that these correlations should be viewed in the context of "change" rather than "impact" (which implies damage). Any recreational use of a resource will result in some change in resource conditions. The critical task for management is to decide what is the acceptable level of physical-biological change. This requires a value judgement as to the *desirability* of changes that are anticipated or have already occurred; i.e., is there excessive deviation from the accepted standard of resource quality? And this acceptable level of change depends on the management objectives of the area.

Plugging study findings into this type of framework yields several observations. Subjective impact ratings do reflect change from natural ecological conditions, and the *relative* amount and type of change by sites. Correlation analysis links this change to levels of use intensity. The task remaining for management is to evaluate the acceptability of the situation that has been identified.

When viewed from a National Park Service-wide perspective, the total recreational use of BBNP and the Rio Grande appears very low. This might lead one to the casual and incorrect conclusion that

recreational impact on the river corridor is not really a problem. This study disaggregates possibly misleading total use figures into area-specific and time-specific data sets that indicate when and where changes exist within the river system and how serious the changes are. While it appears that existing changes have not yet reached the point of constituting serious ecological damage, the changes have been measured in terms of parameters that can be readily perceived by visitors and that are amenable to management. Hence, the observed changes, if deemed undesirable or excessive by management, can be reversed before they lead to serious damage.

Earlier, when total subjective impact scores for 64 river sites were clustered, 49 sites or 77 percent were in the moderately and lightly impacted clusters. Looking at the River Road sites, it is revealing to note that 10 of 18 are shown in the heavy impact cluster. These 10 are all generally related to convenient access; i. e., close proximity to a paved park road or special attractions like the entrance to Santa Elena, Johnson's Ranch, and Mariscal Canyon. Access can therefore be verified as a major component in explaining variation in human impact. While this verification should not be too surprising, it does emphasize the role access plays in distributing human impact.

These impacts can be controlled, shaped, or mitigated because access can be easily manipulated. This is particularly true in Big Bend where use of sites on the River Road is concentrated at 6 sites (accounting for 71 percent of total annual River Road use). Here a washed-out road may be naturally responsible for reducing use at one of the most impacted sites. Deliberate management strategy can have the same result. Use can be rotated among sites either explicitly through permit allocation or implicitly through ranger's suggestions when asked by a party where they should camp. Impacts can be reduced and distributed once management goals are established.

For example, we know how many River Road campsites are among the heavily impacted campsites (10 of 18). Further, principal components analysis indicates that the remaining River Road campsites all possess good campsite potential (also rated subjectively, figure 2) although they are lightly impacted. In other words, the spectrum of suitable campsites available to the River Road user includes 10 heavily impacted and 8 moderately or lightly impacted areas. Is this acceptable? What should the distribution be among the light, moderate, and heavily impacted clusters? Should there be no heavily impacted sites or should sites be equally distributed among these impact clusters? Once this is decided by management, we might know how to respond in terms of impact expected if, for example, the River Road is paved (as has been proposed). Clearly, given our understanding of the correlation of impact and use and the role played by access, increased use of all sites is likely to occur with associated human impacts. Further, human usage may increase to the point where use impacts are a source of significant ecological impact.

In the past, investigators have often done good, thorough research only to find that their results had little effect on resource management. This has occurred because researchers have failed to articulate their findings in terms that are useful to management personnel. It has been our goal to obtain the types of data that BBNP managers need and to present it in such a way as to serve as a useful input to normal managerial decision-making.

Consequently, our recommendations focused on suggesting ways to incorporate study findings into the process of determining management strategies that will achieve the objectives sought. Based on a review of pertinent literature relative to resource allocation decision-making, several critical decision points can be identified:

Decision 1.--Select management objectives
Decision 2.--Determine whether existing situation conflicts with management objectives
Decision 3.--If a discrepancy exists, select management tools and strategies to meet objectives
Decision 4.--Evaluate results of implementation of management strategies, including monitoring of environmental conditions.

Clearly, the selection of management objectives serves as the basis of the

entire suggested decision-making framework. This is the responsibility of NPS management personnel. Findings from this research, though, should play an important role as an input to Decisions 2 and 3, while additional research will be needed in the future before Decision 4 can be considered.

ACKNOWLEDGMENT

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PROBLEMS OF DEFINING AND MEASURING THE PREFERENCES OF RIVER RECREATIONISTS

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ABSTRACT.--The paper discusses seven broad types of problems experienced by the authors during their research on the preferences of recreationists using three rivers in Michigan. Those problem areas concerned the tasks of: selecting variables to be included in research designs; deciding which research approach is the best suited for particular purposes; designing sample plans; collecting data in the field; understanding the dynamics of human preference formation; defining the word preference; and specifying clearly the preferences to be studied. Recommendations for helping solve these problems are offered.

Most outdoor recreationists prefer to be near, in, or on water, including rivers, but their preferences are not easy to quantify. This paper discusses the principal problems we have encountered attempting to identify and measure the preferences of recreationists using three rivers in Michigan (Bassett *et al.* 1972 , Knopf *et al.* 1973 , Driver and Bassett 1975). Other researchers have experienced similar problems, so we make no pretense to be original. Instead, the objectives of the paper are to outline some of the familiar problems, and then discuss in detail two related areas that we believe are more complex in river recreation research than is commonly recognized. These problems are defining clearly what is meant by the word "preference" and specifying the precise types of preferences that are being measured. We will begin with a brief overview of five problems common to all researchers: selecting appropriate variables, deciding how to measure variables, designing an efficient sampling scheme, collecting data in the field, and gaining an adequate background understanding of human preference formation.

SELECTING VARIABLES

Water-based recreation, especially on rivers, encompasses great diversity in use and in users. This diversity poses unusual problems in experimental design, particularly in identifying appropriate variables to measure and in devising ways to measure them. For example, recreation-related river uses include many activities such as different types of fishing, various kinds of boating (including water skiing), swimming, ice skating, waterfowl hunting, and various shoreline activities, including picnicking and viewing. This list of uses is compounded by the fact that some activities are not uniform with respect to when they occur (time of day, day of week, or season of year), where they occur (on shore, or in or on the water), and in skill or equipment required. For example, in our current Huron River study we have found it difficult to differentiate a river user from a user of the shoreline facilities in the Huron-Clinton Metropolitan Authority's parks that border on that river.

Moreover, the users themselves differ with respect to age, sex, income, stage in family-life cycle, occupation, education, home and work environment, distance travelled, and past-experience level. Also, it matters whether users are local residents or tourists, and whether they choose a recreation area as their primary destination or merely as a stop while passing through on their way to another spot. These differences among users cannot be ignored because they influence the preferences of those users.

A matrix that includes all combinations of uses and users in a river recreation system will contain more variables than any researcher can afford to sample. The dilemma is deciding what to omit, because the researcher knows full well that omitted variables can influence not only the scope of the research but its quality as well. For example, we found that group size was an important predictor of preferences on the Au Sable River, where many of the canoeists were members of sponsored, organized groups. Had we not determined group size and membership, useful information would have been lost.

MEASURING VARIABLES

Most recreation researchers agree that the preferences of river users should be measured by different research approaches that can serve as cross-checks on each other. Despite this agreement, it is difficult to decide which method of gathering data will give the most valid results in a particular situation. Also, it is difficult to assure that cross-checks will be made because of budget and time constraints and the inability of any one researcher to be knowledgeable about all of the research approaches and the theories behind them. For example, three broad types of research approaches have been identified (Driver 1976b). These consist of techniques that measure: (1) verbal-worded responses, such as those made to a questionnaire; (2) overt nonverbal responses, such as observable behaviors that reveal preferences (e.g., time spent by people doing something, or evidence of trampling at a site); and (3) physiological measures, such as pupillary dilation, pulse rate, or perhaps even brain waves, to correlate preference states with physiological responses.

In our river recreation preference studies, we have relied heavily on the use of questionnaires, despite the many problems associated with their use. We have, however, collaborated with other researchers using other techniques such as User Employed Photography (see the paper by Cherem and Traweek in these proceedings) and have gathered some preference data by unobtrusive observation of the users' on-site behaviors.

SAMPLING

Generally the total population of recreationists is so large that it must be sampled. The many kinds of recreation associated with a river, coupled with the high variability in users themselves, combine to make it difficult for the researcher to design a simple random sample or to stratify the sample and estimate how many samples to take in each stratum. Ideally, pilot studies should be conducted to estimate variability of response data, but they often are too expensive simply to be used for designing sample plans. Our approach has been to design our sample plans, using the most reliable information available, and then modify the design after sufficient samples have been collected to make adjustments in the sampling schedules.

Sampling designs that are not modified to reflect information gained after sampling has begun can produce results that are not representative of the preferences of the user population being studied. For example, it might be discovered that some river recreationists tend to cluster, such as in flotillas of canoes or on rafts. Depending upon how they distribute their questionnaires or otherwise measure preference, researchers faced with this situation must decide whether to adjust the sampling frequently and whether to employ cluster-sampling techniques. Another common situation that influences the representativeness of the results occurs when a male-female couple answers a questionnaire together, rather than individually. One "togetherness" response is not the same as one male or one female response.

COLLECTING FIELD DATA

The problems of sample design, although difficult, often are less perplexing than the implementation of the design in the field. For example, we have found that trout fishermen are difficult to contact or even observe because they are in the stream and tend to be active at night or early in the morning. For other recreationists, measurement is often difficult even during the day. Often leaders of raft parties or groups of canoeists, particularly those working for commercial outfitters, may not want interviewers to delay a trip. Moreover, efficient data collection is complicated by the fact that some uses are concentrated in time, such as on weekends or during certain times of the day, or in space, such as at crowded access points.

These field problems frequently require changes and innovations in techniques and scheduling which, in turn, can affect the quality of the information being collected and bias the results. For example, to adequately sample a group of canoeists being rushed by livery personnel into a pickup vehicle at a takeout point, a researcher might have to use a mail-back questionnaire (and possibly get a lower response rate) rather than having the questionnaire filled out on-site. Or sampling frequencies might need to be adjusted to accommodate increased numbers of users at unexpected times, which might result in an insufficient number of responses during periods of low use.

UNDERSTANDING THE DYNAMICS OF PREFERENCE FORMATION

The processes by which people form and pursue their preferences are complex and dynamic. For example, it is known that recreation preferences are influenced by various variables in home and work environments and by things that happen while the users are travelling to the site or while they are actively participating on-site. For these reasons, recreation researchers interested in preferences must have a reasonably good understanding of the dynamics of human behavior. Obtaining this understanding can be difficult, however, because there are many theories of human behavior, including choice behavior. To help solve this problem, we have adopted the rather generic "problem-solving" model of human behavior (Knopf *et al.* 1973 , Driver 1976b).

The model is a simple one that views man as a complex information-processing and problem-solving organism. Within the model a problem state is defined simply as *a gap between a person's existing state and a relatively more preferred state.* Therefore, any life situation is posed as a problem when such a gap exists, and the problem is solved as the gap is closed. The advantage of the problem-solving orientation is that it makes the concept of preference less static; it forces us to think about the dynamics of problem-solving behavior.

The dynamic nature of human problem-solving has been discussed by several authors. For example, Miller *et al.* (1960) suggest that human problems are resolved either by habitual or heuristic (trial and error or searching) behaviors. Habitual behaviors are ingrained from learning (or from successful problem resolution in the past). White (1959) argues convincingly that repeated mastery has a lasting effect that prompts us to achieve higher levels of competence or mastery in a particular problem situation. This is relevant to recreation preference studies because past experience levels do influence preferences, for activities such as skiing, hunting, fishing, playing chess, or white water canoeing. In contrast, heuristic behavior is employed to resolve novel problems and involves much exploration and seeking of new situations. Obviously, both habitual and heuristic behaviors are dynamic, and one would expect the preferences of the first-time user to differ from those of the repeat user. In fact, our research indicates that researchers studying the preferences of river recreationists must be aware of differences between first-time and repeat users. The first-time user seems to have less predictability than the repeat user about the specific types of satisfactions expected and desired. But even first-time users have considerable information gained from friends and other sources.

Although levels of past recreation participation do influence recreation preferences, other variables also affect the dynamics of preference formation to a great degree. One category includes the so-called "individual difference" variables, which include user characteristics such as age, sex, income, and education (Driver 1976a). Another category is the so-called "intervening" variables, such as the changing influence of the weather, work conditions, and peer groups on recreation-related preferences. Recreation researchers must be familiar with these influences so they can either control or test for their effects in specific research designs. The absence of such controls may limit the utility of the results and can introduce bias.

Finally, an understanding of the dynamics of recreation behavior clarifies the need for the researcher to (1) define clearly what is meant by the word preference and (2) understand the various behavioral components of human preferences. These problems are discussed in the following section.

DEFINING PREFERENCES

A pervasive difficulty in measuring preferences of recreationists is defining

how the word "preference" is used as a variable in a research design. Everyone has an intuitive understanding of what the word means, but if a group of recreationists were asked to explain their concept of preference, they would cite several ideas such as aspiration, demand, desire, expectations, things to be satisfied, value rankings, wants, and perhaps motivations and needs. Survey researchers must therefore be extremely careful that the words chosen to define preferences probe the *same* concepts of *all* the respondents. Otherwise, several preference variables--rather than one variable--are being measured. For example, if the words expectations and values are used synonymously in a questionnaire, the researchers would be tapping at least two different concepts and would never be able to determine what percent of the respondents made which type of interpretation.

To help resolve this definitional problem, we have found the literature from motivational psychology, especially that on Expectancy-value theory, to be useful (Birch and Veroff 1966 , Atkinson and Birch 1972 , Lawler 1972). These psychologists have suggested that behavioral tendencies (or preference states) are influenced by four different but related components: the incentive component, the expectancy component, the availability component, and the motive component.

The incentive component is defined as the value or the relative importance attached to the consequences of a behavior. For example, one type of user might value solitude more than another. The expectancy component relates to a subjective appraisal (probability) that a particular thing, object, or event will gratify a particular preference to which value is attached. For example, a fisherman might value the solitude of a particular stream very highly but realizes that the stream is used by more canoeists than he prefers. Although he would expect to realize less solitude on his preferred stream than from an alternative stream, he might still go to the more congested area because of other constraints. This leads us to the availability component, which is articulated as the perceived constraints on one's ability to pursue alternative preference states. These constraints deal with time, income, skill level, physical ability, or the supply of recreation opportunities. The final component, or motive, identifies the influence of one's personality dispositions on behavioral tendencies. For example, a highly anxious person might have a different preference for risky recreation activities than a less anxious person, or an introvert might have a different preference than an extrovert regarding social settings in a recreation environment.

Knowledge of the four factors that influence behavioral tendencies can help us define our preference variables better in river recreation research. For example, it is important (particularly for some activities) not to confuse expectations with values--they differ.[1] If the research is designed to quantify expectations, then its focus should not be on values and vice-versa. Also, even though past satisfaction will affect the incentive or value component of preferences, it should be recognized that observed or self-reported levels of satisfaction are not always the same as preference, especially if *preferred types of satisfactions* are not being studied. One can be recreating in a nonpreferred area and be satisfied, but have a strong preference for an alternative area if conditions were such that the alternative were a real choice. Preferences and perceived satisfactions frequently do agree across large numbers of users and over time, else the users would leave the market for those particular areas. Nevertheless, one must be careful when interpreting information on satisfaction levels. Such information might or might not reflect preferences.

Finally, in this section, the problem of measuring latent preferences should be mentioned. Economists talk of revealed and unrevealed demand, with revealed demands being those that can be observed through behaviors such as the paying of a price. Recreation planners have called the unrevealed demands "latent demands." In the public sector, especially, the unrevealed preferences or demands are a relevant concern because these nonusers are paying their prices through taxation. If

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1 Economists and other decision theorists have long separated expectations and values (or utility) when discussing decision processes under conditions of risk (or limited information). Their concept of "expected utility" is well documented (Luce and Raiffa 1957, Von Neumann and Morgenstern 1947).

preferences are equated with satisfactions or with revealed demands, these latent demands have been ignored. Admittedly, these latent demands are difficult to quantify, but that is no reason to forget about them.

SPECIFYING TYPES OF PREFERENCES

The previous discussion emphasized the need to specify what dimensions of a preference are to be studied. Equally important is the need to define precisely what *types* of preferences are to be studied and how *general or specific* the preferences are. For example, are the preferences: (1) rather broad (or general) and define desires for river-related recreation activity opportunities; (2) more specific, such as for the attributes (characteristics or features) of the physical setting of a river, of its social setting, or of management actions that define a quality activity opportunity in the minds of the users; or (3) quite specific with respect to well defined types of satisfying experiences that are both expected and desired? It is difficult to study all of these or other preferences in one study without overloading the respondents, the research budget, or the researcher!

The specificity needed in preference studies raises challenges to the researcher. In the face of limited information on most river users, it is not easy to decide which type of preference information is most important. Also, gaining the needed specificity requires a good acquaintance with the theory and methods of the social and behavioral sciences. Finally, a part of the knowledge needed to gain the specificity is not found in "books," but comes only from experiences based on trial and error attempts; the state of the art is still growing.

SUMMARY AND RECOMMENDATIONS

Research on the preferences of river recreationists is complex for several reasons. Seven problem areas identified in this paper were:

1. Selecting variables to be included in research designs.
2. Deciding which research approach is the most appropriate for measuring the selected variables.
3. Designing samples and implementing field designs.
4. Collecting preference-related information in the field.
5. Understanding adequately the dynamics of preference formation.
6. Defining precisely what is meant by the word preference.
7. Specifying the type of preference that is to be studied.

Although our discussion of each problem area indicated that there are no easy solutions, we *can* offer a few suggestions or recommendations.

Common to our discussion of each problem was the idea that great care must be taken to define variables precisely when designing studies. In particular, we recommend that the specific types of preferences studied be clearly defined. Along that line of thought we urge for a greater separation of: (1) expectations (which are subjective "probability" estimates that certain values will be realized); (2) incentive values (or the importance attached to particular consequences of recreation behavior); and (3) specific satisfactions (which are the pleasurable experiences that occur *after* revealed preferences have been reflected by paying a price, travelling certain distances, or allocating other resources, such as time, to a particular recreational engagement). By clarifying our variables better, research will obtain more useful information on what is expected and valued, and we will learn more about instances when preferences and actual satisfactions do not agree. Also, through greater specificity of our variables and a clear stratification of preferences by different types of users, environments, and uses, we will be better prepared to determine which types of river-related recreation opportunities should be provided for whom, where, when, by whom, in what amount, and at what price. And in the process, we will achieve a better standardization of measures and variables, which will enhance our ability to make comparisons across different studies.

In addition to care in research designs, good understanding of the theory and methods from the social and behavioral sciences seems necessary for recreation preference studies. Efforts by researchers in the social and behavioral sciences are encouraging in that they reflect increasing agreement about user preferences and behavior. Yet, we need additional cross-checking studies based on

different procedures and more replications of particular designs to see if results are consistent over time and space. Also, the growing practice of researchers to send preliminary drafts of research proposals and manuscripts to peers and managers for review helps solve problems through sharing of knowledge and experiences. Finally, as a recommendation, we suggest that all researchers work closely with local managers in all steps of the research process, including application of the results.

In a nutshell, our recommendations are for: greater care in research designs; a better understanding of the social and behavioral sciences by both researchers and managers; more studies using alternative procedures as cross-checks; more replications of studies in time and space; greater use of peer and manager review of research proposals and manuscripts; and close cooperation between researchers and managers, from hypothesis formation to application of the results.

METHODS USED FOR EVALUATING RECREATIONAL RIVERS IN CANADA

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ABSTRACT.--Reviews techniques for describing and evaluating recreational rivers in Canada. It considers methods developed and/or tested in Canada, and methods developed elsewhere that have been applied in Canada.

Most usable methods for evaluating recreation resources have been developed since about 1955. Searth (1970) reviewed most of these methods developed in America and Canada to 1970, and did not report any methods published in Canada before 1961. The following reviews methods developed in Canada since then to describe and evaluate recreational rivers.

EARLY EFFORTS

In a report to Resources for Tomorrow Conference, Baker (1961) presented a comprehensive overview of government activities related to the provision of opportunities for outdoor recreation, and suggested a national program for inventory of recreation resources. He did not discuss recreational use of rivers, and did not identify specific needs for inventory and evaluation of recreational rivers. In 1963, Baker prepared a report on recreation resources of Manitoba (Committee on Manitoba's Economic Future). Rivers were considered almost entirely in terms of opportunities for fishing and waterfowl hunting. The Resources For Tomorrow Conference led to the Canada Land Inventory program, which included an inventory of recreation resources. Four evaluation methods were produced in connection with the Canada Land Inventory program.

Method of W. M. Baker

W. M. Baker (1964) proposed a method of recreational classification consisting of two parts: (1) shorelands of lakes (and large rivers) and (2) uplands. The methods suggested for shorelands produced detailed descriptions of the foreshore, beach, and backshore which would be useful for site planning for such uses as swimming beaches, campsites, and cottage areas. The method for uplands consisted largely of classifications of topography and landforms. It did not include a classification of water courses. There was no method for recreational evaluation of rivers.

Method of Hart and Graham

The method of Hart and Graham consisted of three major parts: (1) delineation of "texture regions", based on local relief, landforms, drainage, and other criteria; (2) mapping of physical limitations to recreational uses; and (3) classification of the general capability for recreation, using five quality classes (Acres Company 1965). The delineation of "texture regions" was of no value for river recreation. Of the 10 "limitations to recreation", the following could be related to river recreation: water deficit, inundation or overflow, monotony or lack of contrast in landscape, volume of water, shoreline of water, shoreline quality, and water quality. These limitations were considered in some detail. The final evaluation of recreation potential was made in terms of a variable mix of recreation activities appropriate to an area. Rivers were not evaluated separately, but as contributing to the quality of areas in which they were found.

Canada Land Inventory Method

A method originally proposed by C. S. Brown was selected for use in the recreation sector of the Canada Land Inventory (CLI) (Canada Land Inventory 1967). This was essentially a mapping system, and the map

was the only product. In terms of the evaluation of rivers for recreation, the most distinctive feature of the CLI method was that water courses and water bodies were not evaluated and mapped directly for their recreation potential: "The recreational value of the water body accrues to the adjoining shores".

The CLI method started with the division of nonwater areas into "land units", based largely on physical criteria but also on their value for recreation. The next step was to assign to each "land unit" from one to three "recreation features"; the latter were defined as "an aspect of a land unit providing opportunity for recreation" (p.5). Twenty-five "recreation features" were used:

Angling
Beach
Canoe Tripping
Deep Inshore Water
Vegetation
Waterfalls and Rapids
Glacier
Historic Site
Gathering and Collecting
Organized Camping
Landforms
Small Surface Waters
Lodging
Upland Wildlife
Cultural Landscape Pattern
Topographic Patterns
Rock Formations
Skiing Areas
Thermal Springs
Deep Water Boat Tripping
Viewing
Wetland Wildlife
Miscellaneous
Family Boating
Man-Made Features

A 7-part rating of capability was used, ranging from (1) very high to (7) very low. The basis for capability rating was supposed to be "the quantity of recreation which may be generated and sustained per unit area of land per year under perfect market conditions". The final step was to present the relevant information for each "land unit" by means of letter and number symbols.

One of the most serious defects of the CLI method is that it does not provide an adequate picture of the recreational capability of any region in terms of specific activities or groups of activities (Hamill 1977). Each small area (land unit) is evaluated in terms of from one to three "recreation features", and the result is a chaotic representation of recreation capability. The problem is aggravated by the fact that water areas are not evaluated directly.

Method of Ontario Recreation Land Inventory

The Ontario Department of Lands and Forests has for many years been engaged in a program of land evaluation, using methods developed by A. H. Hills (1961) (based on earlier work by J. O. Veatch). Climate, slope, soils, moisture relations, and other site factors were used to delineate different levels of land classification, including areas small enough to be used for forestry planning. The Ontario Land Inventory (Ontario Department of Lands and Forests 1968) used a modification of the Canada Land Inventory method, and applied it to areas already delineated by use of the Hills method of site mapping. These smaller units were used in place of the "land units" used in the CLI method.

The concept of "recreation feature" of the CLI method was used with some changes in terminology and definition. The most important difference was (1) detailed mapping of shorelands and (2) separate evaluations of the recreation capability of lakes and large rivers.

The Ontario Recreation Land Inventory used what is probably the most complete available method for describing and evaluating shorelands for potential recreational use. The backshore, shore, and nearshore water of lakes and large rivers were evaluated in detail and the results presented by means of complex consecutive numerical codes. Water bodies, lakes, and large rivers were evaluated for boating and other water-based recreation. Water bodies were normally ranked for boating, viewing, and angling. In addition, some water bodies were ranked for yachting.

DEVELOPMENTS AFTER 1967

Most of the Canadian developments of techniques for analysis of recreational

rivers since 1967 have been related to "wild rivers", or their equivalent. The most important of these were the attempts to use the methods of L. B. Leopold, by Parks Canada and the Province of Manitoba. Newbury and McLeod (1973) developed a useful typology of riverbank landscapes for the area between Lake Winnipeg and Hudson Bay. Most of the other developments have been refinements of existing descriptive methods.

Parks Canada Wild Rivers Surveys

According to Juurand (1972a), the Canada National and Historic Parks Branch considered several possible methods for evaluating wild rivers: a method developed by Water Resource Engineers, Inc. (1970), the method of Dearinger (1968), the method of Morisawa (1971), and the method of L. B. Leopold (1969). The latter method was chosen.

In the summer of 1971, 16 students canoed 3,300 miles on 15 major rivers in the Yukon Territory. Two kinds of information were produced: unstructured descriptions and evaluations of the rivers, and Leopold's rating for (46 factors) at locations where there were "observable changes" in the river or the landscape. In total, 136 sites were chosen for application of the Leopold technique. At each site, one of Leopold's rating forms was filled out. In the office, "uniqueness ratios" were calculated for physical characteristics, water and biologic characteristics, human interest characteristics, and all factors. Each of the sites was ranked separately for each of these four sets of "uniqueness ratios".

According to the "Summary Report On The Wild Rivers Survey, Yukon Territory, 1971" (Juurand 1972b), problems were encountered in interpreting and using the calculated "uniqueness ratings", and the rankings derived from them. Experiments were made to try different ways of combining factors for calculating uniqueness ratios and for ranking sites. In addition, "desirability scores" were calculated by rating selected factors in ways that consistently reflected preferences for esthetics and recreational opportunity.

There were serious problems associated with the selection of sample sites and the collection of data with Leopold's method, the most important of which was interpreting and using "uniqueness ratios" (Juurand 1972a). In spite of these unresolved problems, it was recommended to continue using the Leopold method. A revised version of the method was applied in 1972 and 1973.

The kind of information produced by the wild river surveys of Parks Canada in years after 1971 is shown in, "Description and Analysis of Scenic Resources Along the Churchill, Sturgeon, Weir and Clearwater Rivers (Juurand 1974). This report begins with a short verbal description of stretches of each river. The more technical part of the inventory is based on the revised method used in 1972 and 1973. The river was divided into sections, each designated by a number. These sections were from 25 to more than 100 miles long. They contained one to more than six survey sites. At each site, a rating form was completed, and the following information was used to rate the scenery for the section: water pattern, ratio of river width to valley width, ratio of highest visible point to valley width, vertical view confinement, sample type (reason for choice of campsite), crew rating of preference or quality, miles to next site. "Water pattern" included smooth, surges, waterfall, and rapids. Several other criteria and some simple statistical procedures were also used.

Although the Wild Rivers Surveys of Parks Canada used forms based on L. B. Leopold's technique in 1971, 1972, and 1973, most of the recent reports of results of these studies have been descriptive, and have not included any statistical analysis of data.

In 1974, Parks Canada began to issue illustrated guides to selected Wild Rivers in different parts of Canada. Thus far river guides have been prepared for 10 areas: Alberta, Saskatchewan, Central British Columbia, Northwest Mountains, Yukon Territory, The Barren Lands, The James Bay/Hudson Bay Region, Southwestern Quebec and Eastern Ontario, Quebec North Shore, Labrador, and Newfoundland. These guides are essentially trip descriptions for canoeists for selected rivers and are similar to trip descriptions by many private persons and clubs; they use no distinctive techniques of analysis or presentation.

Juurand, Guzelimian, and Beaman (1974) used some of the data produced in the 1972 Wild River Survey in an elaborate statistical analysis. The 1972 Wild Rivers survey used a modified version of the inventory form used by Leopold. For each site surveyed, a form was completed that listed a number of characteristics of water, banks, vegetation, and other phenomena. The authors used three methods of statistical analysis (linear regression analysis, analysis of variance, and automatic interaction detector model) to extract from the completed forms some information on the relation between the overall judgment of site quality and the individual site factors for which information was collected.

Most of this large report is concerned with the technical details of the three types of analysis used, and discussion of the findings. The authors concluded that the Automatic Interaction Detector (AID) model provides a better analysis of this kind of data than does either the linear regression analysis or analysis of variance. They also claim that the AID model has wide potential application in environmental research.

The 1972 Wild Rivers Study was not designed to investigate how canoeists evaluated river sites. Therefore, the information that was collected at each site was not designed to provide an adequate investigation of this question. In addition, there appear to have been problems of variability in data collection due to incomplete standardization of definitions and procedures. Different results likely would have been found if the initial data collection had been designed specifically to answer the question of how recreational canoeists evaluate a river. Therefore, the results of this study may be considered as indicative, not definitive.

Method of Peter Jacobs

Peter Jacobs (1973), a landscape architect, proposed to Parks Canada a method for evaluating routeways, and applied it to the Chambly Canal in Quebec. The actual survey of the Chambly Canal is described in eight pages of text and three maps, and attention will be limited to this part of the report.

Jacobs starts with a description of the "paths" in the study area (following Lynch 1960), and of how they differ in summer and winter. He refers to three types of boundaries--spatial, activity, and time--and gives examples of each in the study area. The effect of these zones and boundaries on the "legibility" and "congruence" of the area is discussed. Examples of "visual cue dominance" include landforms, water form, and build form. This method provides largely an abstract visual analysis of a routeway, and it requires advanced design skills to understand and use this type of information effectively.

Method of G. B. Priddle

Priddle (1974) proposed to Parks Canada a method for evaluating routeways that could be applied to recreational waterways. The introductory discussion proposed the use of five quantitative methods for determining potential of a routeway for special designation: "landscape potential" of the total route, "landscape potential" of each segment, "visual attractiveness" of each segment, "meaning" of each segment, "visual attractiveness" and "meaning" for each segment, considered together. The formula actually given in the later field manual produces an average for the whole route of the quality estimates made by the observers (as a group) for each segment.

The report consists mainly of a proposed "Landscape Field Manual", in four sections. Section 1 concerns the physical mapping and evaluation of routeways. The actual field mapping of routeways emphasizes "the envelope", "visual penetration", and "sites of interest", and seems to use concepts and procedures proposed by Litton in 1968 and 1973. A six-part quality rating is recommended for rating each segment of the route. A set of management prescriptions is then discussed, including screening, thinning, preservation, conservation, and enhancement. Viewpoints would be identified and evaluated, using Litton's 1973 report on *Landscape Control Points* as a guide.

Section 2 is concerned with "user response to routeway landscape". A number of alternative ways of determining 'user response' are mentioned.

Section 3 is concerned with determining the effect of traffic composition and volume on user response to the routeway. Ways of obtaining this information are identified and discussed briefly. A questionnaire was used to elicit this type of information as well as that required for Section 2.

Section 4 is concerned with economic and political feasibility. There is a short discussion of some of the factors that might affect economic and political feasibility. A "priority rating form" developed by the U.S. Department of Commerce (1966) is recommended. The last part of this report contains specific instructions for carrying out many of the steps mentioned in the body of the report. Many of the procedural questions arising from the wording of the text are answered in these instructions.

Method of R. A. Hooper

Hooper (1975), reported on tests of several methods for evaluating waterways for canoeing, and recommended one of them. His field study was conducted in the Gammon River drainage, and connecting waterways, east of Lake Winnipeg.

Most of this thesis reports the use of a combination of methods to describe and evaluate the study area for wilderness canoeing. A variant of the method of Craighead and Craighead (1962) was used to estimate the overall recreational "value" of part of the area for wild river canoeing. A shoreline landscape classification, based on the classification developed by Newbury and McLeod (1973), was also used. There was an additional classification of "landscape features" included water features, shoreline features, hills visible from the water, and other features near the water. A "water flow rating system" included four categories of water state (slow or standing, slow turbulence, riffles, rapids and chutes), as well as the six-part "International White Water Rating System". Portages and places where canoes had to be moved by hauling, lifting, lining, and other means, were also rated. There is considerable overlap and repetition in the phenomena inventoried in these different methods.

Taken together, the combination of methods used by Hooper can provide much descriptive information about a recreational waterway. The simple addition and averaging of quality ratings can provide useful summaries of information about selected factors and groups of factors. But the more elaborate numerical procedures proposed by Hooper do not produce useful information, and are probably technically invalid. The initial objective of developing accurate numerical evaluations of recreational potential and scenic quality of waterways was not met. None of the tests reported in this thesis can be considered conclusive, except perhaps for the test of the utility of the Leopold method, because of the failure to use systematic testing procedures.

Prairie-Badlands Inventory Method of Patricia L. Olson

Patricia L. Olson (1976) reported a study of the scenic and recreational resources of the Milk River Canyon in southeast Alberta. She tested the methods of L. B. Leopold (1968), Parks Canada Wild Rivers, (Juurand 1972a), and Morisawa (1971). These were judged not to provide satisfactory results and an alternative method was proposed.

The Prairie-Badlands Inventory Method of Olson is applied to the visual corridor along the river. It consists of four parts: (1) scenic inventory, (2) feature inventory, (3) hydrologic inventory, and (4) shoreline typology.

The "scenic inventory" used, for evaluation, the "characteristic landscape", variety and contrast in the landscape, and visual distance zones, taken from USDA Forest Service sources (Litton 1968; USDA Forest Service 1973a, 1974c). The "feature inventory" identified the presence of named landscape features occurring in the study area. The "hydrologic inventory" identified selected hydrologic features judged to be important for recreational use or scenic quality, including stream hydrographs. The "shoreline typology" included four shore types.

Three checklists were used to collect the information relevant to each of these classifications. A field evaluation form was used to identify and rate selected landscape features visible from the river. Three

types of maps were produced: (1) characteristic landscapes and variety classes, viewpoints, and panoramas, (2) landscape features, vegetation patterns, vegetation species, and wildlife habitat; and (3) shoreline units and river features. Olson used numerical quality scalings for selected landscape features. A number of simple statistical techniques were used to summarize and present the data collected.

Apart from the simple (four-part) classification of shore types and the forms used for collecting data, all of the concepts and procedures used by Olson were previously available in published or unpublished sources.

Navigable Mountain River Study of Parks Canada, Western Region

This study of potential recreational rivers in the western National Parks of Canada was begun in 1974 and is scheduled for completion in 1977. An earlier phase of the study identified 11 rivers that were potentially suitable for recreational use: Belly, Waterton, Bow, Kootenay, Vermillion, Kicking Horse, North Saskatchewan, Sunwapta, Athabasca, Miette, and Fiddle. Detailed studies are now being conducted on these rivers to provide the information needed for policy formation and management, as well as information useful to recreational users.

CONCLUSION

The methods reviewed document the development of methods describing and evaluating recreation currently available in Canada. Although many of these methods are not widely known, they nevertheless represent the current state of the art in the few government agencies involved in current planning for the future use of recreational rivers. Taken together, these methods include a number of procedures that identify, describe, and evaluate those phenomena most important for the visual experiences associated with recreational boating. The evaluation of opportunities for recreational boating activities is not as well developed, and does not seem to have advanced much beyond techniques available in 1962. The persistence of attempts to use the method of L. B. Leopold, in spite of its many demonstrated defects, is one of the most interesting features in this historical process. Another interesting development is the apparent decline in attempts to use elaborate quantitative methods, and the apparent increasing use of simple rating procedures. There has also been an apparent increase in the collection of descriptive information about the visual and activity corridors adjacent to rivers.

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RECREATIONAL USAGE AND USERS OF RIVERS

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ABSTRACT.--Describes trends in the recreational use of rivers using available participation data and usage information for selected rivers. Identifies patterns of socio-economic, and experiential characteristics of users. Evaluates existing data on river recreation use and users and assesses data needs.

There is little in the way of information specific to participation in river recreation. The supposedly heavy amount of stream fishing, river-oriented hunting, and boating on rivers is obscured by the general-activity categories customarily used in most State and National Surveys of recreation. Moreover, in many recreation areas, considerable participation in camping, swimming, and other recreation activities is in fact closely associated with rivers. Canoeing seems to be the one activity that is frequently considered, and is generally, though not exclusively, identified with river recreation.

A cautious inspection of available participation information, however, does provide some important insights into the river recreation scene. First, the proportion of the population who participate in canoeing, and the total number of canoeing occasions have increased substantially in recent years (table 1). Moreover, other indicators of interest or participation also support the conclusion that there is a strong upward trend in river-oriented activities.

Table 1.--*Estimates of interest or participation in river-oriented and river-specific activities*

Indicators	Years for which data have been collected										
	1960	1965	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Membership in organizations												
American Whitewater Affiliation members						1,200		1,700		2,200		2,600
American Whitewater Affiliation clubs						75						150
American Canoe Association members		1,000									5,000	
U.S. Canoe Club members		100									1,700	
Sponsored river events												
Entries in the Atlanta Ramblin Raft Race				50				8,000				
Races on Southeastern U.S. rivers			10						33			
Sierra Club River outings					24		20	31	35	36	48	
Magazine circulation												
Canoe									5,000			30,000
National surveys of participation												
Population 12 years and older participating in canoeing (millions)	2.6	4.5						3.0[1]				
Canoeing occasions (millions)	7.8	18.9						18.3[1]				

[1]Summer months only.

Existing data suggest that there are substantial regional and state-to-state variations in interest in river-oriented recreation (table 2). For example, the Northeast and North-central regions of the United States appear to account for almost 70 percent of the total annual canoeing occasions in 1972. But individual states in all sections of the country show both very high participation levels and participation rates in river-oriented activities.

THE RECREATIONAL USE OF RIVERS

There is, at this time, no source of complete or comparable data on the use of specific rivers for recreation. Nonetheless, it is useful to examine those data that are available to assess both what they do tell us and what they do not.

Table 3 summarizes river use data obtained from widely divergent sources, such as managers' memoranda, superintendents' annual reports, theses, unpublished research reports, and the like. Obviously, these are not entirely representative of rivers in the United States, but they do provide some insights into the use picture for a variety of different river recreation situations.

The rapidly rising popularity of river use in the late sixties and early seventies is reflected in the use trends for most of these rivers. Rivers showing the greatest use pressures are nearest large concentrations of population in the mid-West and East and close to the Pacific Coast. Some rivers have experienced relative stability, even some declines, mostly as a direct result of the establishment of use limitation programs of one sort or another.

These figures alone do not tell the complete story of the river use situation. Rivers experience considerable season-to-season variability in use. Holiday weekends, such as Memorial Day, the Fourth-of-July, and Labor Day, may account for as much as one-quarter of total annual use on some rivers. Use also responds significantly to both seasonal and daily changes in weather conditions, turbidity, water depth, and velocity.

There are also some fairly predictable weekly and daily rhythms. Weekends account for as much as three-quarters of total weekly use. Most daily use is between 10 a.m. and 3 p.m.

Most rivers experience use differences

Table 2.--*Regional patterns of participation in river-oriented recreation activities*[1]

Activity	Population participating	Participation rates: Occasions per person	Participation rates: Occasions per participant	Total occasions (1,000's)
	Percent	*Number*		
Northeast Region canoeing (1972)	3.7		6.2	6,200
New Jersey canoeing (1970)				468
Virginia canoeing (1972)	2	.16		700
Delaware river swimming (1970)	2.9	.11	4.1	1,320
West Virginia canoeing (1975)				1,234
South Region canoeing (1972)	1.9		4.1	3,660
Louisiana canoeing (1974)	7.0	.3		1,039
Florida canoeing (1970)			0.8	
Florida river fishing (1970)			1.54	
Arkansas canoeing (1973)		.04		336
North Carolina canoeing (1972)	4.0	.52		1,331
North Central Region canoeing (1972)	3.6		2.8	6,405
Nebraska stream fishing (1972)	21.0			1,913
South Dakota canoeing (1973)	3.3		4.5	98
Minnesota canoeing (1974)	15.0	.78		2,823
Indiana canoeing (1972)		.39		2,165
Illinois canoeing (1975)				356
Michigan canoeing (1972)	12.0			5,891
West Region (1972)	2.2		3.0	2,380
Wyoming stream or river fishing (1972)	36.0		9.9	1,185
Utah river trips (1972)				64
Utah canoeing/kayaking (1972)				61

[1]U.S. Bureau of Outdoor Recreation, Outdoor Recreation, A Legacy for America, Appendix A (1973), and selected Statewide Outdoor Recreation Comprehensive Plans.

Table 3.--*Recreational visits for selected U.S. rivers by region (1965-1975)*

(In numbers)

River by Region	Visits for years data have been collected[1]										
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
East											
Allagash River (Maine)		4,141	4,539	3,786	4,820	5,460	6,345	7,814	8,337	7,128	9,447
New River (W. Va.)											6,000
Youghiogheny River (Pa.)						17,000				80,000	
Midwest											
Apple River (Wisc.)											
Buffalo River (Ark.)										15,505	18,748
Crow Wing River (Minn.)		9,700									
Current River, Ozark National Scenic Riverway (Mo-Ark)										150,000	
Eleven Point River (Mo.)											
Little Miami River (Ohio)						14,000					
Pine River (Mich.)		13,000					50,000		64,000		
Upper Iowa River (Iowa)								3,416	4,386		
West											
Colorado River, Cataract Canyon (Utah)					585	889	1,670[2]	2,439	4,422	4,096	17,248
Green River, Desolation Canyon (Utah)						1,600		5,000			23,195
Colorado River, Grand Canyon National Park (Ariz.)	547	1,067	2,099	3,609	6,019	9,935	10,885	16,432[2]	15,219	14,253	113,228
Colorado River, Westwater Canyon, (Colo.-Utah)						318		500			7,677
Green and Yampa Rivers Dinosaur National Monuments (Colo.-Utah)			2,493	3,755	5,740	9,762	14,145	17,159[2]	16,739	12,874	35,156
Rio Grande River, Big Bend National Park (Texas-Mex.)	926	1,540	2,741	2,389	3,996	4,006	4,478	4,421	4,850	6,013	
Rogue River (Oregon)							2,800	4,800	5,885	7,210	28,369
Salmon River, Middle Fork (Idaho)	1,260	1,260	1,299	1,396	1,624	3,028	3,250	3,972	4,372	4,036	25,670
Salmon River, Lower Main (Idaho)									4,003[2]	2,200	2,062
Salmon River, Upper Main (Idaho)									2,593		3,201
Selway River (Idaho)						46	194	406	419	439	1,661
Snake River, Grand Teton National Park (Wyoming)		18,000						71,256	73,885[2]	51,906	
Snake River, Hell's Canyon (Ore.-Idaho)									1,184	1,788	9,285
Stanislaus River (Calif.)										35,000	32,572
South											
Chattooga River (S.C.)						300	700	4,000	10,500	14,500	
Everglades Canoe Trails (Fla.)									4,000	5,000	
Nantahala River (N.C.)								1,000	3,000	4,000	
Okefenokee Canoe Trails (Georgia)							300	500	800	2,000	
Hiawassee						800	1,200		2,000	3,000	

[1]Data from various published and unpublished sources.
[2]Year in which restrictions of some type were instituted.

between segments within them. A large proportion of total use may occur at campgrounds or other point locations along the course of a river. Over the length of most rivers, there is considerable variation in attractiveness for various types of river use.

THE USERS OF RIVERS

Who are the users of rivers? Understandably data dealing with the identity of river users are even more difficult to obtain than are use figures. It is one thing to estimate or even count visitors, but is quite another to identify them and to obtain detailed information about them! Nevertheless, based upon the evidence that is available, it is worth making some tentative observations about the characteristics of these recreationists.

Socio-Economic Characteristics

The National Recreation Survey indicates that canoeists are drawn from somewhat higher income groups than participants in other recreational activities[1] as shown below.

Activity	*Family incomes > $15,000*	*With at least 4 years of college*
	(Proportion of participants)	
Canoeing	28	25
Wilderness camping	23	17
Camping in developed campgrounds	24	23
Fishing	18	14
Hiking	24	26
Outdoor swimming (nonpool)	26	20
Hunting	18	9
Total population	21	12

This applies to river users overall (table 4). Thus, available evidence suggests that canoeists (floaters/rafters) are drawn disproportionately from professional or white-collar segments of the society and that they are highly educated. The inclusion in many of these studies of large numbers of students is significant in its own right, but it also may tend to have a depressing effect upon some of the indicators of socio-economic level.

[1]*Bureau of Outdoor Recreation, 1973.*

Studies have shown, however, that river fishermen appear to be drawn in greater numbers from lower-income groups and from non-professional and non-technical occupations. Also users of the San Antonio River, in a central-city setting, tend to approximate the characteristics of the population as a whole.

Most studies have revealed that river clientele is drawn disporportionately from younger age groups as shown below.

River	*Total use* (Percent)
Upper Iowa (Iowa)	
Canoeists/Campers (under 30 years)	76
Fishermen (under 30 years)	53
Apple River (Wisconsin)	
"Tubers" (under 25)	64
Rogue River (Idaho)	
Floaters/Rafters/Canoeists (under 40 years)	74
Pine River (Michigan)	
Canoeists (16-24 years)	50
Eleven Point (Missouri)	
Floaters (under 30 years)	67
St. Joe (Idaho)	
Floaters (17 to 29 years)	34
Au Sable (Michigan)	
Canoeists (under 35 years)	74
Fishermen (under 35 years)	51
Colorado River (Grand Canyon)	
Rafters (under 30 years)	27
Total U.S. population	
Under 25 years	46
Under 35 years	58

Over three-quarters of the canoeist/campers on the Upper Iowa are under 30; almost two-thirds of Apple River (Wisconsin) tubing enthusiasts are under 25. In contrast, youthfulness is not a dominant characteristic on some of the Western white water rivers that require considerable investments in guides and/or equipment. This also applies to fishermen on the Upper Iowa and the Au Sable.

Table 4.--*Socio-economic characteristics of users on rivers for which data are available*

River	Proportion of users			
	Belonging to families whose head of household has a professional/ technical occupation	With at least 4 years of college	Incomes at $15,000-16,000	Incomes at Over $16,000
	Percent			
Rogue River (Idaho)				
Floaters/canoeists	32	54		
St. Joe River (Idaho)				
Floaters/canoeists	17	27	22	
Au Sable (Michigan)				
Canoeists	16			26
Fishermen	19			24
Residents along river	24			42
Apple River (Wisconsin)				
"Tubers"			43	
Middle Fork, Salmon River				20[1]
Pine River (Michigan)				
Canoeists	23	27	27	
Upper Iowa (Iowa)				
Canoeists/campers	27	40		
Fishermen	5	10		
San Antonio River (Texas)				
All users	12		20	
Colorado River (Grand Canyon)			64	
Total United States population	14	12	21	

[1]All over $50,000.

THE EXPERIENCE FACTOR

One of the most distinctive characteristics of river recreation is the extent to which participants are newcomers to a given river.

River	*No experience*	*No experience on this river*
	(Proportion)	
Colorado (Grand Canyon)		
Oar	39	94
Motor	61	66
Pine (Michigan)		66
Au Sable (Michigan)		
Canoeists		42
Fishermen		14
Eleven Point		
Floaters/Canoeists	11	60
Rogue (Idaho)		
Comercial		52
Noncommercial		46
Apple (Wisconsin)		
"Tubers"		44
Upper Iowa (Iowa)		
Canoeists/Campers	55	76
Mother Load Country (California)		55
Ozark National Scenic Waterways		33

Moreover there is evidence that a substantial portion have had no previous river recreation experience. These findings are consistent with the previously described rapid expansion of river recreation activity in the United States. Rivers in the West seem to be especially prone to this observation, but the author was unable to find any studies that reported first-time users accounted for less than one-third of total users except among fishermen on the Au Sable.

EXISTING DATA

Obviously then there are important shortcomings in available information regarding the participation in river-oriented recreation. There are some apparent inconsistencies in the participation data themselves. For example, there are almost as many canoeing occasions estimated for Michigan in 1972 as are indicated for the whole North-Central Region in the same year. However, the fundamental problem with respect to estimating participation levels has to do with the fact that most participation survey data are collected and conveyed in activity categories that are not resource specific, or in this case river-specific.

Thus, existing data probably do not give a satisfactory picture of participation patterns and trends.

The data that are routinely available on the use and users of rivers is also inadequate. It is incomplete in that there is no routine in the collection of use data for *most* rivers, and many of the more significant ones. At best, the data sets are coarse, failing to reflect the temporal and intra-river variability in use. There is also reason to suspect that existing data are not accurate representations of the use of rivers because measurement techniques are insufficient. Moreover, certain river-specific uses, such as stream fishing, as well as those activities taking place in the river corridor, are routinely excluded.

REASONS FOR LACK OF ADEQUATE DATA

Factors that account for the difficulties with respect to river recreation data can be readily identified. First, many rivers are not the responsibility of any agency. At the other end of the spectrum, many rivers come under the supervision of a number of agencies, local, State, and Federal. Cooperation in these latter cases is as difficult to obtain as is leadership and responsibility is in the former.

Even where the responsibility for management is clearcut, and the spirit is willing, there is substantial lack of agreement on what is river use. Some organizations restrict the term "river users" to those who pursue river-specific recreation activities, either in-stream or on-stream. Others take the broader view and include in river use all activities that are associated with the presence of a river, including camping at sites located on a river, or hiking along a trail located along a river.

Lack of agreement regarding what types of data on use and users is needed. Not only is there disagreement between planners and managers as to what is needed, but also there may be disagreements among managers of different types of river resources.

Finally, there appear to be inherent difficulties in measuring and monitoring use of rivers. Typically, rivers have a multiplicity of egress and access points. Rivers extend over considerable distances, often through several administrative jurisdictions. They often exhibit markedly different attractiveness, use, and use-potential characteristics in different sectors.

Data Needs

More and better information is needed in order to more effectively plan and manage rivers for recreation. To understand the potential for future development of river recreation demand, there is an immediate need for participation surveys at both National and State levels. Such surveys must be carefully planned so as to provide useful insights on river-specific activities. There is also an urgent need for more accurate and detailed estimates of usage on a larger number of rivers. In order to meet this need, there must be improved design of use-monitoring and reporting systems in order to cope with the temporal and intra-river variability in use. Finally, there is a need to obtain detailed data on a more systematic basis as to the characteristics of users both to supplement participation surveys as well as to gain insights that will allow river managers to more effectively serve their recreation clientele.

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DOWN BY THE RIVERSIDE: INFORMATIONAL FACTORS IN WATERSCAPE PREFERENCE

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ABSTRACT.--Rivers and riversides by their nature are preferred by people because they often provide both a sense of orderliness and a sense of involvement and mystery. The recreation value of rivers extends far beyond fishermen, boaters, and other traditional users. Even unspectacular rivers provide a source of enjoyment and tranquility for many who use only the riverbank, view the river from afar, or who only know that it is "there" and available. Since these "passive" users experience benefits similar to "active" users, their requirements deserve attention in design and management decisions. Ways must be found to involve "passive" users in decision-making so their diverse needs and concerns will not be overlooked.

Whether it's an ocean, lake, river, stream, or pond, placid or fast-moving, tranquil or falling, with trees reflected or with rapids, water is a highly prized element in the landscape. Why? Is it just attractive in a picture on the wall or in the "real world" too? And does anyone other than canoeists, fishermen, boaters, and other active users really enjoy a river?

The truth is that much of the enjoyment that waterscapes provide is low in action. Countless river users are uncounted nonusers. They are not "in the water" but "at the water". And sometimes, they are not even right by the riverside, but their enjoyment is no less. It is almost a use by proxy--a place to enjoy for its mere presence, for being there.

The purpose of this paper is to examine why the riverscape is the source of so much "passive" use and to consider the implications for designing and managing this prized scenic resource. The issues that are raised here are important not only for wild rivers and those that have been legislated as "scenic", but also for the rivers of "everyday nature" (R. Kaplan 1976a)--the unspectacular, more accessible ones to which more citizens have more frequent exposure.

In the recreation literature there seems to be a separation between the "environment" (rivers, in this case) as a resource, on the one hand, and the user of the resource, on the other. Studies of users generally involve counts of a variety of background variables and consideration of their motivations for being there. Studies of the "environment" often entail inventories of the countable objects. An important middleground involves the physical environment as it is seen and experienced by the user. Users are not on the river merely to satisfy specific needs, nor do they necessarily know one inventoried category apart from another. They may not notice particular trees, or even litter, or the fact that the banks are eroded. What does constitute their experience? How can one characterize the types of environments that are sought by different groups or by a given person at different times?

LANDSCAPE ASSESSMENT

Much has been written about scenery as a resource. Many different procedures have been developed to analyze the landscape and to examine aspects that users are likely to prefer. A conference on that subject has led to a useful compendium called LANDSCAPE ASSESSMENT (Zube *et al.* 1975). It is a valuable source of background material and innovative approaches. In addition, Cerny (1974) has thoroughly reviewed the scenic analysis literature and also criticized some of the methods with much insight. Although

neither of these sources is restricted to rivers, they shed light on it indirectly and also include material that focuses on rivers per se (e.g., Leopold's (1969a) often-cited study). Two other sources are Morisawa's (1972) review of the literature, and the Litton *et al.* (1974) overview of waterscapes using the landscape-architectural concepts that Litton had previously developed.

Instead of repeating this wealth of material, I would like to focus on an approach to landscape preference that is oriented to the analysis of the attributes of the physical setting in terms of their usefulness to the human observer (R. Kaplan 1975, S. Kaplan 1975, S. Kaplan and R. Kaplan (1977)). The approach will be described briefly here, showing how it applies to environments in general, and then to rivers in particular.

An Informational Approach to Environmental Preference

Humans are a kind of animal that has a well-developed visual system, that has the capacity for a fairly extensive range, and that is, in certain respects at least, social. Like other animals with these characteristics, humans tend to evaluate the terrain and prefer habitats that are likely to offer safety and the resources they need. They stay near the edge of openings--neither in the middle of the open areas where they can see the situation (and others) well but face the danger of being seen, nor "in the woods" where they might hide well enough but not be able to foresee danger. While this description is obviously metaphoric, the parallels to other species are by no means lacking. And for humans as for other animals, the evaluation of the terrain and potential habitat is essentially unconscious, automatic, and continuous.

Unlike other animals, humans are knowledge-based; knowledge makes it possible for humans to be less restricted with respect to a great diversity of environments, climates, food, and social arrangements. They are not only capable of storing information and using it in distinctly different contexts, but this is their standard operating procedure. Humans are, in short, at their best when they can make sense of a situation, when they can comprehend it and feel comfortable with it.[1]

However, the story is more complicated. Making sense is important and the inability to make sense can be seriously debilitating. But, at the same time, having everything in good shape, comprehendible and in order, is not enough. People readily get restless, bored, and even unappreciative. Besides requiring coherence and order, people look for excitement; they search for adventure or involvement. So these dual forces are continuously at play--the simultaneous needs to comprehend and to be involved.

What does all this have to do with the environment? How can the environment afford opportunities for these "dual forces"? Certainly, physical settings where one gets lost easily provide failures as far as "making sense" is concerned. Whether these settings are the most recently designed, prize-winning office buildings, or urban centers (Lynch 1960), or natural places such as parks or backwoods (R. Kaplan 1976b), the inability to "read" them reduces the effectiveness of the user.

Through a series of studies (e.g., S. Kaplan *et al.* 1972, R. Kaplan 1976a) we have begun to identify some of the elements that enhance the readability of a natural setting. Important among these are clues as to the spaciousness of the place. The farther one can see, the more one can anticipate what is in that setting. However, a treeless, flat expanse continuing apparently endlessly is not nearly as effective in providing such clues as is an expanse with a few trees, or hedgerows, or other elements that help define the space. When such elements repeat--with a row of trees, for example--they further contribute to the coherence. Ground textures are also very important in providing such depth cues. They not only suggest distance by changes in texture, but also give an indication of how "safe" the place may be.

From some of our studies we have learned that natural settings that are rated as "most liked" are generally not the ones that might be called most "natural". While the word "wilderness" may often mean a natural area to a resource manager, for some people the setting may turn out to be a well-landscaped park, possibly even with a large area of mowed grass! In fact, the highest preference ratings seem to be reserved for scenes that include a well-kept, orderly component to them. The fact that such preference does not characterize *all* people is very important. It no doubt distinguishes many a resource manager from the people he serves.

[1] *The description here is based on a rather extensive and far-reaching theoretical position that receives a fuller discussion by S. Kaplan (1973a, 1973b, 1976b).*

That's only half the picture though. As was suggested earlier, "making sense" in and of itself is often not enough. The most appreciated "orderly" scenes are ones that also permit what we have been calling involvement. Once again, it is useful to examine the elements that enhance this quality. Scenes that are low in diversity are less involving. A large mowed expanse with three or four trees, or endless cornfields are easy enough to "read", but they lack complexity, a richness of things to look at. Furthermore, involvement is greatly enhanced when one cannot comprehend the whole at once, but senses that the opportunity is available. Thus, a scene that is safe and readable enough where one is currently located, but at the same time invites one to proceed and continue the exploration, is particularly engaging. Various elements help extend such invitation. The bend in the road, the trail that winds, the foliage that obscures--all these increase the sense of "mystery". While mystery is by no means unique to natural settings, it is much more likely in such contexts and may be an important factor in the strong preference for natural settings (R. Kaplan 1973, 1977a).

Before extending this analysis to the river setting, two issues should be discussed briefly. One is the relation of the factors that have been identified in this framework to the qualities landscape architects have been using as design guidelines for a long time. Certainly, there is an overlap between the two. After all, many scenic places that are considered as "completely natural" by their admirers, have been the products of skillful and talented landscape architects. The major difference lies in considering the guidelines from a behavioral perspective and in neither pointing to a single all-encompassing factor on the one hand, nor in issuing endless lists of potentially contradictory factors, on the other (S. Kaplan 1976a). In addition, the framework differs from other proposed categories in being based on intuitively reasonable considerations--no trivial matter if one is concerned with their utility.

Secondly, there is the matter of the picture (photo, slide, even painting) as opposed to the "real" world. In certain ways, this distinction is unhelpful. Much of one's "real" experience is from such simulations. Since humans are information-based and social in their orientation, much of what they know is transmitted vicariously, or "second-hand", if you will. As such, it makes little sense to have completely different factors that help understand picture preference and "real" world preference. Our needs to make sense and to be engaged in the process of acquiring and using information pertain to all activities. (It is thus hardly surprising to find the empirical literature showing a great similarity between ratings made in the physical environment and those made to pictured material--e.g., Rabinowitz and Coughlin 1970, Shafer and Richards 1974, Levin 1977).

What About The Riverside?

Given that such an informational framework to environmental preference is reasonable and credible, why are waterscapes so exceptionally favored? Does water possess these qualities in greater abundance?

Let's begin with the human characteristic of "making sense" out of a waterscape. The study of residents living along a storm drain (R. Kaplan 1976a) made it quite clear that all waterscapes are not appreciated. The ones that received the lowest ratings--and these were low indeed--had the "river" uncontained, unkempt, and disorderly. Of course such considerations reflect more than the water itself. They incorporate the appearance and conditions of the river bank and the river corridor in general. Furthermore, such reactions were no different for those people who lived very near the pictured locations as opposed to those who had not seen them previously. The scenes that received the highest ratings fit with the previously presented analysis. A sense of orderliness seems to contribute to preference. Rivers can provide such a sense easily since they are, by definition, bounded, and it is this very edge which can help communicate a sense that all is well and in its place.

Furthermore, water can easily contribute to a sense of spaciousness. With the addition of islands, or rocks, or even tree stumps this sense is further enhanced. The water itself provides a continuing, unifying theme to the landscape and one that calls attention to itself. It has a texture that easily sparkles, or reflects images, or ripples with the wind.

And how does water aid in "involving" the river viewer? Certainly, a sense of mystery is easily communicated by rivers and riversides. The suggestion that one can find out more by going on, or changing

one's vantage point, is provided by the many turns and twists in the river's path, by the hints of glittering water through foliage, by the changes in vegetation at the river's edge. Remember, this is an involvement in an informational sense--a subtle invitation to want to explore further or, at least, to let one know that further exploration promises further information.

The river, it turns out, has many qualities that are likely to enhance enjoyment. The water itself provides some. Both its movement and its stillness can command attention[2] and, of course, that it so readily changes from one texture to another accentuates these characteristics. Subtle changes in sunlight, slight breezes or winds, obstacles in the water course all play a role. In addition, a river is not a river if it has no edges and so a sense of spaciousness is enhanced by this boundary. The banks themselves provide further interest and potential diversity in wildlife. River edges, too, have textures that enhance the potential attractiveness of waterscapes.

No wonder the riverside is a place to "lay down (one's) burden", to seek for a tranquil moment, to enjoy in even the most passive fashion. Many of the qualities that make riverscapes sought and appreciated are available by the river's side.

SUMMARY AND IMPLICATIONS

People have many needs; the potential list might seem endless. As an animal that operates by knowledge--rather than by speed or fang and claw--the human has a basic need to comprehend, to make sense of the surroundings. Both specific and general knowledge are important, and essential for untold future circumstances. To make the quest for continued comprehension more likely, it seems adaptive for the human to have another basic need which is to search, to explore, to want to know more.

Environmental configurations can be more or less supportive of these needs. They can be dull, confusing, ambiguous, incoherent; they can be exciting, orderly, rich in variety, and enticing. Both the water itself and the river's banks possess qualities that can meet people's informational needs.

For many the river is a resource to be treasured even from afar. Knowing that it is there, that it is available, constitutes a use-by-proxy. If it were taken away or changed in major ways such "use" would be violated and the loss to these uncounted many would be real indeed. The "passive" uses I have been discussing here cut across the consumptive-nonconsumptive distinction. No question, fishermen and canoeists and many others also derive the pleasures discussed here. The beauty and tranquility afforded by the river is there for all of us, even as we relive our experiences many times over.

In a sense then, the river involves an even greater variety of uses (and users) than are usually considered in managing for multiple use. And the more passive uses that have been discussed here can also be thwarted by the effects of other uses, just as other on-the-river uses have been shown to entail potential conflicts.

As a first step in resolving the problems of such a multitude of "uses", we must be sure that the various kinds of "users" are considered in public involvement--a process that frequently leads to the frustration of all parties concerned. But these are the same people, after all, whom we have characterized as having a basic need to understand, to comprehend their surroundings, and as having a craving to explore and know more. They are rarely afforded opportunities to publicly participate. We all suffer the inability to make sense of proposed solutions and potential changes in most areas outside our own expertise! The public is not incompetent; it is uninformed. Fortunately, there are concrete means for correcting that problem (R. Kaplan 1976a, 1977b, S. Kaplan 1976a). And when it is, it can lead to effective participation and exciting consequences.

Litton *et al.* (1974, p. 259) have emphasized "the need for one specific definitive esthetic policy for use in appraisal of native conditions and of developmental impacts". Certainly their analysis is correct that current interpretations of esthetic problems are disparate and uncoordinated. But it must be emphasized that their recommendation is in sharp contrast to the proposal made here. The diversity in environment and population

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[2] *The importance of attention as a factor in the strong human preference for natural environments is considered by S. Kaplan (1976c).*

cannot help but require a diversity of approaches if we are to maximize both impact and satisfaction. A unified, definitive approach could all too easily undermine important regional differences as well as the powerful consequences of permitting people a role in comprehending and influencing their own circumstances.

This does not mean a recommendation for no policy, for doing away with designers, planners, managers, or any other professional group. It merely recognizes that diversity is as important a principle in the management and articulation of policy, as it is in the landscape.

There are important and greatly appreciated uses of the rivers above and beyond those that have received considerable attention. There is beginning to be a conceptual basis for understanding these widespread--though neglected--uses. The implications for design and management are several. On the one hand, there is room for greater appreciation of--as well as understanding of--the scenic factors in such environments. At the same time, there is a pressing need to engage the participation of the many interested individuals whose quiet but often intense concerns have previously been overlooked in the decision-making process.

A BACTERIOLOGICAL ANALYSIS OF PORTABLE TOILET EFFLUENT AT SELECTED BEACHES ALONG THE COLORADO RIVER, GRAND CANYON NATIONAL PARK, ARIZONA

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ABSTRACT.--Portable toilet effluent buried at nine beaches along the Colorado River, Grand Canyon National Park, Arizona, was examined for bacteria. Viable total and fecal coliforms were isolated 84 percent of the time. Organisms migrated up to 8 inches away from the burial sites at 22 percent of the beaches. Coliforms were present throughout the strata to a depth of 2 feet. No direct relation was apparent when comparing percent of soil moisture, percent of coarse sand, and numbers of organisms. As ground temperature dropped during the colder months, a comparable decline occurred in numbers of organisms. As ground temperature increased in the spring, a similar increase in numbers of organisms occurred. A definite public health hazard is seen in the numbers of coliforms and associated pathogens that are capable of surviving from one season to the next. Therefore, the health of the 15,000 individuals who annually make Colorado river trips and camp at such beaches is potentially endangered.

A significant sanitation problem was recognized by Park management and other concerned conservationists during 1970 (Bennette 1973 , Carothers 1974) (table 1). In 1972, between late May and July, 132 of 256 individuals involved in 13 river trips experienced gastrointestinal illnesses. Stool specimens revealed that the probable causitive organism was *Shigella sonnei* (Morbidity and Mortality Weekly report 1972).

Because no common food or water source carriers were identified, the outbreak apparently originated in part from infected boatmen who may have transmitted the illness to passengers through food and water handling and inadequate sanitation. The disease could have spread between river parties using common eating places along the river. Contact spread among the passengers probably accounted for the high attack rate (52 percent).

With the inception of Park regulation in 1972, along with excellent cooperation from the commercial river operators, the beaches improved dramatically. The regulations required commercial river parties, representing 92 percent of the total river users, to either carry portable toilets or use other means for the concentration

Table 1.--*Number*[1] *of people running the Colorado River Grand Canyon, Arizona*

Year	Users	Year	Users
1955	70	1966	1,067
1956	55	1967	2,099
1957	135	1968	3,609
1958	80	1969	6,019
1959	120	1970	9,935
1960	205	1971	10,885
1961	255	1972	16,432
1962	372	1973	15,219
1963	[2]6	1974	14,253
1964	[2]38	1975	14,305
1965	547	Total:	95,706

[1]Based on revised figures, March 1976, U.S. Department of Interior, National Park Service, Grand Canyon.

[2]Glen Canyon Dam being filled.

(containerization) of human waste for burial. The recommendations further stipulated that burial should occur in a hole at least 2 feet deep, 6 feet above the normal high river fluctuation line, at least 50 feet from the river bank, and at least 200 feet from normal camping areas.

Despite the fact that campsites became cleaner and more appealing, beneath the beaches an ever-increasing potential health hazard existed in the form of improperly buried and accumulating human feces.

OBJECTIVES

Based on these and other observations, a 6-month bacteriological study was conducted at selected beaches along the Colorado River to determine: (1) the presence and levels of fecal and total coliforms and *Clostridum perfringens* (a spore former) in human fecal waste burial sites; (2) the survivorship of coliform organisms during a winter period when low temperatures prevailed; (3) whether sand substrate influenced bacterial decomposition; (4) whether bacteria migrated laterally from the burial sites toward the river; and (5) whether a significant public health problem existed at some beaches based on the above findings.

METHODS AND MATERIALS

Arrangments were made to accompany two 8-day commercial river parties. The commercial trips were chosen to duplicate actual sanitation practices used by large river parties for disposal of human waste. The boatmen conducted the trips as usual, selecting beaches at their convenience and burying the portable toilet effluent according to normal procedures.

A total of 10 beaches were selected between Lee's Ferry and Diamond Creek, a distance of 227 miles (table 2). The beaches were accessible principally by river boat.

Procedures used in establishing the study were as follows: the boatmen selected the site at which the effluent would be buried. A round, plywood board, 2 feet in diameter, was placed over the site and the outer perimeter of the board marked on the sand. A hole was dug 2-feet wide by 2-feet deep. A wooden stake approximately 2-feet long was centered and driven into the bottom of the hole. The contents of the portable toilet, to which a commercial chemical had been added, was emptied into the hole and covered.

Relocation of the burial sites was facilitated by using the reference markers. A substrate core was taken at each burial site by means of a core sampler. The device, 24 inches long, constructed of galvanized pipe, 2 inches in diameter, was fitted with a stainless steel tip to withstand being hammered into the ground and hitting hard obstacles. A clear plastic core tube was inserted inside and a threaded cap screwed onto the upper end to provide a means for the tube to be hammered.

The device was driven into the substrate at selected places within each effluent site. The round plywood board with holes numbered in a circle around a center hole was used to select the exact spot used each month for taking the core. The center of the board was aligned over the stake and then positioned to a permanent reference point at each beach to avoid taking repetitive samples. Each month a new hole on the board was used.

Additional core samples were taken 8 inches away from the edge of the hole to determine whether the bacteria were mi-

grating toward the river. A control sample was taken at random from each beach. Once the tube was withdrawn, the cover was removed and the inner plastic core tube, containing the actual substrate sample, was extracted. Surface and bottom core temperatures were taken at the time of the coring. Often a chemical dye was seen through the clear plastic tube indicating the presence of buried organic waste.

Ends of the core tube were covered with color-coded caps to ensure that the samples could be tested according to their position in the hole.

Distance between survey beaches ranged from 10.5 to 43.5 miles (table 2), therefore, it was only possible to collect samples from one or two beaches per day, depending upon water conditions of the river.

COLIFORM COUNTS WITHIN BEACH EFFLUENT BURIAL SITES

A total of 61 beach dump site analyses were made. Results of the bacterial examinations (combined total and fecal coliform counts) at all beaches were as follows: 15.8 percent of the samples were negative; 22.3 percent had coliform readings of 1 to 25 colonies per plate; and 61.9 percent had readings of 25+ coliform colonies per plate (table 3). Three beaches, Lava Canyon, Papago, and Deer Creek had viable coliform counts every month.

Table 2.--*Beaches where bacteriological analysis conducted*

Beach	Side of River	River mileage[1]	Distance apart
Boulder Narrows	left	18.5	18.5
Silver Grotto	left	29.0	10.5
Upper Nankoweap	right	52.0	23.0
Lava Canyon	right	65.5	13.5
Papago	left	76.0	10.5
Granite	left	93.0	17.0
Deer Creek	left	136.5	43.5
Shelves	right	151.5	15.0
Mile 173.5 Beach	left	173.5	22.0
Mile 185.5 Beach[2]	right	185.5	12.0

[1]Distance from Lee's Ferry, Arizona, principal launching site for majority of river parties.

[2]Surveyed only once, effluent removed for laboratory experiments.

Table 3.--*Monthly bacteriological results[1] at selected beaches, Colorado River, Grand Canyon National Park, Arizona*

Beach	October 1-25:25+	November 1-25:25+	January 1-25:25+	February 1-25:25+	March 1-25:25+	April 1-25:25+	May 1-25:25+	Percentage Neg.	1-25:25+		Total 1-25+
Boulder Narrows	+	+	+				+	43	14	43	57
Silver Grotto		+	+	+	+	vandalized		20	20	60	80
Upper Nankoweap	+	+	+			+	+	29	42	29	71
Lava Canyon	+	+	+	+	+	+	+	0	14	86	100
Papago	+	+	+	+	+	+	+	0	29	71	100
Granite	+	+		+	+	+	+	20	0	80	80
Deer Creek	+	+	+	+	+	+	+	0	29	71	100
Shelves		+	+	+	+	+	+	29	42	29	71
173.5	No data	+	+	+	+		+	17	33	50	83
185.5	+	Removed for laboratory analysis						0	0	100	100
No. positive:	7/9	4/9 5/9	3/9 5/9	1/9 6/9	2/9 5/9	2/8 4/8	2/8 6/8	15.8	22.3	61.9	84.2
Percentage 1-25+:	78	100	89	78	78	75	100				

[1]Total and fecal coliform plate counts/100 ml sample.

Table 4 analyzes the bacteriological findings from all beaches, by month, by number of coliform colonies per plate, and by the type of coliform present. Fecal coliform plates were positive 74 percent of the time, while total coliforms, *E. coli* colonies, were positive 66 percent of the time. The ratio of total to fecal coliforms in normal water samples, is approximately five to one.[1] However, because we incubated the total coliforms at a higher temperature than the fecal coliforms, a lower total coliform count resulted. Bacteriological standards for quality of potable water requires that 95 percent of all samples be free of total coliforms. In this study a significantly higher percent of positive sample occurred, however, such standards are not applicable under these conditions.

Control core samples were negative for fecal and total coliforms.

COMPARISON OF BEACH TEMPERATURES VS. PRESENCE OF COLIFORMS

Surface soil temperatures ranged from 98°F in October 1975 to 31°F in January 1976, while those at the bottom of the hole ranged from 80°F in October to 38°F in January. The mean surface and bottom temperatures were 60.5°F and 61.4°F, respectively. Bottom temperatures were 1°F warmer than surface temperatures during the period from September 1975 to May 1976 (fig. 1). Although temperatures were at or near freezing at some beaches, vegetative cells were able to survive.

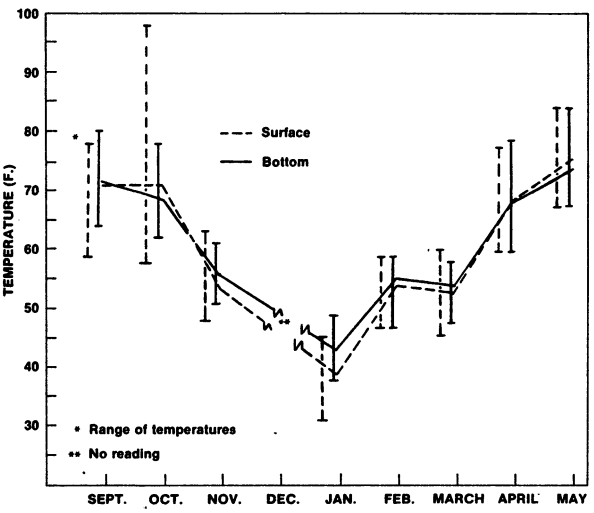

Figure 1.--*Mean soil temperatures at selected Colorado River beaches, Grand Canyon National Park, Arizona, 1975-1976.*

MIGRATION AWAY FROM BURIAL SITES

Substrate samples taken at the edge, and at 8 inches from the edge of the effluent burial sites indicate that some coliform organisms migrated. In October 1975, 61 percent of the beaches showed coliforms in numbers ranging from 1 to 25+

[1]*Personal communication with Mr. Don Finical, State Health Laboratory, Flagstaff, Arizona.*

Table 4.--*Bacterial analysis by month at selected beaches, Colorado River, Grand Canyon National Park, Arizona*

	October	November	January[1]	February	March	April[2]	May	Total
Number positive beaches[3]	7/9	9/9	8/9	7/9	7/9	6/8	8/8	52/61
Percent positive beaches	78	100	89	78	78	75	100	85
Percent negative beaches	22	0	11	22	22	25	0	15
Percent positive (1-25 colonies)	0	33	33	0	22	25	25	20
Percent positive (25+ colonies)	78	67	56	78	56	50	75	65
Percent positive (total coliforms)	78	67	67	56	78	13	100	66
Percent positive (fecal coliforms)	78	89	67	78	67	63	75	74

[1]No. survey in December.
[2]One beach site vandalized.
[3]Fecal and/or total coliform.

at the outer edge of the burial sites. Samples in November 1975, taken 8 inches from the edge of the effluent site, indicated migration was occurring at 22 percent of the beaches. In January, 56 percent of the samples taken at the outer edge of the hole were positive for coliform ranging in number from 1 to 25+. It appears that due to low rainfall, little leaching of the bacteria occurs by water movement.

PRESENCE OF COLIFORM IN RELATION TO DEPTH IN BURIAL SITE

In February and March 1976, a single core was taken at each beach to determine whether difference existed in numbers of organisms present in relation to their location within the substrata. From each core, samples were analyzed in the upper, middle, and lower thirds of the hole (table 5). Fifty-six percent of the beaches had coliforms in the upper one-third, 44 percent in the middle, and 72 percent in the lower. This indicates that feces float to the top at the time of burial and that viable coliforms and associated potentially pathogenic bacteria are distributed throughout the site.

CLOSTRIDUM PERFRINGENS ISOLATIONS

Difficulty was encountered in attempting to isolate *C. perfringens* using the "gas-Pak" incubation system under canyon conditions. *C. limosum*, a normal soil resident often implicated in a variety of animal infections, was identified from cultures taken in December. *C. perfringens*, an organism commonly associated with food-borne illnesses as well as being associated with wound complications causing gas gangrene, was isolated in April from several beaches.

Although this study only examined the presence of total and fecal coliforms and *C. perfringens*, other pathogens are surely present. The implication of this is seen in a case of infectious hepatitis, (Morbidity and Mortality Weekly report 1975) that occurred during a commercial Colorado River trip. The individual, who suffered onset and accompanying symptoms of the disease while on the river, probably was excreting virus during the trip and exposed approximately 35 other individuals. Such virus particles can remain viable for months.

ANALYSIS OF BEACH SUBSTRATE

During the February trip, substrate samples taken adjacent to each effluent site were analyzed for soil moisture and sand grain size. In general, soil moisture content and percentage of coarse sand showed little correlation to numbers of coliforms present in the samples. It is recommended that a more complete soil analysis be made to include percentages of clays and other soil types.

Table 5.--*An analysis of where coliform bacteria*[1] *found in relation to depth of effluent at burial sites*

	February			March		
Beach	Upper	Middle	Bottom	Upper	Middle	Bottom
Boulder Narrows						
Silver Grotto	+		+		+	+
Upper Nankoweap						
Lava Canyon		+	+			+
Papago	+	+	+	+		+
Granite	+		+	+	+	+
Deer Creek	+	+	+	+	+	+
Shelves	+	+	+	+	+	+
Mile 173.5	+					+
No. positive:	6/9	4/9	6/9	4/9	4/9	7/9
Percentage:	67	44	67	44	44	78
Totals:	Upper-56%	Middle-44%	Bottom-72%			

[1]Number ranged from 0-25+ colonies per plate/100 ml sample.

CONCLUSIONS AND RECOMMENDATIONS

Coliform bacteria (total and fecal) were found in significant numbers during an 8-month study period. A public health hazard exists at and near such burial sites as seen by the numbers of coliforms isolated at surface and near-surface levels. Numbers of organisms ranged from one to too numerous to count per 100 mls of diluted sample. These data reflect only a minute portion of the actual numbers of coliforms within the substrate. Such organisms are able to survive the rigors of low winter temperatures. Coliforms migrated up to 8 inches from the burial site. It appears that chemicals added to the effluent prior to burial are ineffectual in reducing a significant number of fecal indicating bacteria.

The significance of these findings is seen in number of river parties (572) running the Colorado River in 1975 alone, with an accompanying 15,000 persons, camping an average of 8.8 nights per trip. From such trips, more than 5,000 Park regulation burials occurred, accompanied by countless number of nonregulation burials, made at times when portable toilets were not set up. If river parties used the estimated 200 readily recognized beach sites along the river, a resultant 25 regulation burials would occur per beach per season. However, some beaches received much greater use due to their locations near popular Canyon attractions. These areas could possibly have 100 or more burials per season. It is at such sites that boatmen complain of unearthing previous parties effluent. At other beaches, only limited areas for burial exist. However, when the course of "least resistance" prevails, burials occur in whatever spot is handy or free of boulders. At such sites, passengers unknowingly sleep and place their personal gear, risking bacterial contamination.

A significant aspect of this study is related to the impact of the continuing practice of burying human toilet waste at beaches along the Colorado River, Grand Canyon National Park, Arizona.

The following recommendations are presented to assist administrators in establishing river use guidelines to safeguard the health of future river enthusiasts.

(1) Discontinue the policy directed at commercial river parties specifying that effluent be buried. Instead, require commercial boating parties to provide watertight holding tanks for the disposal of effluent, with the accompanying responsibility of disposing of the waste outside the Park. Permit private parties to continue the practice as per current regulations. (2) Eliminate small, confined beaches as campsites for all river parties. (3) Establish rustic, pit privies at the larger beaches. (4) Establish Park Service effluent dump stations at a number of locations along the river. (5) Increase river patrols to ensure the presence of Park Service staff at all times during the river running season to assist in the enforcement of regulations.

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BIOLOGICAL APPROACH TO RIVER PLANNING AND MANAGEMENT

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ABSTRACT.--The intent of Wild River legislation was to protect certain rivers for the benefit and enjoyment of present and future generations. To accomplish this goal, river development and management plans must consider: (1) The riverway's ordered nature and inherent limitations; (2) Which specific environments (soils, vegetation) and related variables (aspect, slope) along the river are best able to absorb recreational use; and (3) How much modification (vegetation and soil degradation) of a particular environment will managers accept before they decide to alter or limit use.

What will national recognition of a riverway do to its scenic environment? Will the resource have to be protected from the impact of too many people? Should people using such a high quality natural resource be willing to visit it on nature's terms? If too many use the area and as a result start destroying it, will the public accept a policy that reduces use to ensure perpetuation of the resource?

Such questions have arisen since the Wild and Scenic River Act was passed on October 2, 1968. It designated the 200-mile St. Croix-Namekagon (Minnesota and Wisconsin) and seven other of our nation's rivers and their adjacent environments to be developed for the benefit and enjoyment of present and future generations.

Those involved in river planning have realized that recognizing an area's national significance is one thing; correctly planning and managing it is another. This was the first time our nation had committed itself to preserving several of its rivers; thus planners and administrators were without precedents for guidance.

In early public hearings, one frequent point made was since Wild River planning would be paid for with federal tax dollars it should provide some form of recreation for everyone. In other words, a river plan should attempt to be all things to all people, thereby including such recreational opportunities as motorboating, canoeing, horseback riding, summer cabins, snowmobiling, auto campgrounds, and motorcycling. Unfortunately, what is not understood by those pursuing this line of reasoning is that the resource--the "setting" where the recreation experience takes place--should not be degraded by planning and development because the presence of the resource's natural qualities was the reason the river was singled out for management in the first place.

Another misunderstanding, this time on the agencies' side, is that it is their responsibility to show the public why certain activities are compatible with an area, and others are not. To do this, the agency must adequately document what the resource was like prior to development and why they developed it where they did. Then after development they must monitor the use of the resource and analyze their data as to whether the planning and management policies are compatible with the resource. Unfortunately, this is not done, so when a new river plan is being discussed at a

public meeting and the question is raised, "How well has your agency managed its other Wild Rivers?" the response is usually something like "OK, I guess." This type of response certainly does nothing for the credibility of the agency.

To make matters worse a project supervisor tends to get transferred about every 3 to 4 years. Without good data for decision-making, the new supervisor may have to rely solely on his intuition, which more often than not means the innate natural qualities of the resource are degraded. Such a situation results from the fact that funding is often available for detailed plans but seldom for monitoring the impact of use or evaluating the management policies.

WHERE DO YOU START?

The Act emphasized that a river plan must be compatible with the resource. This implied that data be obtained which would enable decision-makers to plan for use that did not exceed the carrying capacity and resiliency of the resource. In other words, all planning and management decisions must be *biological*; if they aren't, then alternatives *must* be looked for.

Within the above ground rules, how does one develop a plan for a Wild River several hundred miles in length when soil and vegetation maps of the area are lacking? Where do you start, what type of data do you need, and where and how do you get it?

It is logical to use a natural land unit, the watershed, as an inventory base, rather than artificial property or political boundaries. The watershed with its soils, vegetation, and wildlife have been evolving together for thousands of years. Both these biotic factors and the six major types of drainage patterns (fig. 1) can be used to make inferences about missing data (Zernitz 1938, Parvis 1947). Thus a resource can be studied with a minimum number of variables.

By delineating the watershed boundary of the designated river on U.S. Geological Survey maps and examining the types of drainage patterns that comprise the drainage network, one can quickly decide whether the watershed is homogeneous or heterogeneous.

If only one drainage pattern is found and the drainage textures are similar, the resource is relatively homogeneous throughout in regard to slope,

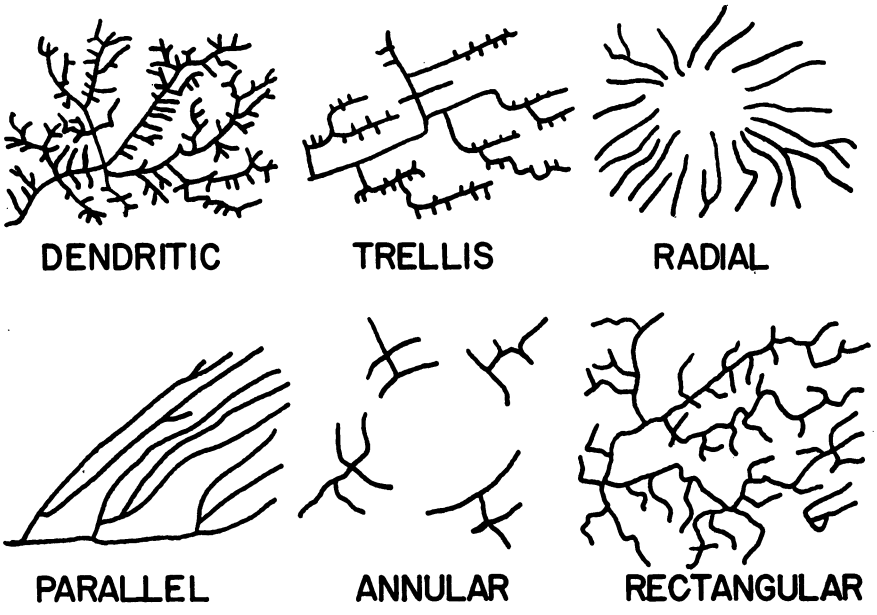

Figure 1.--*Six major types of drainage patterns (Parvis 1947).*

soils, vegetation, and wildlife (Kuska and Lamarra 1973). However, if both the drainage patterns and textures vary (fig. 2), i.e., are heterogeneous, it suggests that the entire area cannot be managed uniformly. Also, the various drainage textures indicate different soil textures and infiltration rates (Morgan 1969), which in turn can have an effect on the type of nutrients that eventually get to the river, thereby affecting the productivity of the river (pounds of fish per acre/year). This could be of major importance if an agency is trying to emphasize fishing in its recreation plan. Such information could also affect a watershed management plan since some soils within the watershed could be so highly erosive that any major disturbance (logging, roadbuilding) could result in high sedimentation rates in the river.

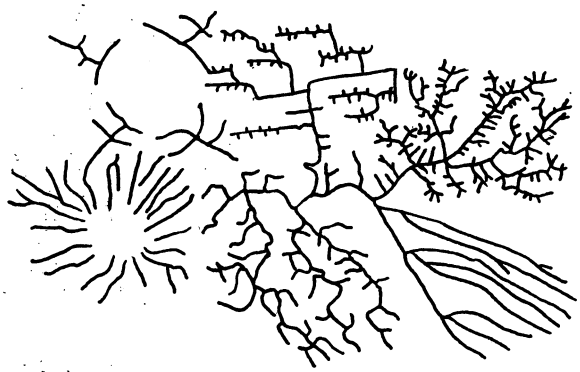

Figure 2.--*Different drainage patterns and drainage textures suggest a heterogeneous soil (Kuska and Lamarra 1973).*

The straightness of the river on U.S.G.S. maps can yield clues as to the homogeneity or heterogeneity of the soil adjacent to the waterway. Rivers flowing through homogeneous unconsolidated material (not bedrock but same material on both sides) are seldom straight for a distance of more than 10 channel widths (Leopold and Davis 1966). Thus, a stream 100 feet wide will be straight no longer than about 1,000 feet if the channel is of the same unconsolidated material. This information will also help the river manager decide early whether a uniform plan can be applied to the entire river, or how many different prescriptions will have to be considered.

RIVER CRITERIA

Once a planner obtains an overview of the resource's complexity, he knows *where* to sample and can start to gather specific resource data. This can save him untold hours of beating the brush, not knowing if he had taken enough data that is "representative" of the project area, or even how many different areas existed. Data on the following criteria should be gathered.

The river environment has five main components (fig. 3). The more ways these components vary, both individually and in combination with one another, the more enjoyable a trip down a river can be. Cross sections from U.S.G.S. maps can be taken at mile intervals to reveal which stretches of the river have deep or shallow canyon walls, narrow or wide flood plains, and the relative width of the river from one area to another.

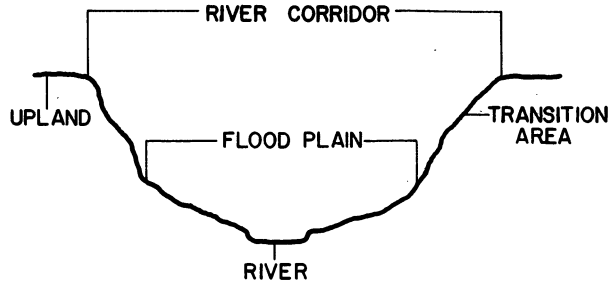

Figure 3.--*Five basic components of a river environment can be identified and evaluated to help determine an area's recreation/development potential (Kuska* et al. *1974).*

Corridor

A narrow corridor helps the river user feel an intimacy with his environment. If the river corridor becomes so wide that a canoeist or kayaker feels as if he were on a lake, the feeling of intimacy is quickly lost. The farther the recreationist is from a riverbank, the less intimate his relation is with plant and animal life, and the more vague points of reference become. The recreationist may feel he is going nowhere, thus diminishing the enjoyment of his trip. Also, steep shorelines adjacent to the water will preclude any campground development because constant trampling quickly leads to erosion of the riverbank.

Gradient

A graph depicting drop in feet per mile will show if the river gradient is similar throughout, or where the fast and slow water will be. If the river has 10- to 15-mile stretches of constant gradients, the recreationist will likely run the river segment that he or she can handle. Areas with steep gradients (6 to 8 feet per mile or more) should not have developed campgrounds along the shoreline since the river user is doing all he can to keep afloat in such water and is unlikely to attempt moving perpendicular to the current to secure a campspot.

Sinuosity

The amount of bending in a river is called sinuosity (Chorley 1969). It determines the maximum distance a river user can see another on the river, or that a camper could see another camper downriver. According to the Wild Rivers Act, a riverway should offer a degree of solitude. Constantly seeing other river users on the river means that objective isn't being achieved.

Sinuosity, then, could be equated with "visual carrying capacity", a subjective term related to a river user's recreation expectations and experience. The more bending (higher sinuosity), the greater a river's visual carrying capacity (fig. 4).

Sinuosity is determined by dividing the channel length of the river (along the bends) by the axial distance. A section of river from 1 to perhaps 4 miles long is usually measured: channel length might be measured from river mile 1 to river mile 5, and the axial distance (straight line) also measured between these two points. This procedure is repeated at each mile along the channel (fig. 5). River sections ranging from 1 to several miles in length have to be tried, and one selected which tends to stabilize the values. The sinuosity values for each river mile interval are then averaged for each study unit (Kuska *et al.* 1974).

Islands

Islands in a river can increase its visual carrying capacity by decreasing the distance a river user can see downriver

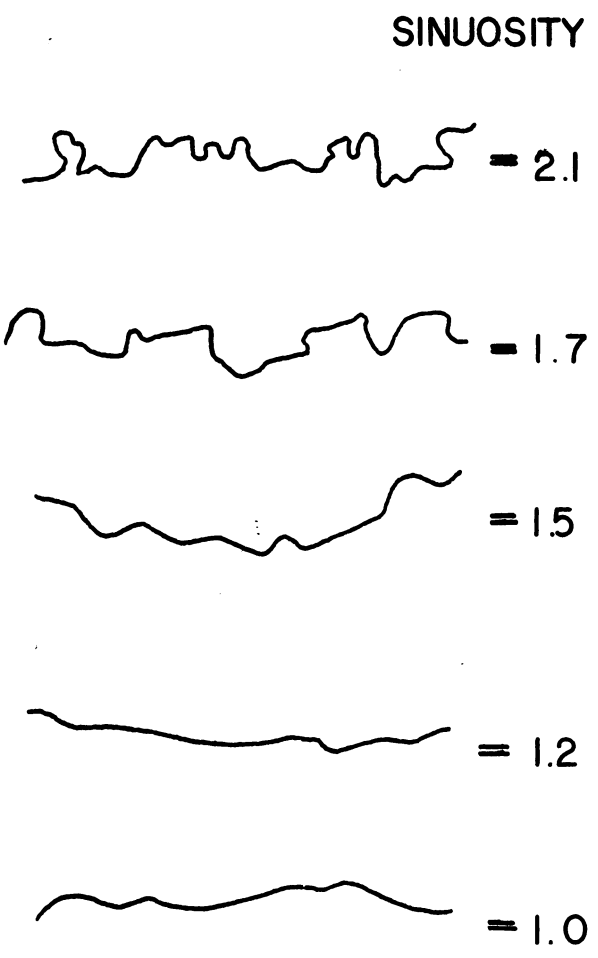

Figure 4.--*Examples of rivers with various sinuosities (Chorley 1969).*

(fig. 6). This data coupled with sinuosity, will suggest to a planner the visual capacity of a river. Usually the shorter the distance one can see downriver, the more interesting the river is to travel.

Rapids

Rapids definitely increase a person's interest, which can be instrumental in determining whether a person will return to the river again. Number of rapids per mile can be counted.

If the river planner plots numerical values for the four previously described topics on four separate vertical axes

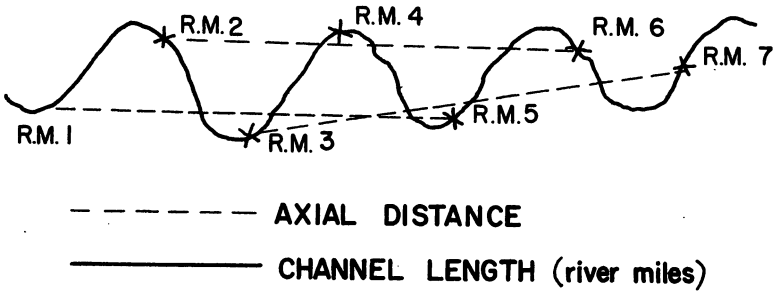

Figure 5.--*Graphic portrayal illustrating how river sinuosity is determined (channel length of river divided by the axial mile length) (Kuska* et al. *1974).*

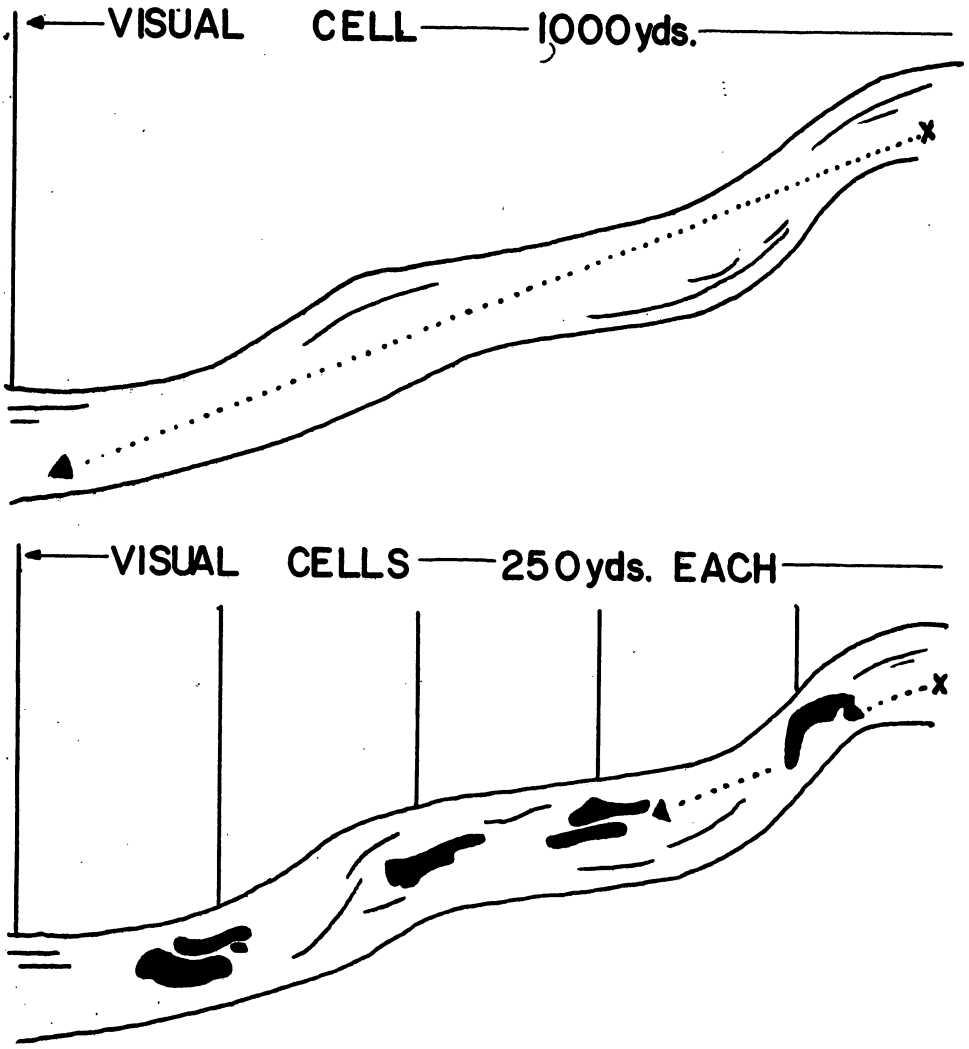

Figure 6.--*Aerial view of two similar rivers illustrating the influence that islands have on the size of visual cells (distance a river user can see downriver) (Kuska* et al. *1974).*

stacked one above the other over a common horizontal axis showing river miles, he can observe where the values for each tend to differ, and will be able to allocate segments to the river. For example, from river mile 0 to 30 the gradient may be 15 feet per mile, and from mile 30 to 75 the gradient may average 1 foot per mile. The sinuosity, island, and rapid data will tend to be relatively constant from river mile 0 to 30, but should change around mile 30 and tend to be constant until about mile 75, then change again to fit the next river segment. This exercise will bring the planner one step closer to understanding the ordered nature of the river and its inherent limitations.

FOCUSING ON SOILS, VEGETATION, ASPECT, AND SLOPE

Soil and plant ecology experts would generally agree that campgrounds should be kept out of riparian areas. Yet, with the designation of national Wild Rivers, planners and managers were just about forced to develop campgrounds in such areas. The solution is to find the least sensitive parts of riparian areas, and locate the auto ingress, egress, and river user camping there. Unfortunately, there seems to be no clearcut answer as to even which soil texture best withstands recreational pressure; Dotzenko *et al.* (1967) and Settergren and Cole (1970) found high clay content best, but Ripley (1962) concluded that sandy areas were better. So many variables must be considered (aspect, slope, climate, intensity and duration of use, etc.), it is doubtful whether any guidelines will ever be applicable nationwide.

How then does one gather data on the soils, vegetation, aspect, and slope of a 200-mile-long river, so that experts familiar with local conditions, can recommend areas that will withstand the recreation impact?

Because soil textures and vegetation are correlated, low-level 35 mm aerial color slides can be used to identify canopy vegetation and thus soil textures. This technique was applied to the 200-mile-long St. Croix-Namekagon River. A slide set with constant overlap was taken from an altitude of about 800 feet at a flying speed of 105 mph. By keying out the vegetation and making field checks, the entire shoreline canopy was identified. By correlating the vegetation with documented soil preferences (Bakuzis and Hansen 1960) and field checking, a general soil texture map was generated. This data can be checked by correlating it with drainage density (miles of stream per square mile of land area). The more coarse material contained in the soil, the smaller the drainage density number; thus a drainage density reading of 0.05 will indicate coarser soil than an area having a reading of 1.85 (fig. 7).

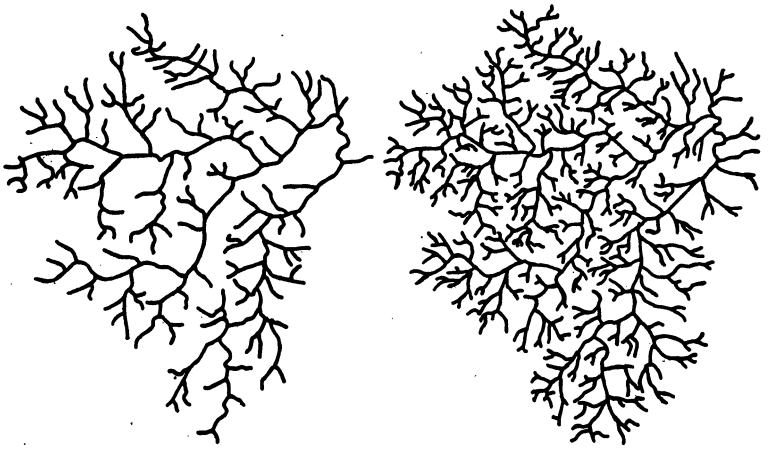

Figure 7.--*Differences in drainage density reflect different soil texture; "A" contains coarser material than "B" (Kuska and Lamarra 1973).*

One more check can be made by comparing the sinuosity data with the soil and vegetation data. If the sinuosity information indicates the river is meandering frequently, the inference is that the adjacent shoreline material is unconsolidated and similar on both sides, thus the vegetation should be the same on both sides. If your data does not support these observations, more detailed field work will be required to find out the reason for the discrepancies. Perhaps aspect and/or slope will be found to be the reason why the vegetation is different on the two sides.

On the St. Croix and Namekagon, compilation of the data revealed major soil and vegetation differences between the two Rivers as well as differences between segments of the same river. The Namekagon is bordered by homogeneous sandy soil which tends to be slightly acid, well-drained, and at times droughty. The vegetation, also homogeneous, consists mainly of the pines, namely jack (*Pinus banksiana*), red (*Pinus resinosa*), white (*Pinus strobus*), and northern pin oak (*Quercus ellipsoidales*). The St. Croix River soils were much more diverse, ranging from glacial till deposits to peat and muck soils. This diversity is reflected in the vegetation which consists of American elm (*Ulmus americana*), silver maple (*Acer saccharinum*), river birch (*Betula nigra*), black spruce (*Picea mariana*), alder, and willow. These species are primarily deciduous and usually found in a hydric environment. Such a variety of species suggests a diversity of shoreline environments which would preclude homogeneous development and management for this river.

The above information can be compiled for less than $250 (airplane, film, gas, pilot, etc.) as compared to having the river commercially flown (black and white aerial photos) and hiring a photo interpreter for a cost of at least $3 to $5,000. The lead time for commercial operation could be 6 months to a year. Also, if the person doing the photo-taking and interpreting is the principal investigator, he or she is gaining first-hand knowledge about the resource while doing the data collection and interpretive work.

WAS IT THE RIGHT CHOICE?

Vegetation-soil Degradation

An important aspect of any development plan is whether it fulfills the management objectives. Is the plan retaining the natural quality of the environment--if that's what was intended? In Wild River planning the resource is to be developed for the benefit and enjoyment of present and future generations. Thus, how much modification of a particular environment will a manager accept before he decides to limit the use of an area?

To answer, data *must* have been collected that would attest to the quality and diversity of the resource *prior* to development. Experts should have been consulted as to which environments (soils, vegetation) and related variables (slope, aspect) they felt had the best chance of withstanding the recreation impact, and then the sites had to be monitored.

Planners can help by laying out sites so they will be conducive to research projects. For example, one campsite could be developed at a density of 1 unit per acre, another at 3 units per acre, another 5 units per acre, etc. Each of these sites should be as identical as possible (in soils, vegetation, slope, aspect) and then a control area should be established. No camping should be permitted on the control area, so it can be compared with the other sites to discern the effect of camping. The duration, dates, and intensity of use should also be noted; a site may be very durable during the summer months, but if impacted during spring runoff when water tables are high, the site may not be able to recover for the rest of the season.

Aspect should also be closely scrutinized since trampled vegetation is vulnerable to severe heat and drying (Cieslinski and Wagar 1970), and vegetation on the cooler aspects has a higher survival rate than on the warmer ones.

Planners also need "indicator" guidelines which will help them evaluate how well their plans are fulfilling the management objectives. For example, what does it mean if a campsite of such and such density has no tree or shrub regeneration within 100, 200, or 300

feet of each campsite? Or if the ground cover for a 10-, 75-, or 200-foot stretch along the shoreline between the river and campsites has been reduced by 80 percent--is that degrading the site?

CONCLUSION

Little is presently being done to find out whether recreational developments on designated Wild Rivers is having a positive or negative effect on the resource. The longer agencies wait to do this the longer planners and managers will be without information from which to make "better" decisions. In addition, the agencies themselves have not defined what they mean by site or resource degradation; thus everyone is looking to someone else for answers. The questions to be asked have not been agreed upon yet.

SIMULATION MODELING AS A TOOL FOR MANAGING RIVER RECREATION

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ABSTRACT.--Accelerating use of free-flowing rivers for recreational floating has led many managers to initiate interim visitor use limits. Ideally managers should know beforehand how use patterns and levels of solitude would be affected when use limits are implemented. We modified the Wilderness Area Simulation Model, developed by Resources for the Future in cooperation with the USDA Forest Service, to predict patterns of river recreation use occurring under a variety of use conditions and tested it on the Green and Yampa Rivers in Dinosaur National Monument for the week of June 23-29, 1975. The "Base Case" simulation and actual patterns of use were compared to test the Simulator's validity and were found to be in close agreement. A variety of experiments, such as changing daily entry rates and opening and closing campgrounds, were simulated.

Recreational use of rivers and streams in the United States has increased dramatically over the past decade. Of particular concern to river managers and many recreation users is the impact of growing use on visitor satisfaction. Research in designated wilderness areas has shown that most visitors prefer few, as opposed to many, encounters with others (Lucas 1964 , Stankey 1973 , Lime 1975b). For river recreation, there has been much less research; but, several studies suggest some users are less tolerant to encounters than others (Roggenbuck 1975 , Pfister and Frenkel 1975 , Solomon and Hansen 1972).

A variety of administrative responses to control or modify river recreation use have been initiated during the last 5 years or so. Daily launch limitations (controlling the number of groups permitted to start per day at each entry point) and party size restrictions are popular measures to control use on about 30 rivers or river segments (table 1). These controls primarily are limited to the West; most are white-water streams, often in canyon settings, and under federal administration; and, such limits have been imposed only within the past several years. Such use controls have been and will continue to be challenged by the recreating public, the commercial outfitting industry, and others through litigation and legislative processes.

SIMULATING RIVER RECREATION USE

The complexities and recent controversies surrounding river recreation issues suggest that the intuitive and subjective approaches often employed in the past to evaluate alternative use management policies may no longer be suitable. More quantitative and objective models of river recreation systems are needed that allow the manager to predict outcomes of alternative use controls prior to their implementation. Such models require managers to identify objectives and to state specifically how much of what kinds of recreation use are acceptable when and where.

Table 1.--*Rivers of the United States with the year daily launch limits and/or party size limits were imposed*

River (State)	Administering Agency	Year Daily Launch Limits Imposed	Year Party Size Limits Imposed
Allagash Wilderness Waterway (Me)	State of Maine	--	1975
Boundary Waters Canoe Area (Mn)[1]	USDA Forest Service	1976	1968
Bruneau (Id)	Bureau of Land Mgmt.	--	1975
Carson, East (Nv)	USDA Forest Service, Bureau of Land Mgmt.	1976	1976
Chattooga (NC, Ga)	USDA Forest Service	1975	1975
Colorado, Cataract Canyon (Ut)	National Park Service	(2)	1972
Colorado, Grand Canyon National Park (Az)	National Park Service	1973	1972
Colorado, Westwater Canyon (Ut)	Bureau of Land Mgmt.	1974	1974
Dolores (Ut)	Bureau of Land Mgmt.	(2)	1975
Green, Desolation Canyon (Ut)	Bureau of Land Mgmt.	--	1974
Green, Dinosaur National Monument (Co, Ut)	National Park Service	(2)	1972
Illinois (Or)	USDA Forest Service	1976	1976
Jarbridge (Id)	Bureau of Land Mgmt.	--	1975
Kern, Lower (Ca)	USDA Forest Service	1976	1976
Kern, Upper (Ca)	USDA Forest Service	(2)	--
Kings (Ca)	USDA Forest Service	1974	1974
Klamath (Ca)	USDA Forest Service	1973	--
Merced (Ca)	Bureau of Land Mgmt.	1976	1976
Owyhee, Lower (Or)	Bureau of Land Mgmt.	--	1975
Owyhee, Upper (Id, Or)	Bureau of Land Mgmt.	--	1975
Rogue (Or)	USDA Forest Service, Bureau of Land Mgmt., Ore. St. Marine Board, Ore. St. Scenic Waterways	1975	1974
Salmon, Lower Main (Id)	Bureau of Land Mgmt.	--	1975
Salmon, Middle Fork (Id)	USDA Forest Service	1972	1972
Salmon, River Canyon (Id)	USDA Forest Service	1973	1973
Salmon, Upper Main (Id)	USDA Forest Service	1972	1972
San Juan (Ut)	Bureau of Land Mgmt.	(2)	1974
Selway (Id)	USDA Forest Service	1974	1974
Snake, Hells Canyon (Id, Or, Wa)	USDA Forest Service, Bureau of Land Mgmt.	--	1975
Snake, Grand Teton National Park (Wy)	National Park Service	1975	1975
Stanislaus (Ca)	Bureau of Land Mgmt.	1974	1974
Tuolumne (Ca)	USDA Forest Service	1973	1973
Youghiogheny (Pa)	Pennsylvania Dept. of Environmental Resources	1973	1973
Yampa, Dinosaur National Monument (Co)	National Park Service	(2)	1972

[1]A million-acre resource with lakes and connecting streams providing the linearity and directional character of a riverine system.

[2]Has seasonal rather than daily launch limits.

Ideally, managers should know how use patterns and levels of solitude would be affected by changes in the amount, distribution, and timing of use before a management policy is implemented. For example, one solution to a suspected overuse situation would be to limit the number of groups permitted to launch from a particular access point. In fact, since 1972 this policy has been implemented by 6 agencies on 19 rivers or river segments (table 1). If such a limit is imposed, some pertinent questions are: How would the river use pattern compare to what it had been before the limit was imposed? How many groups per day, on the average, would any given group expect to encounter? How many groups would camp at each river campsite each night? It would be difficult to answer these and related questions without some means of predicting the behavior of river users.

One approach to evaluating the results of proposed visitor use management policies is to simulate visitor use and behavior with the aid of a high-speed digital computer. Simulation models are simplified representations of real world situations that may provide approximations and insights into the nature of systems that are too complex to be analyzed on a subjective (intuitive) basis.

Resources for the Future, Inc., in cooperation with the USDA Forest Service, has developed such a simulation model--The Wilderness Area Simulation Model. This computerized model can predict levels of congestion that will occur under a variety of use intensities and patterns. It was first used to simulate recreation travel behavior in terrestrial wildland settings (Smith and Krutilla 1976 , Shechter and Lucas, In prep.). Summaries from the model show how many other groups a party will meet or see during the trip (both on the trail and at the campsite), indicate what types of groups are encountered (such as hiker, horseback, small, large, etc.), and will even show the locations within the wilderness where encounters occur.

Through a cooperative study between the North Central Forest Experiment Station and Utah State University, the model was modified for application to river recreation systems. In 1975 it was field tested by the authors on the Green and Yampa Rivers in Dinosaur National Monument.

Knowledge of computer programming or expertise in operating computers is not required to use the model. A users manual (Shechter 1975) is available that describes the type and format of data required to operate the model, the nature of outputs from the model, and other information to aid the user in applying the model to his particular management situation.[1] The model was originally developed using IBM, GPSS-V language and has been modified for use on several other computer systems.

This model is potentially valuable for understanding and contending with the problems of increased river recreation use. It aids managers in assessing a variety of approaches for managing visitor use. Using the model as a tool, managers can make informal judgments regarding appropriate techniques for off-setting undesirable conditions and then evaluate the results. Managers can use it to test proposed use management policies in a faster, more efficient manner than by an on the ground trial-and-error approach spread over several seasons of use.

INFORMATION PRODUCED BY THE MODEL

The simulation model describes what might happen to use patterns on a river under varying use management policies without actually manipulating use and then waiting to see the results. Two general types of output come from the Simulator: (1) information about amounts and patterns of use; and (2) information about the number and location of encounters groups have with each other. Many types of summaries are possible. For example, information by size of group (e.g., small, medium, and large) and types of travel (e.g., privately and commercially outfitted, or kayaks and rafts) could be summarized for:

(1) The number of groups using each entry point;
(2) The number of groups using each river campsite;

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[1] *Available from National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22151. (Manual) Order No. PB 251 635, $12.50 per copy, $2.50 microfiche. (Program) Order No. PB 251 634 (WAUSM) Source Program tape, $150.*

(3) The number of groups using a given river segment (e.g., smooth water between rapids and campsites) or a nearby hiking trail,
(4) The number of groups with different trip lengths;
(5) The number of groups entering and leaving the river each day of the simulation period;
(6) The average number of groups encountered per group per day on the river;
(7) The probability of having a group camped nearby on each night of the trip; and
(8) The probability of a group encountering other groups during the day while on the river.

DATA NEEDED TO OPERATE THE SIMULATOR

To operate the Simulator, three major types of visitor use information are required for the period of time the manager wants to simulate (often the most heavily used one or two weeks in the season).

1. Current river use patterns
   a. Total number of groups launched at each access point by travel mode (e.g., private, commercial) and group size.
   b. Total number of groups launching at each access point by day of the week and by hour of the day--by travel mode and group size.
2. The average time (in minutes) to travel the various segments of the river (such as time between major rapids and between major rapids and campsites).
3. The routes of travel (where groups camp, eat lunch, scout rapids, etc.).

The user of the model can specify the amount of detailed travel behavior to be simulated. In the terrestrial field tests, travel routes were generalized and consisted of portions of the trail network traversed each day and camping locations. Daytime stops to rest, eat lunch, and make short side trips off the trail were not used in defining routes of travel. In the Yampa and Green Rivers field test, travel routes included detailed daily travel behaviors. Portions of the river traveled were further segmented to include hikes up side canyons of the river, and stops for lunch and to scout rapids. By incorporating this level of specificity into the model, more accurate predictions of use resulted.

When modeling use patterns for either trail or river networks, encounters are defined by the type and size of the party encountered and the conditions under which encounters occur. There are four kinds of encounters. *Campsite encounters* occur when two or more parties occupy the same campground or general camping area. *Meeting encounters* occur when two parties going in the opposite direction pass each other. Meeting encounters seldom occur on the river because most parties travel downstream; however, they can occur off the river when two parties occupy the same general shoreline location to rest, eat lunch, scout rapids, etc., or pass each other while hiking. *Overtaking encounters* occur when one party overtakes another party going in the same direction on the river or on hiking trails. *Visual encounters* occur when a party on the river passes within sight of another party on land or vice versa. Visual encounters occur between parties on the river when they are within sight of one another but do not meet, overtake, or are overtaken.

Although a fair amount of information on visitor use is required as input to the model, most managers probably would not need to start from scratch. Often, much information is already available, especially where use permits are required. Information that is not available (such as travel times on various river segments or routes of travel) can be collected through a special study or during routine work schedules. Also, if no better data exists, it is possible to generate input information for the model based on the manager's best judgment of use conditions.

To determine if the model actually predicts real world use patterns, information from users is needed on the number and location of encounters they have with one another. In this way users of the model can determine the level of confidence to place in the model by comparing actual use conditions with results from the Simulator. The visitor use information collected has other important values such as helping to identify trends in use, pinpointing areas

of high use concentration, and quantifying rates of campsite use.

A FIELD TEST OF THE MODEL

To illustrate how the Simulator works in a river management situation, we tested it on the Green and Yampa Rivers in Dinosaur National Monument (fig. 1). The Monument was chosen as a test location because the problems and issues relating to river recreation management on the Green and Yampa Rivers are broadly representative of those across the Nation. Also, much of the information needed to operate the model was available from National Park Service records.

The river system is intensively used for recreation and managers have become increasingly concerned about the effects of its growing popularity, both on the experiences of people who float the rivers and on the environment. In 1973, an interim seasonal use limit of about 17,000 persons was adopted for both rivers. This figure was based on 1972 use, which had grown rapidly since 1967 (2,500 persons). Since 1973, total use has fluctuated near the limit with the 1976 season recording about 14,000 visits.

River use in Dinosaur National Monument is strictly regulated and supervised. Reservations for trips the following season are accepted beginning December 1. Based on a first-come-first-served procedure, floaters are given launching dates and are assigned campsites. There are weekly river patrols and compliance with permit regulations is checked frequently and enforced.

River float trips generally begin in May with a peak during the Memorial Day Holiday. Use remains high through June and July, then gradually declines, and virtually ends by October. In May and June, most use is on the Yampa River, but as the volume of water in the Yampa River drops, the majority of use switches to the Green River, generally around July 1. The number of groups launching each day varies considerably. Most groups launch on Thursdays and Saturdays, while Wednesdays and Sundays have the fewest launchings.

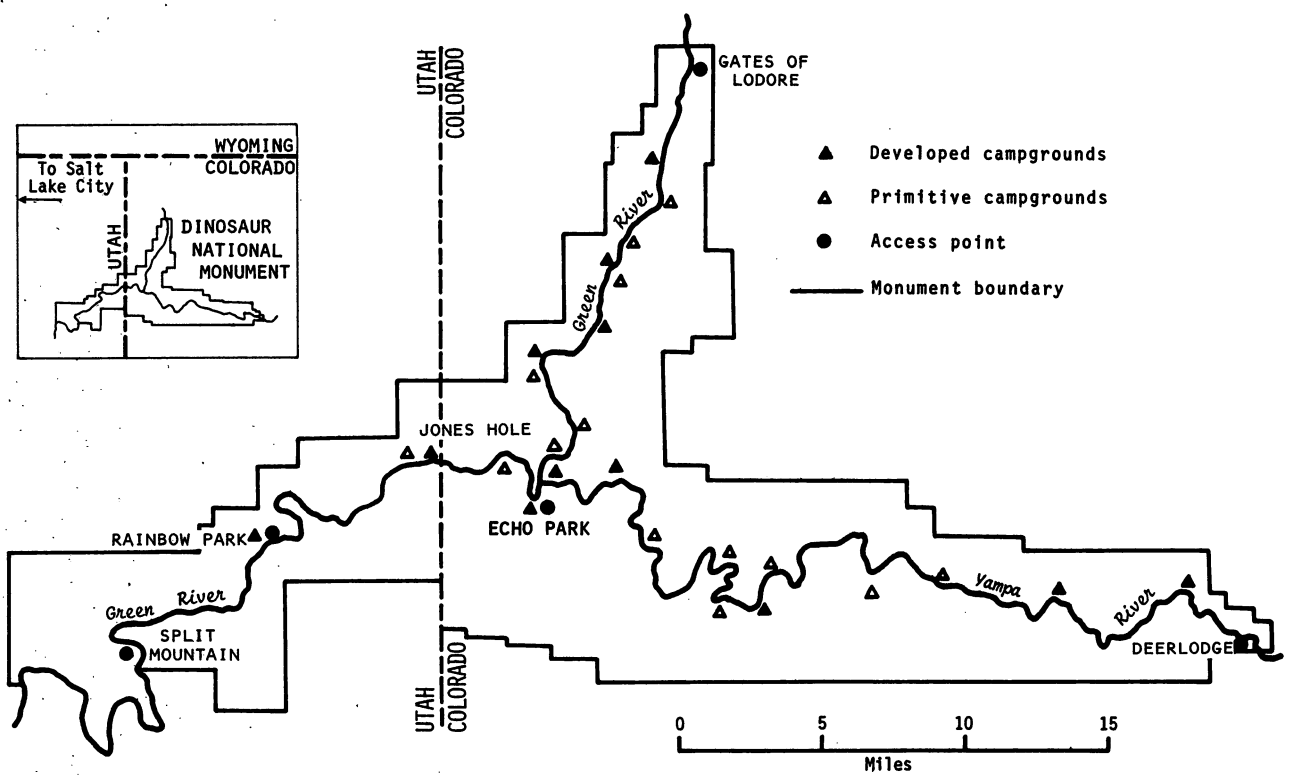

Figure 1.—*Green and Yampa Rivers, Dinosaur National Monument*

In 1975, 12 developed campgrounds (with toilets, tables, and fire grates) and 14 primitive campgrounds (no facilities) were available along the river for float trip users (fig. 1). Each developed campground had one or more developed campsites; primitive campgrounds accommodate only one party each. All were inaccessible by road and were used exclusively by river floaters. Most people stayed at the developed campgrounds but use varied considerably. For example, during the period June 9 through July 20 the occupancy ranged from more than 66 percent at the popular Jones Hole Campground (7 sites) to less than 5 percent at several others. The primitive campgrounds were infrequently occupied; many were not used at all in 1975.

Most of the information needed to operate the Simulator was already available from the National Park Service because they routinely collect it as part of their Special Use Permit procedure. Additional information, such as travel time along river segments, and the routes of travel for individual groups was collected through a special survey. Sample groups kept diaries of their travels and returned them to us following their trip.

Simulating Existing Use

The Simulator was first used to duplicate or predict the existing river use patterns from June 23 through 29, 1975. This simulation was termed the "Base Case" because it represented the actual use situation. During this period, 44 groups launched from Gates of Lodore, Deerlodge, and Rainbow Park.

Once the "Base Case" was simulated, the data were compared with actual knowledge about use patterns for the same period to determine how accurately the model predicted use. Simulated data were compared with National Park Service records for campground occupancy. Simulated data for numbers of encounters on the river (meeting and overtaking encounters) and at campsites were compared with data collected from visitors who kept a diary.

The model predicted patterns of use well. Simulated rates and actual use of campgrounds correlated closely. Simulated and actual encounters (meeting and overtaking) also were highly correlated, although the degree of similarity was closer for encounters on the river than for camp encounters. The model overestimated the number of campsite encounters, but this might be attributed to visitors perceiving fewer groups present at a campground than actually existed.

As expected, the model predicted actual use much better for the entire simulation period than on a day-to-day basis. For example, simulated daily occupancy at campgrounds varied by as much as 50 percent from National Park Service records. This does not mean the model is useless for evaluating the effects of a use management policy on a daily basis, but the model is more useful when interpretations are made using information generated for the entire simulation period.

Simulating Changes in Use

After simulating existing use patterns, use conditions were modified and the Simulator was used to predict resulting use patterns and numbers of encounters that might result if such conditions were implemented by management. Many experimental use patterns were simulated and evaluated--such as increasing use by varying amounts, redistributing daily entry rates between entry points and days of the week, and developing new river campgrounds and eliminating other ones. Some experiments represented use management policies being considered by the National Park Service; others were developed simply to illustrate the effects of fairly extreme modifications in use. Three experiments are briefly summarized below to illustrate how information produced by the model can be presented and what some of the effects of modifying use conditions might be.

Experiment I. Increase the total number of groups taking river trips from 44 to 88 (a 100-percent increase in use). All other conditions remained the same as in the Base Case.

Experiment II. Redistribute daily entry rates so that an equal number of groups entered on each day of the week. All other conditions remained the same as in the Base Case.

Experiment III. Eliminate all primitive campgrounds and add two new developed campgrounds within 2 miles of Jones Hole. Groups who formerly used the primitive campgrounds were assigned to the nearest developed campground; 40 percent of the groups using Jones Hole were equally divided

between the two new campgrounds. All other conditions remained the same as in the Base Case.

In analyzing the results, four questions were asked: (1) What was the percent occupancy at Jones Hole Campground? (2) What was the percent of group-nights (sum of nights camped by all groups) with no encounters? (3) What was the average number of groups encountered (meeting and overtaking) per day, on the river? and (4) What was the percent of group-days (sum of days on the rivers by all groups) with no encounters (meeting and overtaking)?

Several conclusions can be drawn from the results of the three experiments in comparison with the Base Case (table 2).

Experiment I. Increasing use by 100 percent resulted in a proportionate increase in use at all locations. Campground occupancy at Jones Hole approximately doubled while the average number of encounters per group, per day, more than doubled. As a result of other experiments we have conducted and from other field tests (Shechter and Lucas, In prep.) the average number of encounters per group, per day, appears to be a linear function of total use. This means that separate experiments are not required to determine use at a given site and the average number of encounters per group, per day, when comparing the effects of the same experiment with an across-the-board increase or decrease in total use. Because of this relation, the number of experiments required to evaluate a given use policy could be greatly reduced along with a proportionate reduction in computer costs.

Increasing use by 100 percent had only a moderate impact on reducing the probability of a group camping alone. And, only a third, as opposed to about half of the groups in the Base Case, met no other parties on the river during the day.

Experiment II. Equalizing entry rates across days of the week had little influence on either encounters or campground use. This might be explained, in part, because the variation in daily entry rates in the Base Case was not extreme, even though there were signficant differences in use between days of the week.

Experiment III. Adding new campgrounds and closing others had little overall effect on encounters. As expected, modifying the use at Jones Hole reduced its occupancy. The probability of a group camping alone was minimally affected, largely because only a few groups were "transferred" from primitive to developed campgrounds.

DISCUSSION

The Simulator seems particularly useful as an aid to river recreation planning and management because the problem of congestion and overuse is National in scope. Daily launch limits and party size restrictions, frequently based on intuitive decisions, have been widespread--geographically and jurisdictionally (table 1). And, because most of these policies are of recent origin, their validity has not been confirmed and remains largely unchallenged, either face-to-face between the administrators and the public or in the courts.

Table 2.--*Selected statistics for the Base Case and three experiments*

Use Patterns	Groups Simulated	Occupancy at Jones Hole Campground (7 sites)	Group-Nights[1] with no Encounters	Average Encounters[2] Per Group, Per Day	Group-Days[3] with no Encounters[2]
	Number	*Percent*		*Number*	*Percent*
Base Case	44	70	55	1.2	55
Experiment I	88	145	44	2.8	33
Experiment II	44	81	54	1.3	51
Experiment III	44	54	55	1.3	49

[1] Sum of nights camped by all groups.
[2] Meeting and overtaking encounters.
[3] Sum of days on the rivers by all groups.

The Simulator will not make decisions for managers, tell the manager how to choose or define a given use management policy, or tell the manager the best way of achieving a desired use policy (reservations, pricing, zoning, altering access, etc.). However, the model will allow managers to experiment with various use management policies and to get an idea of how such policies would affect river recreation use patterns so they do not have to rely on trial-and-error experiences. In this way managers can test and evaluate the likely results of use management actions quickly and inexpensively. Knowing beforehand the probable outcomes of various policies should increase the likelihood that once action is taken to control use, the expected use conditions will materialize.

The potential for developing use management experiments for simulation is virtually unlimited. One potentially useful experiment to reduce encounters would be to restrict the time of day parties enter the river at each access point. On the Youghiogheny in Pennsylvania and Snake in Grand Teton National Park (table 1), such a policy has been implemented and is under consideration by other river managers nationwide. The model has the capability to limit the number of parties entering for any times desired. The results of such experiments should indicate, for example, if encounters were reduced throughout the experiment period or only for the first day or two until a general mixing of use occurred.

It should be understood that the model has its greatest utility as an aid to river recreation management when the administrator has managerial control of major river access points. This situation exists for all rivers with daily launch limits (table 1). Altering the flow of users through access points is the basic mechanism for controlling use within the model. All modifications in use--such as types and sizes of groups, time of launching and dates trips begin, and the routes of travel taken--are assigned by the user of the model on an access point basis. Obviously, then, river managers who control virtually all access to the river (such as in Dinosaur National Monument) would find the model more useful as a management tool than would managers who control only a few access points.

If the model is used to study possible use management policies for a given river setting, and a policy is selected for implementation, it is important to monitor and evaluate the resulting use patterns. Much of the data required would be available as a result of implementing the use management program. Other information, such as numbers and locations of intergroup encounters, would need to be collected. Such a comparison between simulated and actual use conditions would tell the manager the degree to which desired use patterns were achieved, and permit further adjustments if needed.

Part of the rationale for monitoring the effects on use of a use policy would be to determine if the management policy itself altered the subsequent river travel patterns. Studying how users responded to such conditions would provide a basis for developing new experiments and possible implementation. Only under extreme or drastic modifications in use patterns, closure or alteration of campsites and access points, etc., would we expect a significant change in how visitors used the river.

The Simulator has considerable application to planning and management for a wide variety of dispersed recreation activities. The possibilities for imaginative experiments are exciting and challenging. Its application largely is dependent on use situations where recreation users "flow" along specified networks such as trails, highways, or waterway systems. To implement the results of Simulator experiments, managers of such areas must have the authority to enforce limits on the number of users permitted to enter an area through major access points during a specified time.

THE COMPLEX USES OF AN ACCESSIBLE RIVER — THE KETTLE OF MINNESOTA

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ABSTRACT.--Minnesota's Kettle River provides a wide range of recreation attractions from white-water kayaking to canoeing, fishing, and boating within 100 miles of the Minneapolis-St. Paul metropolitan area. Initial results of a study to develop base line visitor data and a means of monitoring use suggest a complex of uses, visitor types, and river conditions. A river of this type must be sensitively managed to meet wild and scenic river objectives.

The Kettle River in Carlton and Pine Counties is Minnesota's first Wild and Scenic River designated under the 1973 legislative act. Situated within 100 miles of the Minneapolis-St. Paul Metropolitan Area, the river is 79 miles long with a total fall of 484 feet. It originates in agricultural land, flows through a sandstone gorge and joins the St. Croix River in a somewhat remote river bottom forest. A central 2-mile rapids (Hell's Gate Rapids) breaks the stream into three use zones. The river offers recreation possibilities ranging from challenging white-water kayaking to canoeing, boating, fishing, swimming, sightseeing, photography, and related activities. All are influenced by fluctuating water levels (fig. 1).

We undertook this study in 1975 and 1976 to test methods for recording river use and use patterns, and to develop a means to measure user preferences that would allow comparisons with other rivers and other times.[1]

BACKGROUND

Historical records indicate that the Kettle River has been used for boating and fishing by Minnesotans of European origin for over 100 years and prior to that by Indian people. After the Civil War the river was used extensively for log drives. Sandstone quarrying operations commenced along its banks in the 1880's giving rise to the river towns of Sandstone and Banning. A hydroelectric power dam was put in below Sandstone before 1910. These activities affected river use and the construction of related structures. Apparently, there was some running of the tricky, white-water rapids (Hell's Gate) before 1900. In the 1930-50 period there were small river parks near Askov and east of Hinckley. In recent years the city of Sandstone created a river park at the site of the old quarry.

The river level varies as much as 11 feet at some locations. The best months for river craft are from April through June. However, heavy rains can cause a rise in the river in late summer and a resurgence of canoeing, kayaking, and other uses. Fishing continues at most levels.

The Upper Kettle flows by towns and active farms. Interstate 35 (between Duluth and the Twin Cities) crosses it 31 miles above its confluence with the St. Croix

[1]*Financial support came from a cooperative-aid grant to the College of Forestry from the USDA Forest Service, North Central Forest Experiment Station, and from McIntire-Stennis Cooperative Forestry Research funds.*

River. The lower portion of the river passes through two State parks, a game refuge, a State forest, and has limited access. A combination of existing public ownership, the inherent attractiveness of the Kettle, and perhaps the river's relation to the St. Croix (a Federal Wild and Scenic River), encouraged interest in its classification as a Minnesota Wild and Scenic River under the responsibility of the Department of Natural Resources in 1975.

In recent years the Hell's Gate Rapids above Sandstone have become popular with white-water canoeists and kayakists from the Twin Cities. Sections of the river above the Rapids are good for late spring canoeing, boating, and fishing. Below Hell's Gate Rapids the canoeing and boating continue longer, gradually withdrawing to the main pools, as above Sandstone dam, in the late summer.

RELATED RIVER STUDIES

A great many articles have been written about river use in recent years, particularly since the passage of the Federal Wild and Scenic Rivers Act of 1968. River study now has become an important research topic. For our purpose, studies relating to use monitoring, inventory, and river users were helpful.

Lime (1975a) and others have detailed the need for study of river recreation in the *Naturalist* on River Recreation. In the same magazine Priesnitz (1975) describes the Minnesota Wild and Scenic River System with particular coverage of the attributes and features of the Kettle River. The Minnesota Department of Natural Resources (DNR) has developed a detailed management plan for the Kettle River. It includes maps with development locations, management procedures, and proposals plus coverage on land acquisition.[2]

PRELIMINARY METHODS AND RESULTS--1975

To obtain some background information on the River a check was made of access points and local landowners, including campground and boat rental operations. An overflight of the River was provided on August 6, 1975 by the Department of Natural Resources to count river uses. It was decided to try aerial photograph flights in 1976.

Self-registration stations using cards and boxes (a technique used successfully in the Boundary Waters Canoe Area (BWCA)) were placed at 4 major access points along the river--Banning State Park, Robinson Park (Sandstone), State Highway 48 Bridge, and St. Croix State Park. Respondents were asked to complete a group registration card indicating: date, time of visit, watercraft type (if used), number of people in the group, length of time at river, purpose of trip (check list), and mailing address; comments on the visit were also solicited. Cards then were to be placed in a locked compartment of the registration box.

Unlike the experience with this technique in the BWCA where vandalism was minor and registration was more than 90 percent (Merriam *et al.* 1973), the boxes were badly vandalized and the returns were somewhat erratic. (Self-registration could be improved by developing vandal-proof boxes and checking boxes more often. No further use of boxes was made in 1976.) In spite of these limitations the technique did reveal, at relatively low cost, the wide range of activities occurring on the Kettle River (table 1).

For example, responses indicated that 75 percent of the registered parties were engaged in multiple activities involving the River environment, including both the bank and the water. This was confirmed by our river and aerial reconnaissance. For example, rafting and tubing were indicated activities for Banning State Park, where the box was placed at the beginning of Hell's Gate Rapids.

METHODS--1976

The information obtained in 1975 provided the basis for our 1976 tests of observation, questionnaire, interview methods, and aerial reconnaissance. Our investigation focused on the period May 15th through September 15th, the period of heaviest use. During this period we were just as interested in learning

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[2]*Minnesota Department of Natural Resources, 1974. A management plan for the Kettle River. (Preliminary draft.) 141 p. St. Paul, Minnesota.*

Table 1.--*Number of registered parties that engaged in various activities by location, Kettle River, 1975*

Activity[1]	Location				
	Banning State Park	Robinson Park (Sandstone)	State Hwy. 48 Bridge	St. Croix State Park (Big eddy)	Totals
(Respondents)[2]	(50)	(33)	(25)	(13)	(121)
Fishing	7	9	5	7	28
Picnicking	13	14	1	0	28
Sightseeing	27	21	9	4	61
Photography	15	11	5	0	31
Wildlife Observation	22	13	7	5	47
Canoeing	10	8	7	2	27
Hiking	27	14	4	5	50
Bicycling	3	0	0	0	3
Camping	2	2	1	0	5
Rest and Relaxation	2	0	0	0	2
Rafting	1	0	0	0	1
Tubing	1	0	0	0	1
Rock Climbing	0	1	0	0	1
Beer Drinking	2	0	3	0	5
Scavenging	0	0	1	0	1
Sex	1	0	0	0	1
Prank	5	3	9	0	17

[1]Seventy-five percent of the registrants listed from 2 to 6 activities. Twenty-five percent (30 out of 121) of the respondents listed only one.

[2]Each respondent signifies 1 group of from 1 to 30 people.

when the area *was not* used as we were in when it *was* used, how many used it, their activities, and attitudes.

Observation Methods

An observation method suggested by Burch (1964) was used to obtain data on use at access points (which were also used as interview points). From May 15 through June 30 we counted all river and riverbank users during two randomly selected 3½-hour periods on each sample day (7 a.m. - 9 p.m.). Four of the sample days were weekend days, and four were weekdays, all randomly selected. The access points observed were: Highway 73 south of the town of Kettle River; Willow River (Highway 41), Rutledge (county road); Robinson Park near Sandstone; Highway 48 bridge; Highway 23 near Askov; and Maple Island (St. Croix Park). We were confident that these points accounted for most boat and canoe access to the river (fig. 1). Access points near the towns of Kettle River and Willow River were abandoned because of low water by the end of May.

A similar procedure was followed from July 1 to September 15 except that the study was concentrated below Highway 23, and 4 weekend days and 6 weekdays were randomly selected.

For each access point and time period we recorded the number of people seen, their approximate age, sex, and type of group. Also recorded were their vehicles, equipment, type of watercraft, and their river activities. Weather and water conditions were also noted.

Interview and Questionnaire

All persons entering or leaving the river at access points were interviewed as to their river use, socio-economic status, knowledge of the Wild and Scenic River, and

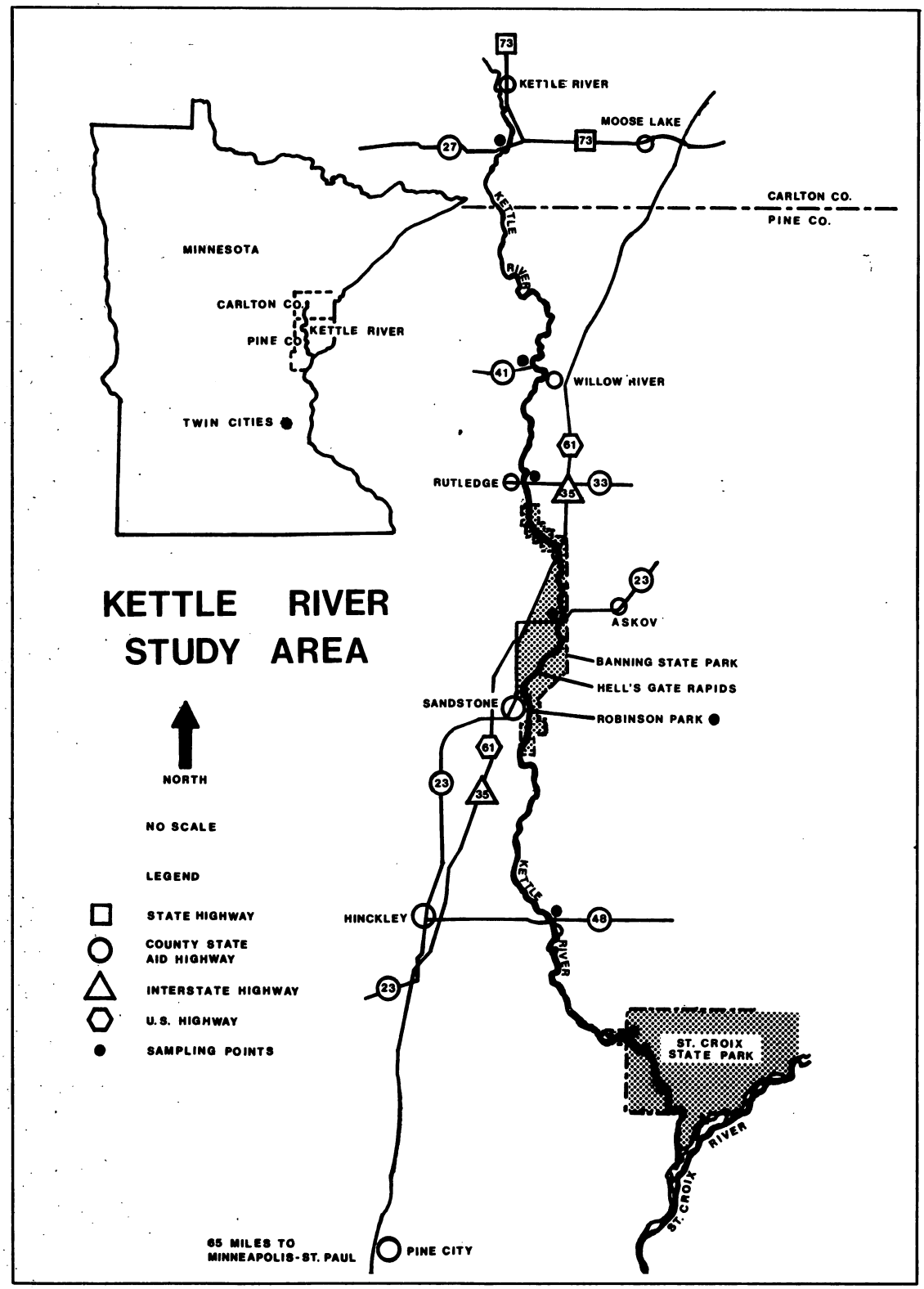

Figure 1.--*Map of Kettle River study area.*

their opinions about Kettle River management alternatives. The interviews were kept brief to avoid inconveniencing the respondents (table 2).

The questionnaires dealt primarily with attitudes on river use and management and trip activities, and took more time to answer. Those interviewed were asked to fill them in and mail them back at the end of their trip. The questionnaire[3] was unique in that it attempted to define preferences in terms of tangible components of the environment rather than vague, subjective descriptions. For example, the respondent was not asked if he was seeking "solitude"; instead he was asked to indicate how desirable it would be to encounter various levels and kinds of use on the river. Hopefully, this approach will reduce the amount of judgmental interpretation in management decisions. The interview and questionnaire were keyed to each other by number. This data is being summarized and evaluated for later reporting.

[3]*Additional information on the use of the River, including the Hell's Gate Rapids, is being obtained by a separate questionnaire sent to the membership of, and in cooperation with, the Minnesota Canoe Association. Data collected is similar to that obtained from other river craft interviewees.*

Between interview periods various sections of the Kettle were run by canoe and other river access locations were observed.

Aerial Reconnaissance

On June 19 and August 28 overflights were made of sections of the River by the Remote Sensing Laboratory plane.[4] Color 35mm photographs were taken to check river use. Photographs were taken at both 4,260 and 2,130 feet altitudes to check resolution differences; researchers on the ground verified photo results. A Cessna 206 aircraft, flying at 110 miles per hour, and Ektachrome X film were used in both flights. The primary purpose of the flights was to determine what kind of information could be obtained from aerial photographs. No attempt was made to estimate total seasonal use.

RESULTS--1976

The year 1976 proved to be one of the driest on record in northeastern Minnesota. The Kettle River level dropped by the middle of May and remained low all summer, except

[4]*Institute of Agriculture, Forestry, and Home Economics, University of Minnesota, St. Paul, Minnesota.*

Table 2.--*Number of interviewees by contact activity and residence*

Type of user	Contact Activity	Residence			
		Carlton and Pine Counties	Twin Cities Metro Area	Other Minnesota	Wisconsin
River craft	Canoeing	8	12	0	2
	Kayaking	0	2	0	0
	Motor boating	4	2	0	0
	Motor canoeing	0	2	0	0
	Row boating	0	1	0	0
N = 33 Subtotals/(Percent)		12 (36)	19 (58)	0	2 (6)
Bank visitor	Fishing	7	7	5	0
	Hiking	9	6	0	0
	Sightseeing	1	5	1	0
	Swimming	3	2	0	0
	Other[1]	10	3	3	0
N = 62 Subtotals/(Percent)		30 (48)	23 (37)	9 (15)	0
N = 95 Totals		42	42	9	2

[1]Relaxation, lunch, waiting, car washing, education.

for a mild rise in mid-June that made the Hell's Gate Rapids attractive to kayakists and most of the River navigable by canoe. Use was generally restricted to the lower river and main pools, such as the pool behind the Sandstone Dam that extends 2 miles upstream to Robinson Park. River use, particularly by kayakists and canoeists, was light. All State Parks on the River were closed to public use due to fire hazard on the week following the end of our study period.

Despite these conditions we obtained much valuable information about the River and its users. Insights were obtained on the role of the Minnesota Department of Natural Resources (DNR) in river management. During the course of our interviews we learned much of the local lore, politics, and problems as well as obtaining our study data.

We interviewed 95 persons in total. Of the 33 river craft interviewees, 19 (58 percent) were from the Twin Cities metropolitan area with 12 (36 percent) from local counties (table 2). On the other hand river bank visitors were more often locals, 30 out of 62 (48 percent) with 23 (37 percent) from the Twin Cities. Canoeists and kayakists were younger (79 percent in the 18-31 year age range) than boat and motor users (55 percent in the 40-70 age range).

Seventy-nine percent (49) of the contacted bank users knew of the Kettle River's Wild and Scenic River status and most approved of it. Four local people voiced reservations concerning adequate river protection and displacement by outsiders. On the question of charges to manage the Kettle River, 54 percent of all locals polled opposed charges as compared to 15 percent opposition from other parts of Minnesota.

Local residents were not always in tune with on-the-ground management decisions. At the Highway 23 access that is in Banning State Park, a river access canoe campground had been installed and a road blocked by park officials to keep cars out. The local people who had previously used the road for fishing access pulled down the barrier several times.

The aerial photo flights enabled us to count and describe river users at a particular point in time. On the higher altitude photos (4,260 feet) it was possible to identify all river craft by type in the main river channel. People, however, were difficult to count. On the other hand, at the lower altitude (2,130 feet) individual craft, people, inner tubes, vehicles, etc., could be identified. It was also possible to identify canoeists with or without packs and other gear.

In the aerial photos forest vegetation tends to limit counts of shore fishermen and bathers. Probably, there would be better resolution of objects if Kodachrome rather than Ektachrome film was used. Cloud cover, wind and cost would limit the use of aerial photo counting. Interviews, checks, and aerial photos from this study showed that 1976 use was concentrated in river segments with adequate water.

It was interesting to observe the various techniques utilized to overcome the problem of getting people and equipment from one end of a "use unit" to the other. (Hell's Gate Rapids, a use unit used primarily by white-water canoeists and kayakers when the River is high enough for passage, separates the upper river and lower river use units, which are generally used by cruising canoeists, boaters, and fishermen.) In some relatively short stretches, it is possible to simply motor back upstream. This technique permits a party to put in and take out at the same point. It is used primarily by fishermen and is not very popular with canoeists who may be trying to experience more interesting parts of the River and are probably reluctant to use motors in any case. One canoeist was observed "poling" upstream. This technique may gain in popularity as more people become aware and skilled. Hitchhiking was also observed.

The authors experimented with a "bicycle shuttle"; i.e., a bicycle was hidden at the lower end of the use unit and used to return for the transport vehicle. This technique is quite efficient when there are only two people and one automobile. These observations suggest that the logistics of shuttling back and forth may be an important factor affecting use patterns.

The Hell's Gate Area deserves special consideration. This segment is a series of rapids totaling about 2 miles in length and

is very popular with white-water enthusiasts using kayaks and covered canoes. The season is relatively short since this area can only be negotiated when water levels are sufficient, usually in the early spring. It is also possible for the water to be too high and therefore dangerous. During the study period DNR personnel cleared a portage trail around the rapids on the east bank of the River. This facility may have a significant effect on use patterns and may reduce the barrier effect of the rapids; the scenery of this section should also act as an attractant.

The "where" and "when" of use are inextricably related. However, it is useful to abstract the time dimension for the purpose of analysis. Other than extreme cold, water level has the most important effect on use. The canoeability of the Kettle River is extremely sensitive to variations in water level. As water levels go down, people tend to concentrate on the lower sections of the river and there are fewer of them for researchers to contact. Reputation for having an adequate water level is probably as important as actual water itself, and a group is more likely to plan a trip for a stretch of river having a reputation for adequate water level during that period. Canoeists with knowledge of how the river is affected by local rains can take advantage of temporary rises in the water level. A Department of Natural Resources service which gives information via telephone on water levels may influence use.

Other time-related variables, such as rain, hot weather, and insects influence use in a less predictable manner. As expected, we found the weekends to be the principal summer river use periods on the Kettle. It was obvious that the Kettle River is not typically the site of extended summer visits.

From observation and bank interviews in 1976 we found that many local townspeople use the River as a social gathering point for celebrations (e.g., 1976 Quarry Days in Robinson Park), for bank fishing, swimming, and car washing. Some of them frequent particular locations used for years and have never used a canoe or boat. Developments changing these uses may be viewed by some as threats to local life styles. Other conflicts could develop simply because of increased use or because management tended to favor one use over another. If canoeing should increase significantly it may interfere with fishermen, both in boats and on the bank.

DISCUSSION AND IMPLICATIONS

So far our study suggests several things about monitoring river use and visitors--at least on our study river. First of all, to obtain meaningful data, a river study should cover a period of several years so as to avoid unusual conditions like the low water and dry conditions of 1976. Secondly, counting techniques for readily accessible areas should not depend on easily vandalized counters or registration boxes. Aerial photography and aerial counts offer hope to check use patterns. Few people go to the Kettle for just one activity. There are also different use patterns for difficult river segments and seasons of the year.

On the Kettle, and perhaps other rivers, there are definitive differences in the use patterns of local people and those of persons from a large metropolitan area. A management agency may want to maintain constant communication with local residents as they implement day to day on-the-ground decisions. It probably is not enough to involve them only in the original planning process.

Programs such as Minnesota's "Wild and Scenic Rivers" are very broad in nature. Legislation provides general guidelines, but the management agency must be able to interpret specific needs. Our study has helped to show that rivers have qualities that should be emphasized. Mere designation does not provide the detailed management directives that are necessary, although it is important to remain consistent within the limits of legal authority.

The Kettle River is a good example of a river with unique qualities. It is quite evident that a stereotype "plan" cannot be superimposed on this river. Due consideration must be given to the unique aspects of the river, both physical and social. It will be especially critical to take into account local use of the river and traditionally established uses. We are not suggesting that these be overwhelming determinants for management, but only that

they must be dealt with in a straightforward manner.

We have also discovered that it is impossible to deal with one kind of land or river use without taking into account the effects of other uses. The latter may be very subtle and complex. For example, winter use may, at first glance, appear to have little relation to summer use. Yet, winter activities may contribute to a person's overall familiarity with the area and may help to "set the tone" for later use of the area.

AN ATTEMPT TO QUANTIFY THE ESTHETICS OF WILD AND SCENIC RIVERS IN IDAHO[1]

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ABSTRACT.--Describes the procedure used to estimate demand for outdoor recreation on rivers and in development of a Likert-Type Scale to distribute the net resource values estimated in the demand analysis according to perceptions that users indicated as being important to the wild and scenic river experience.

We sought to develop a basis for quantifying recreationist responses to the wild river environments. The quantity of such experiences are affected by many factors: the weather, mood of the individuals involved, time of year, related types of outdoor recreation in which they participated (such as fishing or hunting), type of watercraft used (if a floating experience), type of land transport (hiking, motoring, or horseback experiences), and types of wildlife encountered. Together these are referred to as the esthetic experience.

This definition was further defined to include their perception of natural beauty seen on or near the river. These perceptions change as one moves along a stream. This creates problems because it implies that esthetic perception is a dynamic problem and that a recreationist has certain esthetic expectations when he plans his trip that change during the trip. Thus, any attempt to develop a single valued function to quantify esthetics is not likely to be completely successful. As a result, the numbers in this study are used as indexes of relative esthetic value, not used absolute values.

RELATION BETWEEN ESTHETICS AND OUTDOOR RECREATION

The data used in this study covered three areas on the Salmon River, and the Middle Fork Salmon River, based on a survey done in 1969; and on the St. Joe River and in the Stanley Basin on the Upper Salmon River, based on surveys done in 1971 (fig. 1). We developed outdoor recreation demand models for these areas to provide the basis for valuing outdoor recreation, and hence for esthetics. These models estimated the number of visitor days that would be consumed at alternative costs per visitor day. A visitor day was defined as any portion of a 12-hour period spent recreating in the out-of-doors. Our efforts are directed toward finding a way to allocate value to the esthetic portions of the whole outdoor recreation experience. To establish this relation, we sought to determine the amount of "consumer surplus" involved in the outdoor recreation experience, and then to estimate how much of it was related to esthetics.

Consumer surplus is defined as the difference between total utility and the market value of a good or service. The difference is a surplus of utility that a consumer receives because they get more than they pay for. This occurs because each unit of a good or service that a consumer buys costs only as much as the last unit is worth. And according to the law of diminishing marginal utility, the previously purchased units are worth more than

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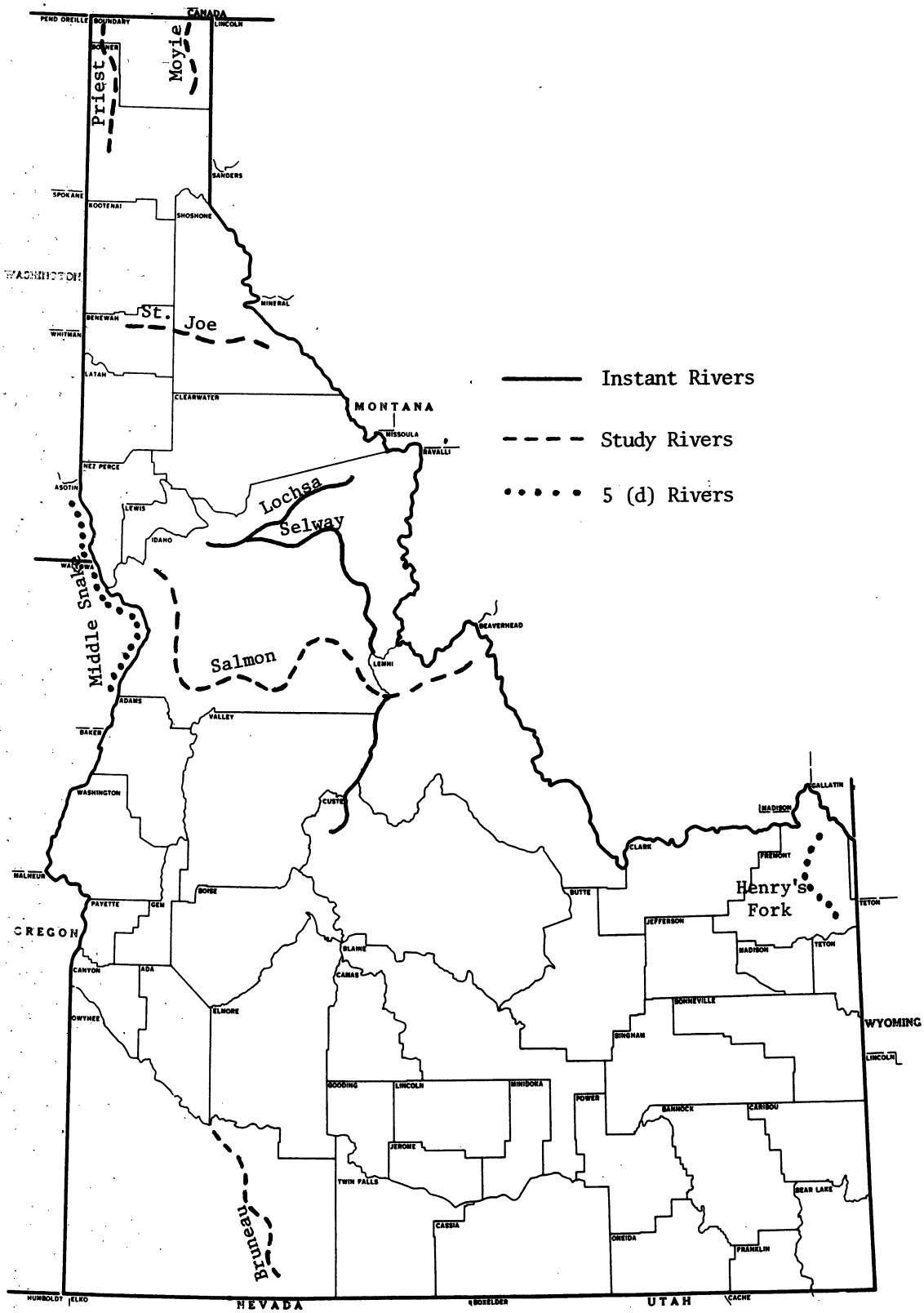

Figure 1.--*Wild and scenic river system in Idaho.*

those purchased more recently. Thus he obtains a surplus on each of the earlier units purchased.

A graphic example is shown in figure 2. At a price P_1, the total cost (TC) is the area included in OABC, and the consumer surplus is the area included in ALB for the quantity q_1. At the price of P_2, the total cost is the area ODEF and the consumer surplus is the area DLE for the quantity q_2. The gain in utility is represented by the area DABE. At price P_3, the total cost is the area OGHK and the consumer surplus is the area GLH for the quantity q_3. The gain in utility is the area GDEH.

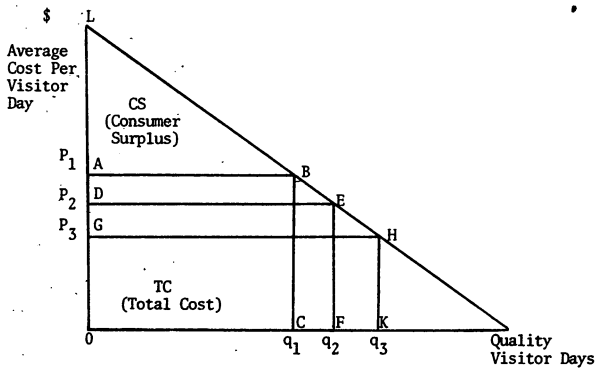

Figure 2.--*Hypothetical demand curve for recreation.*

As consumption increases, the price falls, and each unit costs less. This is the mechanism that creates the consumer surplus.

We used Nawas' (1972) technique to estimate the demand for outdoor recreation. This uses data obtained from recreationists to estimate a demand curve for outdoor recreation. The data gathered consists of user costs that are substituted for price data normally used in market demand studies.

The demand for river related recreation was estimated for the following three general recreation areas in the Salmon River area: (a) the Upper Basin, which was defined as the river between Stanley and Clayton, Idaho; (b) Corn Creek, the river between North Fork, Idaho, and Salmon Falls; and (c) Lower Basin, the river between Salmon Falls and White Bird, Idaho (fig. 1). The Middle Fork of the Salmon River included all of the river downstream from Dagger Falls and all of the St. Joe River. The Stanley Basin included the area above Stanley upstream to the Galena Summit area.

Demand equations shown in the box were estimated for several rivers, all of which have quite different characteristics. The statistics of fit for all the equations are shown in table 1. The Middle Fork of the Salmon River is unique for its white-water rafting. The Salmon River is noted for its fishing in the upper reaches including the Stanley Basin, and also for its outstanding scenic beauty. The Corn Creek and Lower Basin are noted for steelhead and salmon fishing, jet boating, hunting, and camping resources. The St. Joe River is a canoeing, fishing, camping, and hunting river.

Demand Equations

Stanley Basin, N = 425

1971 $\hat{Y}=40.5505+0.00056X_{1_i}+0.0499X_{2_i}-13.1362X_{3_i}+19.4988X_{4_i}$

(0.00022) (0.0272) (0.9409) (1.3763)

Where $\hat{Y}$=number of visitor days
X_1=total income of person responsible for covering expenses
X_2=total annual paid vacation time for nonretired persons
X_3=total transfer costs per visitor day
X_4=travel time to and from recreation area

St. Joe River, N=109

1971 $\hat{Y}=20.425+0.986X_{1_i}-0.012X_{2_i}+0.34X_{3_i}-5.777X_{4_i}$

(0.3926) (0.0033) (0.0321) (0.5544)

Where $\hat{Y}$=number of visitor days
X_1=travel time to and from river
X_2=miles travelled to and from river
X_3=total cost of trip
X_4=total transfer cost per visitor day

Main Salmon River Areas

1969 1. Upper Basin, N=150
$\hat{Y}=18.6233-0.6675X_{1_i}-0.7084X_{2_i}+0.0002X_{3_i}$

(0.17004) (0.94848) (0.00019)

1969 2. Corn Creek, N=159
$\hat{Y}=19.0331-0.6736X_{1_i}+1.5999X_{2_i}+0.0001X_{3_i}$

(0.13121) (1.18315) (0.00024)

1969 3. Lower Basin, N=304
$\hat{Y}=17.2797-0.4921X_{1_i}-1.2347X_{2_i}+0.0001X_{3_i}$

(0.07474) (0.87836) (0.00017)

Where $\hat{Y}$=number of visitor days
X_1=total transfer costs per visitor day
X_2=education level
X_3=income level

Middle Fork Salmon River, N=218

1969 $\hat{Y}=12.66783-0.07879X_{1_i}+0.30243X_{2_i}-0.00001X_{3_i}$

(0.01625) (0.17429) (0.00003)

Where $\hat{Y}$=number of visitor days
X_1=total transfer cost per visitor day
X_2=education level
X_3=income level

Table 1.--*Statistics of Fit for Outdoor Recreation Demand Equations*

Equations	Date	Linear form				Log form		
		N	R	R^2	F	R	R^2	F
Stanley Basin	1971	425	0.646	0.418	[1]75.4	0.706	0.498	[1]73.50
St. Joe	1971	109	0.768	0.590	[1]37.41	0.805	0.648	[1]47.82
Upper Basin	1969	150	0.324	0.105	[1]11.43	0.694	0.482	[1]45.25
Corn Creek	1969	159	0.402	0.162	[1]16.54	0.808	0.653	[1]97.15
Lower Basin	1969	304	0.368	0.135	[1]13.65	0.764	0.584	[1]140.41
Middle Fork	1969	218	0.351	0.173	[1]3.58	0.641	0.412	[1]49.87

[1]Significant at the 0.001 level.

DEMAND SCHEDULES

Schedules showing how visitor use would change with a change of costs per visitor day are shown in table 2. Obviously, costs would have to increase significantly if use were to be reduced on the Salmon River or on the Middle Fork Salmon River. On these rivers the demand is relatively inelastic, and use would not change much with an increase in cost. This relation however, does not hold for the Stanley Basin or the St. Joe River areas, where the demand is more elastic, and use would vary considerably with a change in cost. The elasticities of demand differ for these areas largely because of accessibility and the type of outdoor recreation available. The Salmon River and Middle Fork areas are more remote, thus the activities engaged in are white-water floating or jet boating, fishing, and other more remote area activities. The parties that came to these areas were small family groups and individuals. Access to the St. Joe River and the Stanley Basin areas is much better because of highways. There is no access to the Middle Fork Salmon River and only limited access to the main Salmon River. The types of activities engaged in by recreationists on the St. Joe River and in the Stanley Basin are camping, swimming, boating and waterskiing, and backpacking into high country. These are largely family groups.

The demand in the Stanley Basin and St. Joe River areas tends to be more elastic than that for the Middle Fork and other Salmon River areas because of the nature of the recreational experiences available in these areas, the types of people who recreate in these areas, and the availability of areas relatively close by which could provide substitute types of experiences.

The Middle Fork is an "Instant Wild River", that is, a wild river created by an act of Congress (PL90-542). As such, it has received an increasing amount of publicity since 1968 when PL90-542 was enacted by Congress. Consequently many more people have been attracted to it since.

Expenditures varied from $1.90 per visitor day in the Stanley Basin for campground type recreation to $18.50 per visi-

Table 2.--*Demand Schedules for Outdoor Recreation Linear Form Equations*

Transfer cost or price	Stanley Basin	Upper Basin	Corn Creek	Lower Basin	Middle Fork	Middle Fork II	Middle Fork III	St. Joe River
	Visitor Days Consumed							
0	82.7	19.4	25.8	15.1	13.6	19.9	19.5	42.0
2	56.4	18.1	24.5	14.1	13.4	19.9	19.4	30.5
4	30.1	16.8	23.2	13.1	13.3	19.8	19.3	18.9
6	3.9	15.4	21.9	12.1	13.1	19.8	19.1	7.4
8	-22.4	14.1	20.6	11.2	12.9	19.7	19.0	-4.2
10		12.8	19.3	10.2	12.8	19.7	18.9	
12		11.4	18.0	9.2	12.6	19.6	18.8	
14		10.1	16.7	8.2	12.5	19.6	18.6	
16		8.8	15.4	7.2	12.3	19.5	18.5	
18		7.4	14.1	6.2	12.2	19.4	18.4	
20		6.1	12.8	5.2	12.0	19.4	18.2	
22		4.8	11.4	4.3	11.8	19.3	18.1	
24		3.4	10.1	3.3	11.7	19.3	18.0	
26		2.1	8.8	2.3	11.5	19.2	17.8	
28		.7	7.5	1.3	11.4	19.2	17.7	
30		-.6	6.2	.3	11.2	19.1	17.6	

tor day for floating the Middle Fork Salmon River (table 3). The consumer surplus values followed this same pattern varying from $3.05 per visitor day in the Stanley Basin to $76.88 per visitor day on the Middle Fork. The relation between expenditure and consumer surplus was quite different in each of these demand models, which indicates that they reflected area differences. The relation of expenditures to consumer surplus was greatest for the Middle Fork Salmon River (1:4.2) and least for the Corn Creek area (1:1.8). The St. Joe River ranked second to the Middle Fork (1:3.6) in the expenditure consumer surplus ratio and the others ranked as follows: Upper Basin (1:2.9), Lower Basin (1:1.6), and Stanley Basin (1:1.6).

Table 3.--*Estimated Costs and Consumer Surplus per Visitor Day*[1]

River area	Estimated visitor days per trip	Est. average expenditure	Est. average consumer surplus
	number		
Stanley Basin	12.5	$ 1.90	$ 3.05
St. Joe River 1971	27.7	2.50	9.00
Upper Basin	16.6	4.30	12.40
Corn Creek	20.4	8.40	15.55
Lower Basin	11.6	7.30	11.85
Middle Fork 1969	12.2	18.50	76.85

[1]12 hours or any part thereof.

LIKERT-TYPE SCALE ANALYSIS

A Likert-Type scale is used to study social attitudes. In such a scale, the individuals are asked to respond to each item in terms of several degrees of agreement or disagreement (Selltiz *et al.* 1961). The next step is to identify a relatively large group of items considered relevant to the subject matter being investigated, and administering these items to a group of persons familiar with this subject matter.

This was used to develop a weighted distribution of recreationists' reactions. A variety of scales were used and the basic items evaluated ranged from 9 to 22. These items were placed into four categories: (1) land-based experiences (camping, hiking, and hunting); (2) water-based experiences (fishing, swimming, boating, including jet boating and rafting, and waterskiing); (3) visual experiences (sightseeing, scenic beauty, and photography); and (4) other activities (history, archeology, and scientific interest) as shown in table 4.

The distribution of values was based on the respondents' evaluation of these experiences. Two general weighting scales were used. The first was used on the Upper

Table 4.--*Items Included in Likert-Type Scale*

Items	Stanley Basin	Upper Basin	Corn Creek	Lower Basin	Middle Fork	St. Joe River
Land Resources:						
Hunting		X	X	X	X	
Camping		X	X	X	X	
Hiking						
Horse riding	X					
Motorbike riding	X					
Backpacking	X					
Picnicking						X
Wildlife						X
Water Resources:						
Fishing	X	X	X	X	X	
Swimming	X	X	X	X	X	X
Floating	X	X	X	X	X	X
Pure water						X
Powerboats						X
Waterskiing	X					X
Visual Experiences:						
Scenic beauty		X	X	X	X	X
Photography	X	X	X	X	X	X
Sightseeing	X					X
Psychic Experiences:						
Adventure						X
Escape from society						X
Communing with nature (personal enrichment)						X
Family unity						
Isolation						
Other Experiences:						
History		X	X	X	X	X
Scientific interest						X
Other		X	X	X	X	X

Basin, Corn Creek, Lower Basin and Middle Fork areas of the Salmon River and tributaries. The rating scale used was: (a) excellent, (b) important, (c) unimportant, and (d) no opinion. The weights attached to each of these items were: (a) excellent, +2; (b) important, +1; (c) unimportant, -1.

The second scale was based on a relative ranking of the importance of the activities evaluated. This scale ranged from -1, which was the least important, to 4, which was the most important.

The general form of the equation used to develop the weighted scores was:

$$L_w = [(2)(E) + (1)(I) + (-1)(U)]/N$$

Where:

L_w=weighted score
E =number of excellent ratings
I =number of important ratings
U =number of unimportant ratings
N =the total number of observations

In other areas, the calculation was performed in a similar fashion although the rating schemes were slightly different. This occurred because several types of rating questionnaires were used. The results, however, were not radically affected by changing the method of rating responses.

Once the weighted values for the resource uses were developed, a percentage distribution for the complete recreation experience was determined. This made it possible to estimate the relative importance of each of the outdoor recreation categories. In the first round, the definition of esthetics was limited to visual responses. In the second round, other types of esthetic responses were considered in the analysis.

It is impossible to develop mutually exclusive categories. This difficulty arises because of a number of factors. For example, there is the problem of separation. How does one describe an esthetic experience so that it does not impinge or overlap on some other part of the recreation experience? An example is white-water floating. How are the visual aspects separated from the excitement of going over rapids? The procedure followed was to assume that all these categories were mutually exclusive.

Weighted scores (table 5) were calculated for each experience category and area. These were expressed as a percentage distribution for each area. The scale appears to be sensitive to the resource base in each area, that was reflected in the ranking given each experience. There was not an "other" experience category for the Stanley Basin area because of the structure of the rating scale.

The goal of developing the percentage distributions of recreationists' responses to their wild river type of experiences was to develop an allocation scheme that would determine the distribution of the consumer surplus among the experience patterns defined by the recreationists. If it is assumed that the consumer surplus is a valid measure of the utility received by outdoor recreationists from their experiences, the distribution will indicate how they allocated this utility.

Results from the demand models were used to develop values for each experience category. This was done by using the Likert-Type scale to allocate transfer costs and consumer surplus values to the resource uses.

Table 5.--*Estimated Ratings of Recreational Experiences*

Experience categories	Observations	Total score	Weighted average	Percent
	Number			
Stanley Basin Area				
Land	629	1,168	1.86	40
Water	543	784	1.44	31
Visual	398	528	1.32	29
Total	1,570	2,480		100
Upper Basin				
Land	205	298	1.45	26
Water	236	233	0.98	18
Visual	303	558	1.84	34
Other	94	110	1.17	22
Total	838	1,199		100
Corn Creek				
Land	275	443	1.61	27
Water	396	550	1.39	23
Visual	348	683	1.96	31
Other	138	155	1.12	19
Total	1,157	1,801		100
Lower Basin				
Land	444	507	1.14	24
Water	613	597	0.97	21
Visual	606	1,035	1.71	37
Other	225	188	0.84	18
Total	1,888	2,327		100
Middle Fork River				
Land	785	640	0.82	16
Water	1,304	1,734	1.33	26
Visual	922	1,594	1.73	35
Other	450	509	1.13	23
Total	3,461	4,477		100
St. Joe River				
Land	1,040	1,470	1.41	24
Water	955	1,188	1.24	22
Visual	740	1,295	1.75	30
Other	930	1,268	1.36	24
Total	3,665	5,221		100

The estimates shown in table 6 are based on a 1969 to 1971 data base for both the estimated expenditures and the consumer surplus values derived from the demand equations. The average expenditures and consumer surplus estimates were distributed using the percent distribution shown in table 5. The values shown in table 6 can be interpreted as the values related to each experience category based on either expenditures or consumer surplus values per visitor day.

Table 6.--*Estimated Average Values per Visitor Day by Outdoor Recreation Experience Categories*

Area	Land	Water	Visual	Other	Total
	EXPENDITURES				
Stanley Basin (1971)	$ 0.76	$ 0.59	$ 0.55	$ --	$ 1.90
St. Joe River (1971)	0.62	0.58	0.70	0.60	2.50
Upper Basin (1969)	1.12	0.77	1.46	0.95	4.30
Corn Creek (1969)	2.27	1.93	2.60	1.60	8.40
Lower Basin (1969)	1.75	1.53	2.71	1.31	7.30
Middle Fork (1969)	2.96	4.81	6.48	4.25	18.50
	CONSUMER SURPLUS				
Stanley Basin	$ 1.22	$ 0.95	$ 0.88	$ --	$ 3.05
St. Joe River	2.25	2.07	2.52	2.16	9.00
Upper Basin	3.22	2.23	4.22	2.73	12.40
Corn Creek	4.20	3.58	4.82	2.95	15.55
Lower Basin	2.84	2.49	4.39	2.13	11.85
Middle Fork	12.30	19.98	26.90	17.67	76.85

These data were extrapolated from the visitor day basis to the resource values by multiplying the average per-visitor-day values by the estimated number of visitor days of use in the area (table 7). The expenditure and consumer surplus values all reflect the distribution of the experience categories as defined using the Likert-Type scale analysis. As a result the values for the experience categories also reflect their use levels. It is assumed that the level of use in an area reflects the resources of the area and the quality of the experience available in the areas.

The concept of consumer surplus is valid because it is used in determining the net benefits of water resources projects (Water Resources Council, *et al.* 1973). In the case presented here, the totals in table 6 are the total expenditures and consumer surplus values for outdoor recreation in each area. The consumer surplus values can be used as a net economic benefit and compared with the net economic benefits estimated for water resources development projects on a one-to-one basis. Table 7 also provides additional information on how the recreationists ranked their experiences in terms of the value each category received.

The recreationists ranked some experience categories as more important than others. What is interesting is that those categories (visual and other) that can be identified as esthetic tend to rank quite high. Visual included the recreationists' reaction to scenic beauty and opportunities to sightsee and practice photography. The other category included such items as the history and archeology of the area and scientific interest. In the case of St. Joe River, Upper Basin, Corn Creek, Lower Basin, and Middle Fork Salmon River, the visual category ranked higher than all the other experience categories. Only in the Stanley Basin was the visual resource lower than the other categories evaluated. The reason for this was related to the way the

Table 7.--*Estimated Aggregate Values for Recreation Areas by Experience Categories, 1970*

(In thousands of dollars)

Recreation area's estimated visitor days (thousands)	Land	Water	Visual	Other	Total
	EXPENDITURES				
Stanley Basin (703.1)	$ 534.4	$ 414.8	$ 386.7	$ --	$ 1,335.9
St. Joe River (295.0)	182.9	171.1	206.5	177.0	737.5
Upper Basin (316.0)	353.9	243.3	461.4	300.2	1,358.8
Corn Creek (606.8)	1,377.4	1,171.1	1,577.7	970.9	5,097.1
Lower Basin (539.5)	944.1	825.5	1,462.1	706.7	3,938.4
Middle Fork (20.4)	60.4	98.1	132.2	86.7	377.4
Total (2,480.8)	$3,453.1	$2,923.9	$4,226.6	$2,241.5	$12,845.1
	CONSUMER SURPLUS				
Stanley Basin (703.1)	$ 857.9	$ 667.9	$ 618.7	$ --	$ 2,144.5
St. Joe River (295.0)	663.8	610.7	743.3	637.2	2,655.0
Upper Basin (316.0)	1,017.5	704.7	1,333.5	862.7	3,918.4
Corn Creek (606.8)	2,548.6	2,172.3	2,924.7	1,790.1	9,435.7
Lower Basin (539.5)	1,532.2	1,343.4	2,368.4	1,149.1	6,393.1
Middle Fork (20.4)	250.9	407.6	548.7	360.5	1,567.7
Total (2,480.8)	$6,870.9	$5,906.6	$8,537.3	$4,799.6	$26,114.4

Likert-Type scale was developed for the Stanley Basin.

The land and water categories were assumed to reflect recreationists' perception and evaluation of their outdoor recreation activities, such as fishing, swimming, hunting, camping, and other activities. The visual and other categories tend to reflect more the psychic aspects of outdoor recreation experiences.

The procedure is quite flexible. The key to the analysis is in the Likert-Type scale. The type of scale developed can influence the nature of the model used to estimate the values in the experience categories. At the present level, the categories were defined in terms of users' direct responses. The use of indirect responses would most likely improve the sensitivity of the measurement of esthetic parameters, particularly those related to valuing esthetics.

The relation between the experience categories may be evaluated in alternative ways when one considers esthetics. It would be quite easy to combine the visual and other categories under the esthetics heading. These items were history, scientific interest, and archeology, which tend to increase one's appreciation of an area. If this approach were to be used, the impact on the estimated value would be great. The "other" category accounted for a range of from 18 to 24 percent of the distribution of values.

An example of the increases in esthetic value would vary from none for the Stanley Basin, which had no other category due to the design of the questionnaire used to develop the Likert-Type scale, to 58 percent of the total value on the Middle Fork. At the margin, the St. Joe River would gain the most (24 percent increase); the Lower Basin area the lowest (18 percent increase).

The range of esthetic values involved would vary greatly. The consumer surplus value related to esthetic appreciation would increase from $548,700 to $909,200 on the Middle Fork, where the percentage increase was the greatest. In the Lower Basin area, the consumer surplus for esthetic value would increase from $2,368,400 to $3,517,500. The magnitudes reflect the quantity of use each area receives.

Obviously the magnitude of esthetic values measured can be manipulated to achieve the type of result desired using the consumer surplus technique. Goals must be carefully defined in this kind of research.

CONCLUSIONS

The quantifying of esthetic values is yet an imperfect art. The procedures we developed must be looked upon with skepticism because of the limiting assumptions made. These assumptions were necessary in order to make any progress at all toward the goal of quantifying esthetics in any realistic way.

However, if water resource planners and researchers are willing to accept these assumptions and the overall approach, it would be possible to include the direct consideration of esthetic values quantified in the manner done in this report as a part of the process of evaluating wild and scenic rivers. This should be done with the full knowledge and understanding of the limitations of the method. If done in this fashion, it would permit planners to directly indicate the value recreational users put on the experiences they have with the water resources being evaluated.

This technique needs more study and research to determine its consistency, and the stability of the distributions that have been developed. Will they change as the cost of recreation increases? Economic theory would lead one to believe so, just as the quantity of recreation consumed would tend to vary with the cost of the recreation trip.

Although esthetics ranked high, based on the visual experience category, it should not be assumed that people would be willing to pay high prices to enjoy them. Esthetics are only a part of the overall recreation experience; therefore, the lack of a direct pricing mechanism may be the reason it had such a high value. If fees were imposed on recreation based on the results of the demand analysis, recreationists' responses to increasing cost levels for outdoor recreation would likely be reflected in less use. The elasticity of demand would be an important factor in accounting for the value of all the experience categories.

The Likert-Type scale indicates the way recreationists would distribute the value of their experiences among the several categories. The option value is defined as the value existing for a good or service that should be added to consumer surplus when there is uncertainty in demand. This is not included, therefore, the Likert-Type scale analysis most likely underestimates the value of esthetics (Cicchetti and Freeman 1971). However, because no other approximations of esthetic value have any emperical basis, this Likert-Type consumer surplus approach is a useful approximation to the quantification of esthetic value.

VARIATION AND RECREATION QUALITY IN RIVER MANAGEMENT

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ABSTRACT.--Variation in the river environment is a major determinant of the quality of river recreation experiences. In river canoeing, there are four main sources of variation: psycho-social variation, landscape variation, river variation, and variation inherent in the activity itself. By considering how these sources of variation interact, it should be possible to affect the quality of the recreation experience and accomplish other management objectives as well.

Imagine three families on canoeing vacations. For the first family, everything is perfect. The days are sunny and warm, the evenings just cool enough, and a gentle breeze carries the sweet smell of the forest. The river is just difficult enough to provide some excitement without undue risk.

Members of the second family are experienced white water canoeists. But they find that the stream recommended by a friend meanders lazily through pine plantations and offers little challenge. Furthermore, there is little wildlife or change of scenery to break the monotony. Feeling rather cheated, these people are not enjoying themselves and are anxious to get the trip over with so they can do something else.

People in the third family have bitten off more than they can chew. They have chosen a stream with rapids beyond their ability and would gladly quit. However, it is impossible to paddle upstream to their starting point, and they have no options for getting out until reaching their destination. They have already tipped over twice, have lost some of their equipment, and have badly dented their aluminum canoe. They are nearly terrified, and their trip has become an ordeal to be survived rather than a pleasure.

These three examples represent variations in recreation quality, and most of us can readily recall similar variations. Providing quality recreation experiences should concern all land managers who administer rivers used for recreation. After all, providing people with benefits is the real reason resource managers are in business. Yet, what is quality? Too often we are ready to prescribe what we like best as the formula to be applied across the board. The trick, however, is to find a logically consistent framework that will help us understand recreation quality for other people, not just ourselves (Wagar 1966).

In this paper, we will examine the importance of variation in providing quality recreation on rivers. After a short look at basic relations, we illustrate their application to one type of river recreation--canoeing. While the relations we suggest stem from basic psychological theory rather than empirical testing, we do feel that they offer the river recreation manager some insights into concrete management problems.

THE NEED FOR VARIATION

As biological and social creatures, people have a number of different needs: hunger, thirst, cravings for affection, physical activity, etc. All play an important role in motivating human behavior. One of the least obvious, but most important of these needs is the need for variation in environmental stimulation. Work on this need began when it was discovered that prolonged exposure to monotonous environments could have pathological effects on people (Herron 1957). Imagine participating in a sensory deprivation where all stimulation is blocked out. In such settings, people experience intellectual disruption, severe emotional disturbance, and even hallucinations (Dember 1960). While this is, of course, extreme, the implications are quite clear--people dislike simple, monotonous, unchanging environments.

On the other hand, some environments may offer excessive amounts of variation or stimulation. Remember the first time you drove in some large and unfamiliar city? While everything was still new, you probably were acutely aware of the enormously varied stimuli with which you were bombarded. Cities are normally places of high stimulation because of traffic, noise, bright lights, and the virtually endless variety of people, places, and objects, and this in itself may have pathological consequences (Milgram 1970). Excessive variation in a chaotic environment quickly overloads people and creates feelings of stress.

Fortunately, we can usually adapt to levels of variation and stimulation that may at first seem overwhelming. The routine subway ride, during which a New Yorker dozes or reads his paper, would at first probably terrify the Australian Bushman as it rushed him noisily through darkness with unexplained noises, flickering of lights, smells, and lurching changes in direction. More technically, repeated exposure to the same types of stimuli tends to reduce the impact that those stimuli have on a person (Walker 1972). Therefore, we expect that the expert canoeist and the novice might have very different emotional reactions to the same stretch of river.

Thus, there is a relation between the amount of variation in an environment, and people's preferences for that environment. Environments that are too simple and unchanging are disliked, as are environments that are excessively complex or chaotic. In between, there is a mid-range of variation that people prefer, and at some point there is an optinal level of stimulation. This would be the point of greatest preference (fig. 1). The three families mentioned above can be located on this preference curve, and by thinking in these terms, we can begin to understand why they reacted as they did.

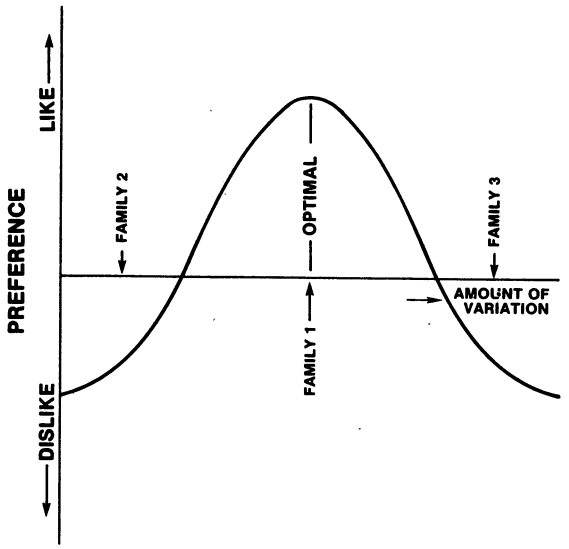

Figure 1.--*Relation between preference and amount of variation (adapted from Walker 1972).*

In this way, management has an opportunity to affect the quality of the recreation experiences a particular river provides by regulating variation. This is a general principle that holds true for different types of rivers and different forms of river recreation activities. What follows is an attempt to show how this might be applied to one type of recreational activity: canoeing in a natural environment.

THE CANOEING ENVIRONMENT: SOURCES OF VARIATION

There are four main sources of variation in river canoeing: psycho-social variation, landscape variation, river variation, and variation inherent in the activity itself. Each of these contributes to the quality of the recreation experience.

Psycho-Social Variation

Psycho-social variation encompasses differences both within and between individuals. Important sources of individual variation include variation in abilities, physical condition, and experience levels as well as individual differences in expectations, satisfactions, perceptions, and motives (Knopf *et al.* 1973). Sources of social variation include other river users (canoeists, fishermen, riparian property owners, etc.) and management personnel (rangers, outfitters). Relations between canoeists and other river users may range from coexistence to conflict (Knopf *et al.* 1973, Peterson 1974, Lime 1975b), although the relations between canoeists and management personnel appear cordial (Peterson 1974).

Over some of these sources of variation, the manager has little or no control; an argument between friends can ruin an experience. On the other hand, many of the management techniques developed in wilderness areas may be applicable to river management. For example, in canoeing the group may become the basic unit of social interaction--the presence of other groups is resented much more than the numerous numbers of one's own group. Control of numbers, use periods, and itineraries can be used to reduce contacts between groups. When possible, careful control of concessions and land uses should be exercised. Zoning and land acquisition can reduce the impact of competing uses by separating them, either in space or in time. For example, water skiing is sometimes restricted to certain hours, and horsepower limits and paddleboat regulations can help to keep different kinds of boaters separate. Most of these techniques are familiar to resource managers.

Landscape Variation

Much of the variation in canoeing comes from the landscape around the river. To illustrate how trees can be managed to create a more stimulating visual environment for canoeists, let's consider an example of a monotonous reach--one that is usually dull and uninteresting. Imagine a sluggish, nearly straight stream, about 80 feet wide with trees and vines forming a wall of vegetation right at the water's edge. This corridor-like reach of stream could be made more interesting merely by altering the forest vegetation to create different visual effects.

Along the river banks, vegetation is often dense and luxuriant due to the large amounts of available moisture and sunlight. This vegetation frequently creates a visually impenetrable wall. There are a number of different ways that this wall can be modified to create variation. First, the distance between the forest edge and river bank can be varied. Trees can be harvested to create meadows or clearings at intervals. The size of the opening and the setback of the far edge can be varied from one setback to the next. Thinning and pruning out branches, vines, and understory vegetation is another way of breaking up the wall of vegetation. Once the initial edge is opened, stocking levels can be varied in the stand beyond to permit more or less visual penetration.

Controlling the sequence of stands is also important in producing high quality experiences. Long stretches through any particular type will produce boredom and monotony no matter how interesting that type seemed at first. Type changes from old to young conifers, to meadow, to hardwoods, to shrubs, etc., will keep the amount of landscape variation fairly high, thus maintaining visual interest. Hopefully, such manipulations could be coordinated with other forest management activities, in order to reduce the cost of applying them.

River Variation

The river itself is a major source of variation. Its width, depth, distance to the next bend, the height and slope of the banks, water color and purity, and the content (animal, vegetable, or mineral) are all variable. Islands, too, add variety and stimulate user curiosity. But, for canoeing, perhaps the most important sources of variation are the speed of the water and the extent and difficulty of rapids, if any. In some cases, where there is an excessively long stretch of calm, slow water, it may be possible to narrow the channel and add rocks or boulders to break up the monotony. Or, if rough water predominates, it might be slowed in some places by creating pools.

Change between river conditions is essential for quality recreation experi-

ences. Too many stretches of rapids may contain too much information and require the canoeists to be ever alert, reducing the quality of the experience. On the other hand, a long, straight, calm stretch of river can become rather like driving through the midwest in the middle of the night. Balance is required.

Variation in the Activity

Canoeing is, in essence, a journey through both time and space. As such, some variability is inherent in the activity itself. Over time, the canoeists themselves may change--blisters develop, muscles begin to ache, backs get sunburned, people become more relaxed, etc. In fact, we may be dealing with very different sets of people on the fourth day of a trip than we were on the first.

From a spatial standpoint, virtually every stroke of the paddle changes the canoe's position. Since most canoeists have limited time, they will probably have goals in mind--that is, specific physical points that they will strive to reach by a certain time. A goal might be a campsite, a point of scenic interest, a portage, or the end point of the trip. Managers can create or remove goals, and also provide landmark stimuli that show canoeists how far they have to go to reach the next goal. Adding landmarks or attractions can increase the quality of the experience.[1]

INTERACTION BETWEEN SOURCES OF VARIATION

When we speak of recreation, we usually mean a total experience. Each source of variation contributes to this total. While it may suit our purposes to break them down into convenient subgroups, in fact they act jointly to produce a total canoeing experience. Therefore, we need to consider how they fit together from both a management and a recreationist point of view.

First, canoeists see the landscape from a specific vantage point. Their range of vision will be limited primarily to a 180° range centered straight downstream. Thus, the view upstream should probably concern us less than the view downstream.

Another limiting factor can be the height and slope of the banks. High, steep banks may create a short viewing distance limiting the need to deal with any but streambank vegetation. Other vegetation may be more important where banks are low and the line of sight is nearly horizontal.

In some instances, the sources of variation can themselves be limiting. In long, calm reaches of rivers (i.e., when river variation is low), providing variation in the landscape may be especially important. In areas of moderate white water, however, there may be less need to manage the landscape. In fact, a competing land use may be less noticeable here than elsewhere because people's attention will be focused on the river. In areas of extreme hazard (stretches of river with dangerous white water or "sweepers"), it may actually be desirable to promote monotonous landscapes in order to focus people's attention on the river. Thus, by manipulating these sources of variation relative to one another, it should be possible both to affect the quality of the experience and accomplish other management objectives as well.

CONCLUSION

In this paper, we have tried to examine the relation between variation and recreation quality, and to illustrate how this might be applied to river management for canoeing. There are probably other sources of variation, but the same basic relations should apply, both for canoeing and for other kinds of river recreation as well. Indeed, many of the applications to other activities may be similar to those described here. However, variation is only one determinant of recreation quality. In some cases, stimuli that could provide variation might conflict with other motivations of users, thereby reducing the quality of the experience. For example, a simple way to provide variation along a scenic river would be to put up billboards of different sizes, shapes, and colors. Obviously, however, this would conflict with some of the other important motivations of canoeists like the desire to experience an unchanged

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[1] *More, T., and G. Buhyoff. On-site behavior in forest recreation areas: a theory of recreation quality. Unpubl. manuscript on file at Northeast. For. Exp. Stn., Amherst, Massachusetts.*

natural environment. Careful thought is necessary.

Yet, the creative manager can still do much to influence recreation quality by considering the role of variation. In most cases, we should strive to heighten the quality by providing variation. However, in a few cases it may be desirable to manage for reduced quality by promoting monotony. Managing for variation can be a useful tool for accomplishing management objectives.

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EFFECTS OF NATIONAL PARK SERVICE AND FOREST SERVICE REGULATIONS ON CONCESSION OPERATIONS

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ABSTRACT.--Examines the impact of USDA Forest Service and National Park Service regulations on elements of market structure and conduct for commercial float trip companies under their respective jurisdictions. Discusses price and quantity aspects of demand and differences in regulations.

The underpinning of our social and economic system is the allocation of scarce resources through the free market process. Basically, in most industrial settings we assume that resources will be allocated to uses where they will fare best. This means that the price system will value resources consistent with demand and that production, land, labor, and capitol will be channeled into productive uses to provide needed services and products. The concept of demand therefore, has two dimensions: how much is sought and at what price. If the supply of a particular product falls short of the amount desired by consumers, prices will increase. This provides a signal to industry to transfer resources to that pursuit which will best meet consumer expectations.

Unfortunately, workably competitive markets (an assumption of the free market process) are not found in all industries. Even if they were, there are still externalities and imperfections in the market process that tend to justify the existence of independent regulatory agencies to regulate monopolies or near monopolies that are likely to develop under such imperfect conditions.

The classic example of a highly concentrated industry under the regulatory oversight of an independent commission is the public utility industry. In this industry, the fixed costs incurred by a firm are of such magnitude that the long-run average total cost for a firm declines. Therefore, as the price charged must cover average cost, the consumer is offered lower prices by a regulated monopoly than would be available from multiple producers in a free market setting. There are other such imperfections as a limited physical spectrum (the broadcasting industry), very scarce resources (extractive industries), and at least theoretically, chronic excess capacity (found in overly mature or exploited markets).

Externalities also are not considered adequately by the market process. For example, the costs of pollution or of social benefits, such as education, may not be properly considered by industry or consumers because the private returns are not sufficient to cause appropriate investment in them.

There are conditions rapidly developing in markets that rely upon public land and water resources administered by governmental agencies. One is the commercial use of scenic and white water rivers on public lands. These rivers are a very scarce resource. The utility derived by consumers (float trip passengers) can be substantially diminished by overuse of the resource.

There are numerous analogies that can be drawn between the traditional, regulated industries, and the river running industry. For example, the Civil Aeronautics Board (CAB) allocates routes to various airlines ...the National Park Service (NPS) allocates sections of rivers to various concessions. The CAB regulates the number of flights and origin and destination of these flights...the NPS regulates the number of floats and points of embarkation and debarkation. The Interstate Commerce Commission (ICC) establishes load limits for common carriers...the USDA Forest Service (USFS) establishes carrying capacities for rafts. The Federal Communications Commission (FCC) regulates entry into the broadcasting industry through licenses...the USFS regulates entry by issueing limited special use permits. Thus, resource management agencies have been placed in the position of the traditional regulatory agencies. The rapid escalation in use of the scarce resources they administer will force these agencies to examine first, the ecological consequences; and finally, the economic consequences of regulations and resource use much in the same way the traditional regulatory agencies have had to address such issues.

An example can be isolated in the USFS regulation of ski areas. Initially, special use permits were routinely granted; then safety and environmental considerations became more important; concern for a quality experience followed; now lift ticket pricing, design specifications, and restricted entry are serious problems. Recreational use provided by commercial outfitters on rivers is now probably well into the second level of evaluation by most resource management agencies.

THE PROBLEM

Increasingly, various regulations are being added to the existing list with little understanding of their effect upon the economic characteristics of commercial outfitters or float trip users. Most policies and regulations are intended to enhance and protect the environment and scenic quality of wild and near wild rivers. However, the results may be counter productive or at least diminished from what was intended as a consequence of unanticipated economic impacts. For example, user limits placed on certain river systems (an economic production quota) has resulted in a black market for river trips that is contributing to political tension and an overall reduction in the quality of the river experience. Price ceilings (price control) result in a production, cost-cutting orientation by commercial outfitters that tends to reduce the quality of the float trip experience and contributes to crowding. While the intent was to provide a bargain for the float trip customer, the net effect is the opposite. Seemingly innocuous regulations, e.g. life vests, have economic overtones that may adversely affect the overall safety of a float trip operation. The added increment of safety as a consequence of the better and more expensive life vests that might be required may reduce needed expenditures for maintenance on floating or land/air transportation equipment and/or boat operator training. This could result in a lower overall safety factor. One can't place limits on use, ceilings on price, requirements on certain types of investment, and restrictions on certain activities and expect that *all* the results will be those that were intended and directly related to the specific regulations. In fact, this is precisely the reason economic impacts of particular "environmental" decisions should be studied and are specifically required by the Environmental Impact Statement (EIS) process.

The need for an understanding of the economic consequences of regulations and administrative action is even more critical where agencies exercise specific control over the business practices of a firm. Frequently, the result of a particular regulation or administrative decision by regulatory agencies may be witnessed outside the geographic limits of their regulatory authority. The effect in a ski area may be economical, social and/or environmental. When ski area is built in a canyon, it may affect water quality for a town below, cause a change in the social structure of the community, and require increases in the bonded indebtedness and taxes to provide the necessary services--water, waste removal, protection, health, school, etc. Or, a user limit might reduce the tax base, cause unemployment, and allow the appearance of the community to deteriorate. Of more immediate concern perhaps is where two resource management agencies are in close proximity and decisions in one, the NPS for example, may have an immediate effect upon the other, the USFS, for example.

THE SNAKE RIVER CASE

The Snake River in northwestern Wyoming offers an excellent opportunity to examine the close relation between two resources regulating agencies, the USFS and NPS. The Snake River originates in the Teton Wilderness area and gains substancial size as it flows through Yellowstone National Park. As the river exits Yellowstone, its size and access affords the first opportunity to float the river commercially or privately. There is a short section (3 miles) of white water, a four to six rating depending on water and weather conditions, then a high quality scenic section that flows through the Rockefeller Parkway into Jackson Lake and Grand Teton National Park. This section of river, however, provides only a very small portion of the user days on the river. The water flow is dependent upon snow melt; hence, it only provides spring and early summer floating.

The Snake River below Jackson Lake Dam is subject to fluctuation between early summer and fall; however, the impoundment behind Jackson Lake Dam provides some stability (an average flow between 3,000 and 4,000 ft^3/s during the summer with a floatable range between 400 ft^3/s and 15,000 ft^3/s). The section between the entry of Pacific Creek (4 miles downstream of the dam) and Moose provides a 25-mile scenic river within Grand Teton National Park. There are intermediate entry and exit points and 80 to 90 percent of the commercial floaters are on the section between Pacific Creek and Deadman's Bar or Deadman's Bar and Moose. The commercial outfitters operate under concession permits issued by the NPS.

Farther to the south, the Snake River flows through the Snake River Canyon, which is under the jurisdiction of the USFS. In the past, administration of the Snake River Canyon was under the Targhee National Forest. Since October 1976 however, it has been administered by the Bridger-Teton National Forest. During 1976-77, the Bridger-Teton will make a study to determine the extent to which the Snake River Canyon will qualify for designation under the Wild and Scenic Rivers Act. The commercially-run section of river is approximately 8 miles long with short rapid stretches rated up to a 7 or 8.

Commercial float trip operations began in the late 1950's on the section of river in Grand Teton National Park. Little regulation was in evidence and float trips did not have a commercial character. Stops were frequently made to view animals and investigate bald eagle, red tail hawk, osprey, and great blue heron nesting areas. This practice was discontinued voluntarily between 1966 and 1968, and, subsequently, by NPS mandates when use levels became too great and scheduling became a problem. No motors are allowed on the Snake River within the Park. Similar growth patterns occurred more recently in the Snake River Canyon, but motors were not excluded. However, under recently-issued use permits, motors are not generally permissible except on rescue craft and to tow boats through the backed up waters of Palisades Reservoir.

A Categorization of Ecenomic Regulations

Economic regulations governing commercial use of rivers are applied at two levels. These regulations by the USFS and NPS affect the market "structure" and "conduct" of the industry.

The terms "structure" and "conduct are familar to most economists as two of the principle components of the Industrial Organization (IO) model. In this case, however, the constraints on structure and conduct are a consequence of USFS and NPS regulations and management policy rather than the unregulated workings of the market place. Structure refers to the characteristics of a particular industry rather than that industry's activity. Elements of structure include concentration, which refers to the number of firms and their respective market shares; entry barriers, which refers to the type and size of economic limitations facing firms attempting to enter the industry; and, to the extent to which the industry is integrated, which refers principally to a relation in successive functions dependent upon one another in the delivery of the product to the consumer. These areas are of principle concern to the resource management specialists of the USFS and NPS as is evidenced by existing regulations. Some economics may isolate other elements of market structure; there certainly are other supply and demand constraints that are characteristically associated with structure.

Structure refers to the characteris-

tics of an industry, conduct refers to the activities or behavior of firms in that industry. Traditional economic theory examines conduct options (1) decisions regarding price and (2) decisions regarding output. However, conduct can be expanded to include those activities of the firm related to the marketing of its products or services: pricing, product differentiation decisions, personnel decisions, transportation, advertising, and generally any other aspect of the business associated with providing a float trip experience for river users.

The USFS uses special-use permits to commercial float trips on the canyon section of the Snake River. In their applications for such permits , commercial outfitters request boat launching and exit sites, stops in route, and describe the type of floating craft to be used. The applicant also forecasts the potential number of individuals who will be floated during the season. A permit is then issued that typically includes the following items: (1) use sites on national forest lands (2) restrictions concerning the use sites if any (3) lunch stops and camp sites (4) types of boats authorized (5) number of boats permitted at one time (6) boat names (7) the period of use (8) the initial authorized use as an estimate of the number of people to be served and (9) the fee, calculated at 25¢ per person (minimum fee of $25) to be paid based upon the estimate of the initial use. There are 32 other general provisions that clerify and expand the basic special-use permit.

Most of the USFS regulations affect the conduct of float trip companies rather than the structure of the industry. The more important regulations affecting structure and conduct are as follows. The number of permits to float the river have been fixed by the Forest Service on the basis of those issued in 1973 and 1974. Hence, entry into the float trip industry may only be allowed should an existing firm choose to exit the industry. Even then, however, a new firm may not enter the market if any existing firm chooses to purchase the allotment of the firm which is leaving. Recently, the USFS has allowed existing float-trip companies to buy the allotment of firms leaving the industry. This one single regulation of structure affects the concentration of the industry, entry barriers, the level of industry product differentiation, and integration within the industry. As a consequence of this constraint, the USFS has become the surrogate for competition and is forced into a position of regulating specific aspects of conduct.

The most important of the regulations of conduct concerns the number of boats a permittee is allowed to have on the river at one time. The number is based on the average number of boats floated by the permittee in the 1973-74 base years. In addition, 25¢ per person fee is charged each of the outfitters. Hence, if a particular outfitter floats 10,000 persons, their fee payable is $2,500. Each permittee is required to maintain insurance at minimum levels of $10,000 for property damage and $25,000 for singles case, and $25,000 for multiple case personal liability. Coast Guard-approved life vests must be provided for each passenger including the boatman. However, their regulation does not require that the vest be worn by the passengers. The USFS encourages the vests to be worn because they notify insurance carriers if they notice that passengers are consistantly not wearing the life vests. All of the above regulations of conduct affect the price and output decisions of the various firms.

There are two other notable regulations affecting conduct that probably do not have an impact on price or output for the various firms. (1) A trip ticket must be filled out for each passenger in triplicate; the first page is deposited at the launch site, the second at the exit site, and the third retained by the permittee. The tickets are used to calculate the final franchise fee. (2) The USFS also requires that all advertising be truthful and stipulate the specific National Forest lands within which the permittee is operating; however, it does not require approval in advance for advertising.

The NPS offers many similar regulations but includes a few additional regulations. Generally NPS regulations are more pervasive than USFS regulations.

NPS limits the number of concessions to those that were in existence in 1972. Three-year contracts are issued except for three concessions whose right to operate on the river is included as part of their overall concession permit to provide food

and lodging facilities among other types of tourist related activities. The NPS also has a mandate under public law that the concession contracts cannot be transferred or assigned. In fact, Public Law 89-249, The Concessions Policy Act, specifically forbids chattel value to accrue to the concession contract. This of course poses an interesting dilemma for the National Park Service because this makes permits extremely valuable. Several concessionaires who have ceased to operate on the river, however, have not been able to sell or transfer their permits because the NPS will not reallocate the user days. Recently, one concession permit was transferred to an existing concessionaire by the NPS. The transfer basically means that the concessionaire is allowed to launch an additional number of trips per day. As the concession permit was reissued by the NPS and not sold by the former concessionaire it is unlikely that any value did accrue to the former concessionaire unless there was a private transaction between the recipient of the new allocation of the user days and the former concessionaire.

NPS regulations like USFS regulations limit the normal competitive aspect of a market place as a consequence of entry, exit, and trade among the member firms of the industry. The effect is to develop very high artificial entry barriers and, consequently, a concentrated market.

The NPS has two additional regulations that affect elements of market structure. The types of boats used must conform to general NPS standards. While not of major significance, this regulation does have some impact on the amount of product differentiation and the general investment decisions for the industry. The NPS also restricts concessionaires to launch sites. This constraint actually produces a spatial duopoly, of sorts, because certain sections of the river become allocated specific concessionaires.

Although there are differences between the USFS and the NPS approaches to regulating the commercial users of the Snake River, these differences as measured by the structural impacts are not too significant. This is not because the regulations are trivial. The limiting of commercial permits to those in prior existence, does have a major affect on the industry. Even the Civil Aeronautics Board (CAB) does not exercise such absolute control. The CAB commissioners recognize the positive aspects of occasional entry, exit, and transfer of routes. One difference is the source of the authority for each. The USFS regulations have a more informal land management policy background than do the NPS regulations. The USFS regulations are basically supported by a general mandate to manage public lands under their jurisdiction. The NPS situation, however, has a specific congressional mandate in the form of the Concessions Policy Act.

The specific control of conduct by the two agencies has some notable differences. In contrast to the USFS policy of limiting the number of boats at one time and limiting certain permittees to specific launching times, the NPS simply states that the total number of trips taken during any one day is limited by a formula based upon prior use in a base year. Thus, in the one NPS concessionaire can have 20 trips on the river at one time. However, under normal operating conditions, trips are usually dispersed throughout the daylight hours. At the more popular launch times and approximately 2 hours after launch at the more popular landing times, crowding on the river and in particular crowding around entry and exit points can be a serious problem; more so under the NPS jurisdiction than under USFS jurisdiction.

The NPS has a franchise fee system based upon a graduated scale calculated as a percentage of gross income. The fee schedule is as follows: first $40,000 of revenue, 1/2 of 1 percent; from $40,000 to $100,000, 1 percent of total revenue; and over $100,000, 1 1/2 percent of total revenue. Certain operating expenses may be deducted from gross income prior to calculating the franchise fee. Hence, assuming 10,000 persons were floated by a particular commercial trip, the NPS fee would be approximately $600 while the USFS fee would be $2,500. It may seem that the concessionaire under the NPS jurisdiction has the advantage of a better fee system; however, 10,000 passengers translates into total revenue of $100,000 under the NPS jurisdiction and 10,000 passengers translates to $150,000 under the USFS jurisdiction. On an equilivalent total revenue basis, the NPS commercial outfitter pays slightly less rent for his use of the asset. However, their fees cannot be considered a financial burden for the rent of a protected market position insulated from outside competition.

Other regulations governing conduct under the NPS system are more specific than those of the USFS. For example, advertising must receive prior approval; the NPS approves all prices; full accounting statements must be submitted annually; a 10-trip training period is imposed on all new boatmen; first-aid training for boatmen is mandatory; the concessionaire must carry insurance but, the levels are not specified; life vests must be carried; and there is an upper limit on the number of boats which may be launched in any one day. Generally, if the NPS so chooses, they exert regulatory authority over conduct than does the USFS.

Supply-Demand Relations

One could correctly conclude that the two most important effects the regulating agency has on the float trip industry are limits on supply (structure) and the regulation of price (conduct). Figure 1 outlines the potential problems associated with limits on supply and price. Notice that the supply of passenger days could increase as price increases up to the level of output (passenger days) Q_2 where output is constrainted. Suppose the demand for float trips is given by the demand curve, D_1D_1. The equilibrium price is P_1 and the equilibrium output is Q_1. If the demand curve should shift to D_2D_2, price would increase to P_2 and the quantity of output to Q_2. Now, if demand shifts even further to D_3D_3, the equilibrium price increases to P_3 but output remains at Q_2 because of the constraint on output. Thus, with the current regulations on supply, price would increase in order to clear the market place and the quantity of output would *not* change. If prices are not permitted to increase to P_3 but remains at P_2, demand will exist for Q_3 passenger days. If such excess demand is allowed to persist, some other means of rationing must be employed, i.e., first come first served, attractive

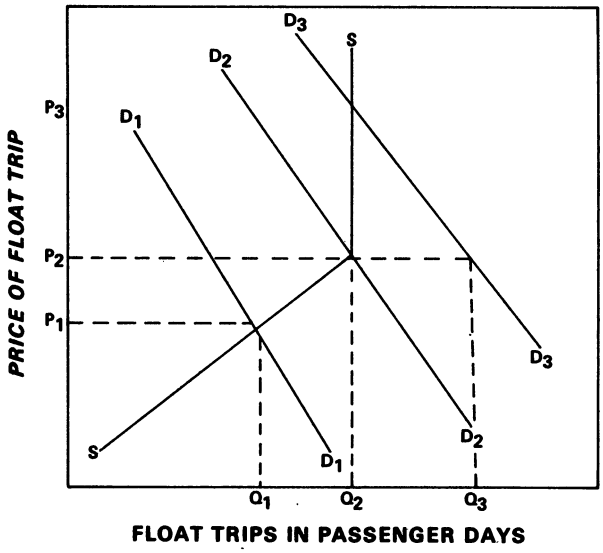

Figure 1.--*Impact of supply constraint on prices and output of float trips.*

blondes only, age, etc. The issue then becomes whether or not the new rationing process is as equitable, effective, or efficient as the price system.

Comparing the supply-demand schedule in figure 1 with the Snake River experience under NPS jurisdiction shows how price has influenced the total number of commercial floaters. Table 1 presents float trip use data on the section of river under NPS jurisdiction. The annual rate of growth is 0.25 percent. And, the number of commercial floaters has remained constant. However, from 1973 through 1976, the average price of a float trip rose from $7 to $9.50. This is an average annual increase of 10.72 percent. It is obvious that demand has increased by some measure. Or, as expressed in figure 1, demand has shifted from D_2D_2 to D_3D_3. The fact that requests for float trip price increases were approved by the NPS probably explains why the NPS did not have to provide some rationing scheme to river use or do battle

Table 1.--*Number of floaters on the Snake River in Grand Teton National Park, 1973-1976*[1]

Year	Commercial trips	Commercial customers	Private floaters	Total use	Commercial	Private
	Number				*Percent*	
1973	6441	67,500	6,500	74,000	91	9
1974	5688	59,500	7,000	66,500	89	11
1975	6515	68,277	4,250	72,527	94	6
1976	6382	68,002	3,800	71,802	95	5

[1]*1976 data are actual through August and do not include September. Hence, the float trip use figures probably slightly understate the total seasonal use.*

with concessionaires who were trying to get their allocations increased.

The same supply-demand relation exists under USFS jurisdiction. Unlike the NPS case, however, the USFS has not regulated supply as directly, and permittees have not increased price because there is the possibility of adding additional trips. Price has stayed constant at $15 per person (group and age discounts excluded). Commercial use has increased at an average annual rate of 24.8 percent (table 2). Figure 2 graphically portrays the USFS supply-demand relation; output moves from Q_2 to Q_3 as demand shifts from D_2D_2 to D_3D_3 while price remains constant. Because daylight hours, limit the number of trips, one would predict price increases and a change in the supply curve similar to the condition found in figure 1.

The important differences between the market conditions portrayed in figures 1 and 2 are partially the result of different approaches to regulating market structure by the NPS and USFS. Moreover, demand shifts and demand's responsiveness to price signals demonstrated that demand is not a synonym for user days; it has a price and a quantity dimension. Both dimensions of demand must be recognized by the regulating agency. Decisions in one jurisdiction have an impact on visitor use in another.

Cross Jurisdictional Aspects of Regulation

Where price is one of the conduct options regulated by the NPS and USFS and there is the additional possibility of establishing limits on supply, there may be a potential shift in consumption from one jurisdiction to another. Put another way, regulations affecting structure and conduct may shift from the NPS jurisdiction to the USFS jurisdiction. The important issue is to what extent are substitutes available.

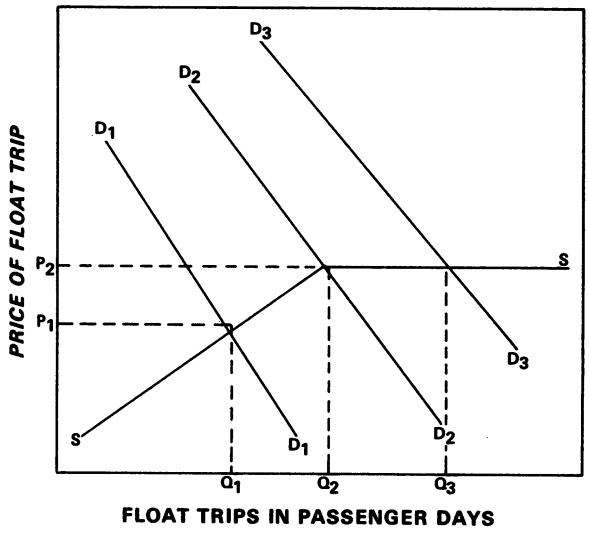

Figure 2.--*Impact of constant price on the supply of float trips.*

The economic concept of cross-elasticity of demand comes into play. If the products are substitutes that fact and the intensity of substitution can be measured by a ratio of the change in the quantity demand of one product to the change in price of another commodity under consideration. The formula for cross-elasticity is:

$$\Theta xy = \frac{\Delta x \div x}{\Delta y \div y}$$

Where: Θxy is the cross-elasticity of the change in the quantity of x demanded with respect to the price of y; x is the quantity of commercial trips in the Snake River Canyon; and y is the price of commercial trips in Grand Teton National Park.

The result of this calculation will tell us when commodities are substitutes for each other, in which case the

Table 2.--*Number of floaters on the Snake River in Targhee National Forest, 1973-1976*[1]

Year	Commercial trips	Commercial customers	Boatmen	Private floaters	Total use	Commercial	Private
		Number				*Percent*	
1973	2044	21,061	2070	3081	26,212	89	11
1974	2320	24,090	2453	3919	30,462	87	13
1975	3204	35,289	3399	4888	43,576	89	11
1976	3717	40,935	3943	6012	50,890	88	12

[1]*1976 data are actual through August and do not include September. Hence, the float trip use figures probably slightly understate the total seasonal use.*

cross-elasticity will be positive and greater then 1; or complements to one another, in which case the cross-elasticity will be negative. Two calculations have been accomplished. One is at the aggregate level involving an average price and total river use. The second is the change in quantity demanded for one firm vis-a-vis the change in price for that firm where the firm in question operated under both jurisdictions.

The results show that the float trip experience under USFS jurisdiction is a substitute for the float trip under NPS jurisdiction. User limits and price increases under NPS jurisdiction have resulted in a shift to the consumption of river trips under the USFS jurisdiction. The cross-elasticity of demand is calculated at 1.14. That is the average percent increase in quantity demanded under USFS jurisdiction was divided by the average percent change in price of the float trips under NPS jurisdiction.

A second calculation is even more dramatic evidence of the substitute nature of the two float trip experiences. One firm operates under both jurisdictions and acts as the price leader in each jurisdiction. That is, the firm is a major competitor in both areas where decisions regarding the float trip price have been followed by other competitors in the past. The cross-elasticity of demand for this firm's products is 1.80. Therefore, the price increase under the NPS jurisdiction has shifted the consumption to the USFS jurisdiction substitute.

The motivation for price change may have been profits. The marginal profit for the USFS trip was greater than that under NPS jurisdiction; hence, the price shift could have been motivated by the knowledge that in equating the marginal profit rates total profits would be increased. Undoubtably, there was some gut feel for the above; however, the principal motivation was probably the relative capacity constraints between the two jurisdictions and the greater competitive pressure under the USFS jurisdiction due to potential excess capacity. It is clear that in this case and with other possible substitute and complement situations, policies affecting the economic behavior of firms under regulation of different or the same jurisdictions can have impact other than that which is directly intended.

CONCLUSION

As visitor use reaches the environmental carrying capacity of various scenic and white water river systems, the economic consequence of various resource agency regulations will become increasingly important. Where significant regulation of economic activity occurs as the consequence of environmental planning, the results of that regulation may affect demand and resource use in other jurisdictions and in ways not specifically expected. Resource agencies that regulate commercial activities are not significantly different from the traditional regulatory agencies. Agencies, such as the NPS and USFS, must recognize and predict the effect of their regulatory actions as surrogates for the normal competitive constraints of the market process.

Several cases have appeared in the courts, and other groups have sought the assistance of members of the House and Senate where resource management policies in general and river management plans in particular have affected economic activity. Research has shown that many river systems offer multi-million-dollar opportunities to those who have permits or contracts to use the resource. Individuals have earned in excess of $20,000 per month operating float trip businesses. Profits approaching 60 percent of sales (before taxes) have been reported. The average profit rate of concessionaires and permittees under three different jurisdictions is four-to-five times greater than the average profit rate for United States industry. All these factors will cause increased awareness and scrutiny of those USFS and NPS regulations that have economic consequences. As a result, there will be a need to develop more reliable and unbiased approaches to managing resources of obvious economic value.

A MARKOV-BASED LINEAR PROGRAMMING MODEL OF TRAVEL IN THE BOUNDARY WATERS CANOE AREA

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ABSTRACT.--Describes and illustrates a Markov-based linear programming method used for predicting and analyzing travel in the Boundary Waters Canoe Area (BWCA) so management can control the rate of entry of travellers into the area.

The BWCA is a roadless wilderness area preserved under the Wilderness Act of 1964--an area of 1,062,000 acres, 18 percent of which is covered by water. There are 1,076 lakes at least 10 acres in size which are interconnected by a network of streams, portages, and ponds comprising more than 1,200 miles of canoe routes. Adjacent, and to the north, is the Quetico Provincial Park in Canada, a similar but slightly larger area.

The BWCA has been the object of political controversy since 1902 when 500,000 acres of public domain land was set aside. There have been struggles over road building, recreational development, logging, dam building and power development, aviation and mining. Currently, logging and mining suits are under litigation.

One of the more disturbing threats to the BWCA is the recent increased demand for outdoor recreation. Since 1969, the use of the BWCA has increased by 54 percent; over a million visitor days[1] during 1974. This use might not be excessive if it were more evenly distributed over space and time, but it occurs principally along certain routes and at peak periods. For example, there are 70 designated entry locations, but 20 percent of all groups in 1974 entered through one (Moose Lake). Ten entries account for more than 70 percent of all use.

This has led to concern both for the recreationists' impact on the integrity of the wilderness ecology and for the detrimental effects such high levels of use have on the quality of the recreational experience. Research has shown that a significantly larger number of people could use the area with less ecological damage and higher levels of satisfaction if the use were more evenly spread. This prompted the Forest Service to adopt a management program for the 1976 season which restricted the number of entrants at entry points and required advance reservations. This program was conceived in part because of a better understanding of recreationists' travel behavior due to the development of the model described in this paper. The Ontario Ministry of Natural Resources is considering a similar program for the Quetico Provincial Park.

Development of BWCA Research

In cooperation with the North Central Forest Experiment Station, research was started at Northwestern University in 1970.

[1] *One visitor day is equivalent to one individual spending 12 hours within the recreational area.*

Its purpose was to explore methods for predicting travel. Initial studies showed that Markov-renewal theory was promising (Gilbert 1972, Gilbert *et al.* 1972)[2]. Subsequent empirical studies demonstrated that the simpler Markov chain provides an adequate pragmatic model (Wojno 1973, Wang 1976, Wang, Peterson, and deBettencourt 1976).

Based on travel diaries collected in 1971 and in 1974, three generations of analysis have been completed. The first was a pilot study of a system of lakes near the end of the Gunflint trail. Based on the results of this, the Forest Service commissioned an operational model of the BWCA's most heavily used area near Ely, Minnesota. This was expanded to cover the entire BWCA and the Quetico Provincial Park. The BWCA was subdivided into 69 interior zones and 33 entry zones, and the Quetico into 6 zones to describe the interaction of travel between the United States and Canada (fig. 1). The travel model now being used was developed for two seasons and three travel modes.

Sixty-seven percent of campers in the BWCA travel by water. Paddle canoes, which is the dominant mode of travel, has accounted for most of the growth during recent years. Thus, it is the principal object for analysis and control. Separate models have been constructed for travel by motor canoe and motor boat. The modes behave differently because of legal and physical restrictions. Spring and early-summer travel behave differently from summer-fall travel; consequently, the canoeing season has been divided into two time periods. Thus, there are actually six separate models, one for each of two seasons and three travel modes. It is mathematically feasible to combine the three modes (Wang, Peterson, and deBettencourt 1976), but this has not been done operationally. The models do not deal with day use because it accounts for only 10 to 15 percent of total use.

The data base obtained in 1971 was roughly a 35 percent sample of all travel. For example, records were obtained from 4,720 paddle canoe groups. These groups spent 19,599 nights camped at 471 different lakes in the BWCA and Quetico. The "average" group spent 1.6 nights at each of 2.6 lakes and remained 4.2 nights in the wilderness.

[2] *A mathematical framework that describes a certain kind of stochastic (probabilistic) process (Cinlar 1975).*

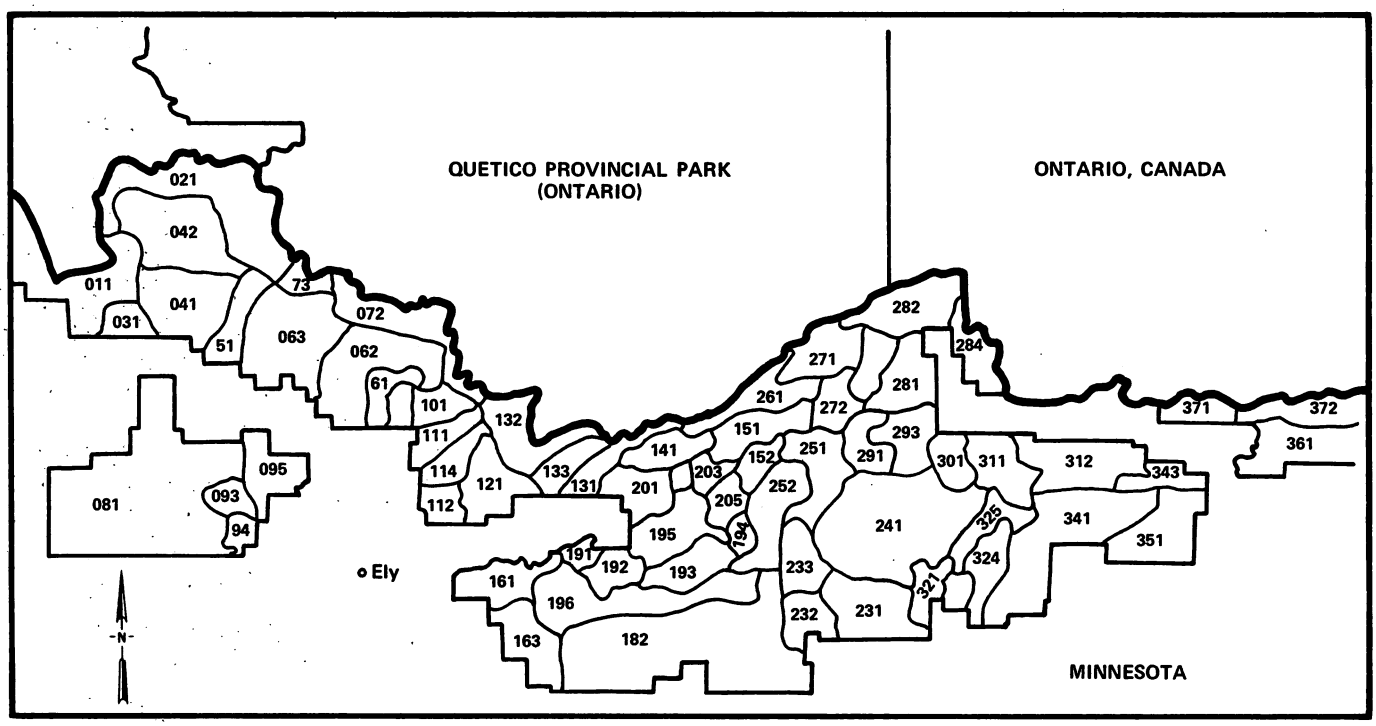

Figure 1.--*Interior travel zones in the Boundary Waters Canoe Area as used in the Markov analysis.*

The 1971 data base was used by Wang (1976) to ascertain the validity of the Markov chain approach before the operational models were developed. Although he found that the theory didn't explain the data perfectly, predictions based on steady-state expectations for 30-day periods were remarkably correct. The Forest Service used these predictions as "bench marks", or reference points, for the development of entry point quotas.

Because the analytical framework of Markov theory can be used, the travel models can be constructed directly for solution of systems of linear equations as opposed to the vastly more complex and expensive simulation approach. The programs have been developed for online use and are easy to operate. Forest managers having relatively little training in mathematics or computers can learn to use the system in a few hours. Thus, it is possible for the manager to do his own analysis of alternative management policies.

The Markov framework allows for the development of two distinctly differently modes of analysis, what we call "forward-seeking" and "backward-seeking" models. In the forward-seeking approach, the manager specifies judgmentally the entry rates for each entry point. These rates are specified as daily averages for a 30-day period. The model is then used to calculate the expected (average) number of visits each zone would receive under this entry policy. The visits are then compared with carrying capacities, also specified by the Forest Service. If, in the manager's judgment, the expected number of visits are not in line with the carrying capacities, he goes back and revises his entry policy judgmentally. Thus, it is a trial-and-error process of 1) specifying entry rates, 2) calculating numbers of visits received by zones, 3) comparing visits with capacities, and 4) revising entry policy.

In the backward-seeking mode, the manager is asked to specify carrying capacities for each of the interior zones--and upper and lower limits for each of the entry points. The upper limits are determined by the physical capacity of the entrance, and the lower limits are generally based on a consideration of the feasibility and implications of radically cutting back on use at existing entry points. Subject to these constraints, a linear programming algorithm then is used to maximize the total number of groups entering the BWCA, expressed as the sum of the numbers entering through each entry point. The solution of this linear programming problem specifies the "optimum" entering rate for each entry, given the carrying capacities, entry restrictions, and the Markov equations describing the travel process.

Thus, in the backward-seeking method, the manager gives restrictions and solves for entry policy. The linear program also gives "opportunity costs" for each of the constraints. This information leads the manager to a reexamination of the carrying capacities and restrictions he has specified, and a decision about their applicability and utility. The backward-seeking method uses the MPOS-MPOSONLINE system developed at Northwestern University's Vogelback Computing Center (Cohen and Stern 1974). This system can be used online, and the models allow the carrying capacities and entry restrictions to be edited interactively.

Mathematical Structure of the Model

The travel model is formulated in terms of three different kinds of zones or states that a camper might occupy: entry zones, interior zones, and exit zones. The entry zone is the access point through which the camper enters the BWCA. Let z_{ki} be the probability that a camper at entry zone k will spend his first night camped in interior zone i. These are the entry probabilities and comprise a matrix Z. Both the probability of going from one entry zone to another and the probability of going from an entry zone to an exit zone are defined as zero.

Let q_{ij} be the probability that a traveller camped in interior zone i one night will occupy interior zone j the next night. The probability of going from an interior zone to an entry zone is defined as zero, and the q_{ij} do not include the probabilities of going from interior zones to exit zones. Let x_{im} be the probability that a camper occupying interior zone i one night will be found in exit zone m the next night. Once a camper enters an exit zone, he is absorbed; that is, the probability of going from an exit zone to an interior or entry zone is defined as zero. The exit zones may correspond geographically with the entry zones, but they are defined

as different zones for mathematical purposes. Indeed, there is only one exit state in the model because exit points were not identified in the 1971 travel diaries.

The q_{ij} probabilities comprise a matrix Q. They also comprise the basis for a Markov chain if it is assumed that the probability q_{ij} is dependent only on the zone occupied, zone i, and is independent of the history by which the traveller arrived at zone i or how long he has been there.

If these and other assumptions are satisfied (Cinlar 1975), the expected number of visits received by each interior zone is given by

$$(V) = [Z(I - Q)^{-1}]'E, \qquad \text{[Eq. 1]}$$

where

(V) is the vector of expected or average number of visits received by each interior zone after all travellers have exited from the system,

E is the vector of the number of groups at each intry point at the beginning of the process, and

Z and Q are the matrices of entry probabilities and interior transition probabilities as defined above.

The exit probabilities, x_{im}, do not enter the calculations directly.

Equation [1] also is true for a steady-state process with constant or stationary daily entry rates over a given time period, say 30 days, where E is defined as the number of entries over a 30-day period and V is the expected number of visits to interior zones over the same period.

Equation [1] actually is a system of simultaneous linear equations and is the basis for the forward- and backward-seeking methods of analysis. In the forward-seeking analysis, E, the entry policy, is prescribed by forest management, and the equations are solved for V, the visits received by interior zones. In the backward-seeking analysis, upper limits are specified for V (interior zone carrying capacities) and, by means of linear programming, E is maximized, subject to these carrying capacities and to the upper and lower bounds placed on the individual entry locations.

Validity of Underlying Assumptions

Equation [1] is valid only if the underlying assumptions of Markov theory are correct and can be applied to the travel process. Potential sources of trouble in this regard include:

1. Dependence of the probability q_{ij} on the history by which a traveller arrives at zone i,
2. Noninformational probabilities that are arbitrary and not predictable,
3. Nonstationary probabilities, i.e., probabilities that change over time,
4. Nongeometric renewal processes,
5. Congestion feedback,
6. Nonstationary entry rates,
7. Heterogeneous population of travellers.

Dependence of q_{ij} on prior States

If the probability, q_{ij}, is dependent upon the route by which a traveller has arrived at zone i, Markov theory will not correctly represent the process. Mathematically, this can be overcome by redefining the states as sequences of states, such that independence is achieved. However, in a network as complicated as the BWCA, this is not practical.

There is a strong tendency in the BWCA for canoeists to exit by the same point through which they entered. This occurs because they have left their cars at the entry point and/or the canoe base where they rented and must return the equipment is at a fixed location. Outfitters will make deliveries and pickups at different locations, but there generally is a significant additional charge if much distance is involved. This problem could be overcome simply by constructing separate models for each entry point and adding the results. This would be more expensive, but it is practical if necessary and if adequate data are available. However, in the BWCA there is another tendency that largely nullifies the problem. The heavily used entry points

tend to serve exclusive interior regions. Areas of overlap that could cause errors are generally in the most lightly used zones. The heavily used interior zones tend to be dominated by single-entry points. Thus, the system tends to behave as a set of geographically separate processes by entry point.

In any case, errors creep in only if proportional entry rates are changed significantly from the conditions under which the data were collected. In other words, problems could occur if one entry point is doubled and another halved, and if these entries serve overlapping regions. There are political pressures, however, that strongly tend to discourage policies that depart radically from the status quo. Because of these tendencies, the model gives pragmatically useful predictions, although the assumption is not strictly satisfied. Although the errors are theoretically important, they tend to be of little practical significance.

Noninformational Probabilities

If travel in the BWCA is whimsical and arbitrary and not determined or biased by fixed properties of the area, there is little point in this type of analysis. The travel simply would not be predictable. However, our research has shown that the probabilities are informational. Travel is influenced strongly by physical characteristics of the network of lakes; most significantly by accessibility (distance and numbers and difficulty of portages). People entering the system tend to be channeled into predictable routes. Although the behavior of an individual party does not appear to be predictable, aggregate probabilities are stable. Statistically speaking, the observed probabilities could not have been sampled from an arbitrary and unpredictable process.

This was verified by data collected at one entry point in 1974, which was essentially similar to the travel originally observed in 1971.

The model is strictly descriptive as it is formulated. If something that helps to determine travel behavior is changed, the probabilities will change, and the model will have to be recalibrated--unless an explanation of the probabilities is available that will allow them to be repredicted from theory. If the Forest Service were to make radical modifications in the difficulty of selected portages, for example, this could alter the probabilities.

Nonstationary Probabilities

If the probabilities were to vary over time, either in a cyclical way by season, or in a systematic drift from year to year, Markov theory would not be applicable without modification. Seasonal variation that has been observed in the BWCA, is accommodated by calibration of two models, one for spring, and one for summer.

Annual drift could be caused by systematic changes in the kinds of people coming to the BWCA. It could also be caused by changes in the route recommendations made to customers by outfitters. It is not clear as yet how stable the BWCA probabilities are over time, but the data collected in 1974 at one entry point agreed very well with data collected in 1971. A great deal of inertia is indicated in the system; if changes are occurring, they are occurring very slowly and by small increments. In any case, a program of periodic maintenance should be pursued.

Nongeometric Renewal Process

In the simple Markov chain, q_{ii}, the probability that a group camped in zone 1 will be found there the next night, is constant for zone i, no matter how long the group has already been camped there. The data have demonstrated this to be true for most of the lakes in the BWCA and Canada, although a few heavily used peripheral lakes and several destination lakes do violate the assumption. The majority of zones show geometric renewal processes, although zones containing several lakes or dominated by a large nongeometric lake are troublesome. The Markov-renewal theory can be used to show that the expected number of visits received by a zone over a time interval is not affected by the nature of the renewal process--if the time interval is sufficiently long.

Congestion Feedback

If the probability, q_{ij}, is dependent upon the number of travellers occupying zone i or zone j, Markov theory is not valid. This question hasn't been tested

rigorously, but there is reason to suspect that canoeists will not modify their camping locations significantly in response to encountered congestion. They may make long-run changes in behavior; that is, they may choose a different route on their next trip, or they simply may not go back. In the short run, however, there is not much they can do that would affect the aggregate behavior in the area. A group may push on one or two portages, but canoeists generally do not begin looking for campsites until they have gone about as far that day as they feel able or willing. When congestion is encountered, a group is most likely to scout the lake in question until a campsite is found or accept a nondesignated site. If they do move on, they will not go far before stopping; thus, they probably will still be in the same travel zone.

Nonstationary Entry Rates

The model is set up to be descriptive of a batch or steady-state process. If the demand process is erratic or cyclical, the zone populations will also be erratic. The long-term expectations will still average out and be correct, but predictions of daily populations (something not attempted by the model) will be invalid. An important question from the management point of view is whether, or for how long, prescribed quotas for entry points can be exceeded without violating interior carrying capacities following a period of low demand at one or more entry points. Our recommendation is conservative: that the benchmark quotas be respected whether or not quotas on previous days have been filled. The model is not designed to answer questions about the dynamic response of the system. This would require a more elaborate (and expensive) dynamic formulation of the model or abandonment of the analytical approach in favor of simulation. Either decision would rule out backward-seeking analysis.

The quotas derived from analysis provide a benchmark or frame of reference for policy decisions and should not be regarded as prescribing decisions or substituting for good judgment. There are certain problems, like the dynamic and nonstationary behavior of the system, that simply are not addressed by the model.

Heterogeneous Population of Travellers

If two or more different Markov processes, each with unique probabilities, are mixed, predictions of the expected number of visits received by the states or zones in the system under batch or steady-state conditions are correct when the proportional mix of the populations is held constant. Under these circumstances, the observed probability, q_{ij}', is a weighted average of the true probabilities of the several populations. If the proportional mix of the populations is changed significantly, that weighted average will change, and the resulting predictions will change.

There are mixed populations in the BWCA. For example, travel mode (paddle canoe vs. motor canoe vs. motor boat) strongly changes travel behavior. These three modes cannot be mixed unless the proportional mix at each entry point is held constant. However, the Forest Service was interested in separate predictions for the three modes, so they were separated in the model and analyzed separately. The two seasons, spring and summer, were also separated. This was done, because it was found that the behavior was different, and the populations had to be analyzed separately.

If there are other problems of mixed populations, say within the paddle canoe group, they will not be troublesome as long as the proportional mix does not change significantly. One potential problem is that outfitters may be biasing the routes of their clients differently by means of the advice they give. We expect, however, that these effects are sufficiently randomized.

The important question is not whether Markov theory is a strict theoretical explanation of travel in the BWCA. The important question is whether and under what circumstances the model based on Markov theory is a useful tool for management purposes. We must frankly state that Markov theory may not be the ideal theoretical explanation of the travel. At best, it is a reasonably valid approximation of some aspects of the travel. The data speaks for itself. In 1974, the Superior National Forest collected a sample of about 300 travel diaries from the Lake One entry point (August). The model based on 1971

data was used to predict the expected number of visits received by the Lake One system of interior zones as a function of the actual number of groups entering at that location. The correlation between predicted visits and actual visits was 0.96, which gives an estimated reliability of 92 percent. Thus, when used properly, the indications are that the model gives very good information. However, it is very important to understand the limits under which the predictions are valid and to recognize that the model is a generator of information and not a maker of decisions.

Areas of Needed Research.--The work to date has identified the following areas where further research is needed.

1. Model validation
2. Monitoring change and evaluation of temporal stability
3. Temporal maintenance of models
4. Better and more current data base
5. Improvement of operational characteristics of existing models
6. Basic research to improve the model framework
7. Use of the models in educational gaming seminars to familiarize and train Superior National Forest personnel
8. Generalization of the approach to other situations and problem areas.

Validation.--Existing data are not adequate to allow thorough validation of the models. Whereas the evidence we have seen from available data as well as from conceptual and theoretical reasoning has made us confident that the models produce valid and useful information, the question needs to be examined more rigorously. We have tested and demonstrated that 1) the travel process is nonrandom (i.e., predicatable), 2) temporal homogeneity can be effectively achieved by partitioning the data into two or three seasons, 3) population homogeneity can be achieved by partitioning by travel mode, 4) the 1971 data comply reasonably well with the Markov assumption, and 5) the models do an excellent job of replicating the 1971 behavior (Wang 1976).

However, weaknesses in the 1971 data prevent us from testing rigorously whether the process must be separated by entry point. The indications are that this is not necessary when evaluated by pragmatic criteria, but in order to be conclusive, new data are required.

We are unable to give the model a rigorous test for subsequent years, because the travel permit data are not adequate. Validation done with a small set of observations collected at entry 30 in 1974 is very favorable, but not conclusive for the entire model package. For proper validation, we need a whole new data set. The data should include point of entry, point of exit, and a day-to-day record of the campsite location by lake, or in the case of large lakes, by location within the lake. The record should also include the usual travel permit data on party size, travel mode, etc.

Monitoring Change.--Whether or not the models are valid and whether or not the travel behavior has not been changing since 1971, control programs imposed in the future probably will change travel patterns. This should be monitored so that the effectiveness of the controls can be evaluated. The monitoring should be done through carefully designed smaples on a continuing basis. Such samples will not only reveal changes, if any; they will also provide a continuing and cumulative framework for model validation and maintenance.

Model Maintenance.--Any model that is used as a source of information for planning needs to be maintained through periodic recalibration and validation. This needs to be done.

Better Data Base.--We have discovered ways that the 1971 data set might have been improved. Various weaknesses in the way those data were collected impose limitations on what can be done with the models. For example, it is important from a management point of view to differentiate among Basswood Lake, Basswood River, and Crooked Lake. In the coding process, Basswood River was coded as Crooked Lake, and we are unable to differentiate. It is also desirable to differentiate among zones within large lakes like Crooked, La Croix, and Basswood. Also, in the 1971 data set, there were problems that made it difficult to determine the entry point for most of the travel diaries. This occurred because the

travel permit, which contained entry point, was separated from the travel diary, which did not contain entry point, and not enough of them ever got back together again.

These and other weaknesses suggest that a freshly designed data base would greatly magnify the usefulness of the models. Thus, we need the new data set and the resources with which to reconstruct new models.

Improvement of Operational Characteristics.--Each of the generations of model construction has revealed ways that the job might have been done better. New questions arise that were not anticipated, weaknesses are revealed that had not been noticed earlier, new capabilities are discovered, new insights emerge.

We need to sit down with the Forest Service in a series of applications sessions where we apply the model, dissect it, learn more about what it can and can't do, and learn more about the questions the Forest Service needs to have answered. This should be done, however, after we have all gained applied experience with using the current models. This could be accomplished in a relatively short time by means of some intensive sessions. Out of such sessions would emerge beneficial reconstructions of the problem as well as the technical structure of the model.

The following questions need to be addressed:

1. Reexamination of travel zone structure and aggregation of entry points.
2. Separation of Canada-bound travel.
3. Cooperation with Canadian concerns.
4. Refinement of the statement of questions in need of answers.
5. Identification of user difficulties.
6. Improvement of specifications for user instructions.
7. Editing improvement in output, including improved legibility.
8. More versatility of online input options (e.g., online modification of travel probabilities).
9. Increased operating efficiency, including input-output time as well as cost of computation.

Basic Research.--The following avenues of new research would be viable because 1) they would improve the performance of the models for the BWCA problem, 2) they would represent contributions to the state-of-the-art in modelling as well as in applications of Markov theories.

1. Explanation of the travel probabilities.
2. Evaluation of this approach against the wilderness simulation model developed by RFF in cooperation with the USDA Forest Service (IBM, RFF, 1973).
3. Exploration of analytical approaches to real time temporal variations in demand (i.e., "peaks and valleys").
4. Exploration of analytical and programming ways to integrate the three travel modes into simultaneous backward-seeking models for the management problem.
5. Consideration of the problem of "encounters" to determine whether it is of real concern in the BWCA problem and, if so, whether it can be dealt with effectively within the analytical framework (as opposed to simulation).
6. Exploration of the merits and potential of analytical treatment of day use in the models.

For example, the problem of explaining the travel probabilities is of importance because, if solved, it would vastly expand the versatility of the analysis in terms of the kinds of management options they are capable of responding to. It would also produce valuable insights on how to get at changing travel behavior.

By explanation of the probabilities, we mean the construction of equations that predict the magnitude of a given probability as a function of the variables to which travel decisions are sensitive. Wang (1976) showed that the travel in the BWCA is informational and nonrandom--that observed patterns of movement (i.e., the probabilities) could not have occurred by chance alone from arbitrary processes. Thus, travellers must be tending to use consistent "rules" as a basis for their movement decisions. At least, we can expect that the decison-making behavior that determines the observed travel can be described by systematic "rules." It is likely

that the movements are determined to a large extent by inherent network properties, especially accessibility factors. Preliminary investigation strongly suggests that the transition probabilities are predictable as a function of measurable properties of the travel network.

Educational Gaming Seminars.--The numerical outputs of the models are valid information about how the BWCA system would behave under real conditions. Equally important, however, is the effect of the model on the person who is using it. Management of the model by sitting down at the computer console and testing alternative management options is a simulation of management of the BWCA. Extended use of the model cultivates the same kinds of skills that would be cultivated by extended management of the BWCA. The operator learns to refine his questions. He develops better intuitive feelings for how the system behaves and the kinds of problems he is likely to encounter. In short, his ability to think about the problem is greatly enhanced. Perhaps this is more important than the direct numerical products.

CAMPSITE CHOICE BEHAVIOR IN THE RIVER SETTING: A PILOT STUDY ON THE ROGUE RIVER, OREGON

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ABSTRACT.--The relation of campsite choice to the natural characteristics of campsites was analyzed along the Wild and Scenic Rogue River in Oregon. Two regression models--for commercial and noncommercial camping parties--were formulated relating campsite choice to 13 site characteristics of river terraces. Of the 5 significant variables selected for each model, 3 were the same: size of the campsite, size of the tributary providing potable water to the location, and a rating of beach area available for landing a boat.

The recent growth in popularity of camping within the confines of river corridors provides a new opportunity to examine man-environment relations associated with campsite choice behavior. Such research may not only help to shed light on features of the environment which attract or repel human use, but also identify behavioral patterns of different social groups in the choice of campsites. Understanding of both matters is of considerable importance to resource managers and planners who are faced with decisions as to the kinds and amounts of facilities that need to be provided. How often do parties stop along a river route and how long do they stay? What features of the natural landscape seem to be especially critical in the selection of a campsite and the utilization of it? Are there important differences between the behavior of groups which have a licensed guide and those which do not?

The present paper reports on an investigation of river travelers and the degree to which their behavior in choosing campsites is related to natural characteristics of the locations where camping occurs. This pilot study of camping in the river environment was initiated in 1974 as a part of a broader research project (Pfister and Frenkel 1974, 1975). It was based upon previous research of campsite choice for auto-camping (Shafer and Thompson 1968, Lucas 1970, Lime 1971) along with recent research to improve methodology for inventorying backcountry campsites (Hendee, *et al.* 1976).

The study sought to identify (1) characteristics of specific groups of river travelers, (2) the campsite choice patterns of those specific groups of river travelers, (3) natural site characteristics of all river terraces serving as campsites, and (4) the relation between the number of times a campsite is chosen and selected natural characteristics of the campsite. For the latter objective, models suitable for examining the relation between the amount of use a location receives and its natural site characteristics were formulated.

STUDY AREA

The study area for this investigation is the Rogue Scenic Waterway in Oregon--a popular, free-flowing river protected under both State and Federal legislation.

Located in southwestern Oregon, the 84 miles of the river that are protected are classified by state legislation (ORS 390.805 - 390.925) into 5 river management areas: natural, scenic, recreation, natural scenic view, and river community (fig. 1).

The study area has been described in detail in the "Notice of Revised Development and Management Plans" (Federal Register 1972). Field investigations were conducted in the "Natural River Area", which begins at the confluence of Grave Creek and terminates at Watson Creek. Under Federal legislation, the identical 84 miles of the river is classified into 3 river management areas--recreational, scenic, and wild--and the study area is classified as a "Wild River Area" (PL 90-542). Numerous camping places are present along this 35-mile river segment, and a substantial number of visitors are attracted to the area each year (table 1).

Table 1.--*Visitors per year in the Rogue Scenic Waterway between Grave Creek and Watson Creek, 1973-1975*

Type of Group	1973	1974	1975	Change 1973-75
	-- *Number* --			*Percent*
Commercial trips	3340	3714	4000	+ 20
Noncommercial trips	1002	1718	2520	+151
Hikers	809	1236	1500	+ 85
Total	5151	6663	8020	+ 56

River terraces as camping locations were selected for in-depth study since, excluding lodge accommodations, they offered the only level areas available for camping within the study area. In this study, a river terrace refers to any topographic bench along a river formed by fluvial or mass-wasting processes. Normally, a "terrace" indicates former flood plains formed at different stages of erosion or deposition. However,

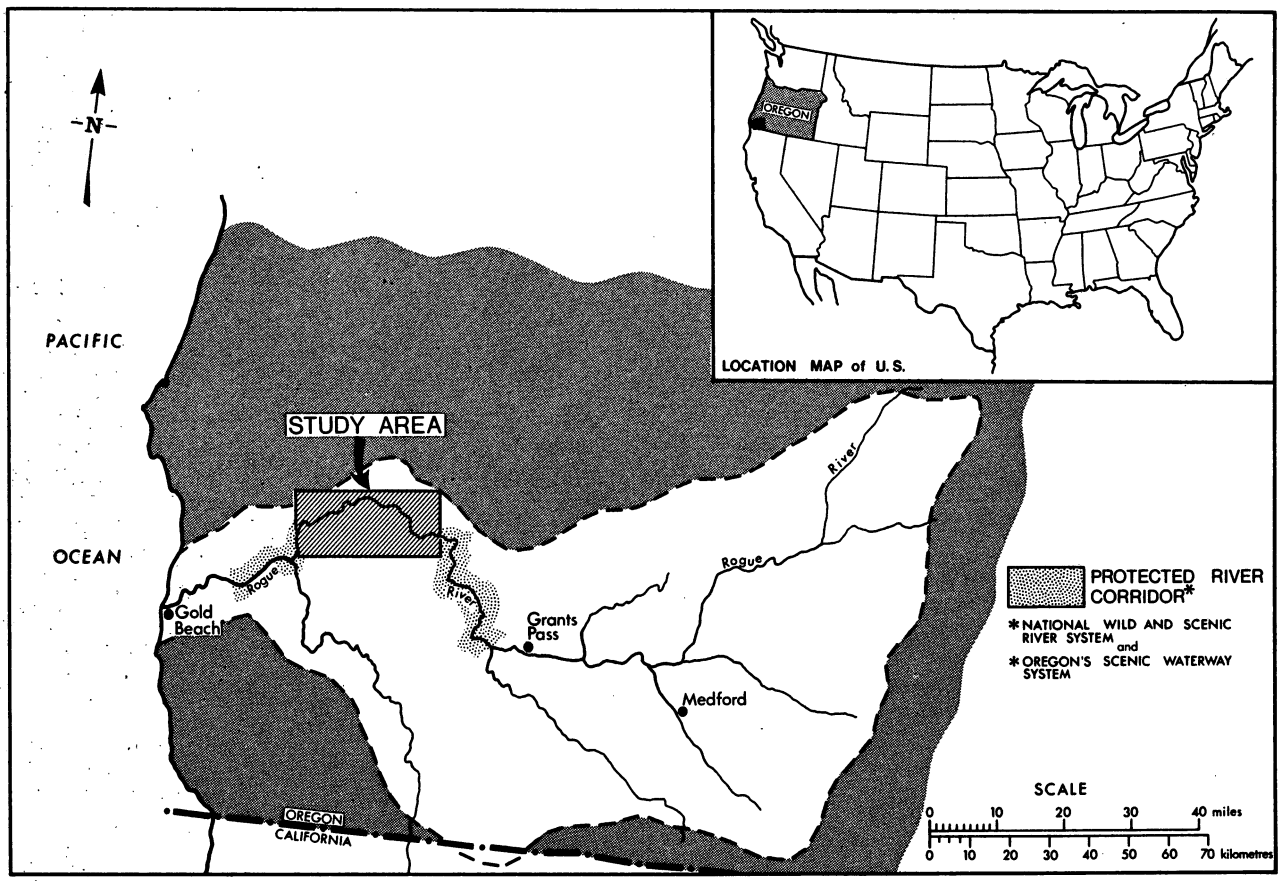

Figure 1.--*Location of the Rogue River drainage basin, the protected river corridor, and the study.*

mass-wasting appeared to predominate in the formation of several high bench areas in the study area and the definition was expanded to include them. Most terraces exist as unvegetated sand bars associated with fluvial processes while some higher terraces may exhibit soil development and forest vegetation cover. Undoubtedly river terraces are one of the most common fluvial features of the riparian environment and are commonly used for camping in other free-flowing rivers protected under State or Federal legislation in the western United States (fig. 2).

STUDY DESIGN

All camping parties had to travel past all of the river terraces in the same direction and had the opportunity to respond to each campsite in the same sequence. In addition, it was known that all river travelers began their trip at some point east of the study area boundary and were unable to exit the river corridor until passing the western boundary of the study area. Previous investigations of campsite choice behavior were unable to control such factors. Few research settings can provide such valuable natural means of obtaining control over the movement of a camping population than those associated with a river corridor.

Sample Unit

The sample unit was a camping party traveling in the study area during the summer of 1974 (July 1 to September 2). (A camping party was defined as a social group that travels together in boats for the purpose of engaging in a variety of recreational behaviors of which camping in the open air was but one type.) Groups

Figure 2.--*View from high terrace looking down the river corridor with low sand terrace (left middle) on opposite shore.*

were further classified as either: (1) Commercial--those groups where a fee, charge, or other compensation was collected by a guide or outfitter for services rendered and where individuals traveled in a boat licensed for hire, or (2) Noncommercial--those groups not part of any profit-making operation and where individuals traveled in privately owned boats. The commercial groups have a long history of use on the river and such use is identifiable through records on the number of licensed outfitters offering commercial river trips. Noncommercial use is a more recent category of river travel. It appears to be increasing rapidly and, in 1974, was not controlled by agencies managing the river.

To assure that seasonal variation in camping parties was taken into account, 57 percent of all possible days were sampled (36 days out of 63 days) between July 1 and September 2, 1974. The sample days were drawn at random within two strata--weekdays and weekends. The number of days sampled within each strata were proportionately equivalent to the total days possible for each strata.

Data were obtained from one member of each camping party upon their departure from the study area. The respondent was randomly selected from each party since his response to selected attitudinal questions was needed as part of another research endeavor. A self-administered questionnaire and a daily log sheet were utilized to collect data concerning (1) Population characteristics--commercial or noncommercial, (2) Party characteristics--size, length of stay, type of boats used, number and location of river terraces used for camping, and (3) Personal characteristics of the respondent--socio-economic, attitudes towards crowding and management controls.

River Terraces

Little information was available which located or described the river terraces within the study area. Several place names for terraces were only known by local outfitters and the names did not appear on published maps of the area. Numerous common terms were often used to refer to what has been defined herein as a river terrace and common descriptive attributes of the terraces had not been evaluated. From two field reconnaissance trips, a list of onsite characteristics was formulated. Additionally, some river landscape variables were considered as identified in the literature (Craighead and Craighead 1962, Leopold 1969b, Morisawa and Murie 1969, Dearinger 1968, Dearinger *et al.* 1973). Twenty-four prospective site characteristics were placed upon a standardized form and a pilot test conducted to evaluate terraces within the study area. Thirteen characteristics were observed to be present at all the terraces and appeared to be readily measureable by a team of 2 researchers. These 13 site characteristics were retained as measurements applicable to the river terraces within the study area and a description of field procedures has been reported by Pfister and Frenkel (1974). The site characteristics were as follows: (1) Campsite area, (2) Distance to potable water, (3) Tributary size, (4) Amount of area unvegetated, (5) Amount of A.M. shade, (6) Amount of P.M. shade, (7) Boat landing, (8) Accessibility of terrace, (9) Visibility of terrace, (10) Amount of firewood, (11) Wind protection, (12) Internal seclusion, and (13) External seclusion.

ANALYSIS

Forty-seven parties were interviewed from the commercial camping population--44 percent of the total population. Eighty-eight parties or 47 percent of the noncommercial camping population were interviewed. Nonresponse to the question concerning campsites chosen occurred in 11 and 4 percent of commercial and noncommercial parties, respectively.

Frequency tabulations were compiled in order to analyze (1) the characteristics of camping parties and (2) their campsite choice patterns. The research hypothesis of this investigation--suggesting that a significant relation exists between the amount of camping occurring at river terraces and selected characteristics of those river terraces--was tested utilizing linear regression analysis.

Characteristics of Camping Parties

Party size ranged from 2 to 25 people and commercial parties were substantially larger than noncommercial parties. Seventy-five percent of the commercial parties ranged from 16 to 25 people while only 13 percent of noncommercial parties consisted of that many people (table 2).

Table 2.--*Commercial and noncommercial groups in camping parties of various sizes*

(In percent)

	People in Party				
	1-5	6-10	11-15	16-20	21-25
Commercial N=47	5	10	10	35	40
Noncommercial N=85	33	37	17	8	5

Most commercial camping parties traveled by inflatable rafts; only 10 percent used any other type of boat. In contrast, noncommercial camping parties were not as specialized as to type of boat used in that inflatable kayaks and hardshell boats (drift boats and fiberglass kayaks) were used almost as frequently as inflatable rafts (47 percent versus 53 percent of the time respectively) (table 3).

Table 3.--*Commercial and noncommercial groups traveling in various types of boats*

(In percent)

	Drift Boat	Inflatable Raft	Inflatable Kayak	Hardshell Kayak
Commercial N=47	10	90	0	0
Noncommercial N=85	31	53	8	8

A difference between the camping parties concerning the length of their trip is evident when one examines those parties spending 3 to 5 days in the area. In this regard, commercial parties tended to spend more trips of 3- and 4-night duration in the area than did noncommercial (56 percent versus 29 percent respectively) (table 4).

Campsite Choice Patterns

Although the commercial parties spent more 3- and 4-night camping trips within the study area, they limited their choices to 26 of 48 locations identified by both parties. In contrast, the noncommercial camping parties, tending to have trips of shorter duration, chose campsites along the entire river corridor occupying 45 out of the 48 locations identified by both parties. From this observation, it seems apparent that the commercial camping party has a more concentrated or clustered choice pattern than does the noncommercial party. This difference is examined further in regards to the results of the hypothesis tested.

Table 4.--*Commercial and noncommercial groups by the number of nights they stayed within the study area*

(In percent)

	Nights				
	1	2	3	4	5
Commercial N=42	7	37	33	23	-
Noncommercial N=82	16	54	26	3	1

Research Hypothesis

Stepwise multiple linear regression analysis was employed to test if significant relations exist between PARTY-NIGHTS (Y) and site characteristics (X's) of the river terraces where camping occurs. The variable, PARTY-NIGHTS, refers to the number of times each campsite was chosen by a camping party. Two regression equations, herein referred to as models, were formulated for relating commercial and noncommercial campsite choice to river terrace characteristics. Multiple regression analysis (Nie, *et al.* 1975) indicated that five variables were statistically significant in describing the variation in PARTY-NIGHTS for each model (tables 5 and 6).

The best model for explaining the variation among party-nights for commercial campers is:

$$Y = 7.7986 + 0.5439\ X_1 + 2.441\ X_2 + 0.5703\ X_3 + 0.6387\ X_4 + 0.8095\ X_5$$

where: X_1 = the square feet of open area at each terrace (AREASIZE); X_2 = average channel size in square inches of the tributary providing potable water at

Table 5.--*Summary of stepwise regression model for commercial camping parties*

Step	Variable	Standard Error	R^2	Increase	t-Value entering	Degrees of freedom
1	TRIBDEX	5.9515	0.6160	0.6160	[1]6.2055	25
2	WINDPRO	4.7186	0.7087	0.0927	[1]2.7058	24
3	BOATLAND	4.1390	0.7556	0.0469	[2]2.0594	23
4	EX-SECLU	3.8718	0.7818	0.0262	[2]1.5869	22
5	AREASIZE	3.6810	0.8024	0.0206	[2]1.4451	21

[1]Significant beyond the 0.01 level.
[2]Significant beyond the 0.1 level.

Table 6.--*Summary of stepwise regression model for noncommercial camping parties*

Step	Variable	Standard Error	R^2	Increase	t-Value entering	Degrees of freedom
1	AREASIZE	16.7911	0.2598	0.2598	[1]3.8397	42
2	BOATLAND	16.0042	0.3113	0.0515	[2]1.7507	41
3	TRIBDEX	15.0913	0.3664	0.0551	[2]1.8655	40
4	PM-SHADE	14.4426	0.4088	0.0424	[2]1.6722	39
5	FIREWOOD	14.1113	0.4372	0.0284	[2]1.3841	38

[1]Significant beyond the 0.05 level.
[2]Significant beyond the 0.1 level.

the terrace (TRIBDEX); X_3 = rating of the beach area available for landing a boat (BOATLAND); X_4 = rating of the degree to which the campsite is protected from breezes (WINDPRO); X_5 = rating of the degree to which a campsite is screened from the river corridor (EX-SECLU) and accounts for 80 percent of the total variation. The analysis of variance for the above model indicated the F-ratio exceeded the F-distribution value at the 0.005 significance level. The model can, therefore, be rated a significant regression equation for explanation of the variation in PARTY-NIGHTS.

The best model for explaining the variation among PARTY-NIGHTS for noncommercial campers is:

$$Y + 7.4649 + 1.628\ X_1 + 0.9702\ X_2 + 0.9810\ X_3 + 1.225\ X_4 - 0.6185\ X_5$$

where: X_1 = the square feet of open area at each terrace (AREASIZE); X_2 = average channel size in square inches of the tributary providing potable water at the terrace (TRIBDEX); X_3 = percentage of campable area covered by shade between 2:00 p.m. and 6:00 p.m. (PM-SHADE); X_4 = rating of the beach area available for landing a boat (BOATLAND); X_5 = rating of the volume of dead, down, and driftwood available at the terrace or boat landing area (FIREWOOD) and accounts for 44 percent of the total variation. The analysis of variance for the above model indicated the F-ratio exceeded the F-distribution value at the 0.05 significance level. This model can also be considered a significant regression equation for the explanation of the variation in PARTY-NIGHTS.

DISCUSSION

Insight into the relation between camping and site characteristics is obtained by examining significant characteristics selected by regression analysis. Three site characteristics TRIBDEX, BOATLAND, and AREASIZE, were selected as significant predictor variables in both commercial and noncommercial camping models although not necessarily at the same step in the analysis (tables 5 and 6). The selection of these three characteristics means that the frequency of camping at a terrace is significantly correlated with the size of the tributary channel which supplies potable water to the site (TRIBDEX), the amount of area available to land a boat (BOATLAND), and

the size of the campsite area (AREASIZE). Each of these characteristics seems logical and important in the choice of a campsite.

Although the analysis identifies a functional relation between certain on-site characteristics of river terraces and the frequency with which they are chosen as campsites, it must be noted that a cause-and-effect relation is not implied. Furthermore, there is an absence of any data on the influence of the previous experience of the decision-maker(s) involved with campsite choice. Prior experience camping in the river corridor (e.g., commercial guides) undoubtedly conditions choice behavior and this will, as with other kinds of spatial search behavior, "likely lead to a habitual set of responses and a stable movement pattern" (Murphy and Rosenblood, 1974). The presence of a conditioned response pattern for commercial groups can be suggested by the striking difference in the actual number of locations chosen by them (26) in comparison to the actual number of locations chosen by the noncommercial parties (45). The difference in predictability of the models for commercial and noncommercial groups may also be related to the potential influence of prior experience.

CONCLUSIONS

This pilot investigation sought to identify characteristics of camping parties, their campsite choice patterns, characteristics of all campsites, and the relation between the number of times a campsite is chosen and selected characteristics of the campsite. The models for commercial and noncommercial parties were formulated upon the groups' actual choice of campsites in relation to measured characteristics of campsites. If some campsites in the study area were to change due to seasonal flooding, and if we then knew the measured values of site variables, X_1 through X_5, then we could probably estimate the amount of camping that each location would receive. Thus, potential shifts in camping patterns along the corridor could be studied.

While the findings are limited to the population camping along the Rogue River, the campsite choice models raise several questions worthy of future research. To what extent are selected site characteristics significant predictors of campsite choice in other river corridors? Are current campsite assessment procedures suitable for application in a variety of river settings? Is prior experience of camping parties an important factor to models which describe campsite choice behavior? In the future, the opportunity to predict variation in camping patterns could provide management agencies with a valuable tool for examining the likelihood of congestion or environmental degradation occurring at particular locations along the river corridor.

In summary: (1) Analysis of camping parties revealed commercial parties tend to be larger (15-25 people) than noncommercial (less than 15 people). The two groups differed substantially in type of boat used and slightly in their length of stay within the study area. Commercial parties chose fewer campsites (26) than did noncommercial (45). Both groups tended to choose the same campsites most frequently. Campsite choice behavior for commercial parties shows clustering. Noncommercial parties were distributed along the entire river corridor.

(2) Selected site characteristics of river terraces were significantly related to the number of times the location was chosen. This relation was presented in the form of two models, one for commercial parties, the other for noncommercial parties.

(3) Five independent variables were significant predictor variables for the dependent variable PARTY-NIGHTS (number of parties spending one night) in both the commercial and noncommercial camping models. Eighty percent of the variance in PARTY-NIGHTS was accounted for in the commercial model.

(4) Of the 5 significant terms selected for each model, 3 were the same variable. These were size of the campsite, size of the tributary providing potable water to the location, and the ease with which a boat could land at the river terrace.

As stated by Lime (1975a), research is badly needed to cope with the numerous problems caused by growing recreational use of backcountry rivers. If the procedures utilized in this pilot study are used on other river settings and if research into campsite choice behavior is expanded, resource management agencies could eventually have models for predicting the intensity and distribution of river camping.

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RELATIONS BETWEEN RIVER TRIP MOTIVES AND PERCEPTION OF CROWDING, MANAGEMENT PREFERENCE, AND EXPERIENCE SATISFACTION

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ABSTRACT.--River users in Dinosaur National Monument were sampled during the summer of 1975. Trip motives, in descending order of importance to users, were found to be: action/excitement, learning about nature, stress release/solitude, affiliation, autonomy/achievement, self-awareness, and status. User scores on the motive scales were related to user perceptions of river crowding, to opinions on appropriate maximum group size, to campsite development strategies, to river management techniques, and to user satisfaction. A number of correlations were statistically significant, though relations tended to be weak. Research implications are discussed.

Whitewater rivers provide a particularly fruitful area for study of the ecological and social impacts of intensive recreational use and management. Float trips on the Green and Yampa Rivers in Dinosaur National Monument have increased dramatically in recent years; from about 2,500 floaters in 1967 to more than 14,000 in 1971. Use ceilings were imposed prior to the 1972 season, but river use still increased to more than 17,000 persons. The number of floaters declined in the years following due to the energy crisis, but participation is now climbing back up. The National Park Service has felt a need to determine the carrying capacity of the rivers for float-trip use, to develop strategies to hold use within capacity, to analyze the social and economic ramifications of river running, and to provide guidelines for future decisions. The present study was formulated to explore the social-psychological inputs to such decisions.

THEORETICAL FRAMEWORK

In order to make any judgments about the human resource, you must understand the nature of it. When recreational use is a management objective, the outcomes of the system to be sought should be the maximization of the satisfactions of the users (Lucas and Stankey 1974). Such outcomes are the "product" of the recreation resource system (Brown 1975). The following will provide a brief overview of recreation behavior and how satisfaction with recreation experiences may be derived. We will subsequently examine how these social psychological variables relate to decisions on use limitations, particularly with respect to carrying capacity.

Recreation Experiences

The major output of recreation management should be to satisfy users. But what determines satisfaction? Each person enters the recreation engagement with certain expectations about the particular experience. When a person enters a recreation environment, the perceived reality of the situation is compared to the person's own expectations. To the extent that perceived reality matches the expectations of the individual, satisfactions may be derived. It is possible likewise that certain expectations may not be met. If these are very important, dissatisfactions may result. For example, if one seeks solitude, the presence of others may preclude that. If one seeks communion with nature, ubiquitous facilities made necessary by high use levels may make that difficult. Thus, satisfaction is dependent on an experiential reality rather than a

physical one.

A particular resource may be perceived differently by various groups. A certain type of individual may perceive the resource as providing one kind of experience, and this may serve as a primary inducement to engage in recreation on the site. Another type of person may perceive an entirely different experience, and may also be motivated to use the site, but with very different expectations. To the extent that the different expectations are all met on the site, we can look with pride on the diversity of satisfactions that a particular resource may provide. However, it is becoming increasingly apparent that certain kinds of experiences may not be compatible, and that unrestricted and haphazard recreation management can result in the exclusion of certain recreation experiences.

In a wildland situation, certain experiences such as solitude can be disrupted by the presence of others. If solitude is seen to be a valuable experience, then active steps must be taken to avoid losing it. This may imply the designation and management of areas specifically for that purpose. If all experiences are likewise represented, then we can provide a recreational resource system that truly meets the needs of the people. Assuming that there is not enough recreational land to adequately handle all experiences and that everyone will not be completely satisfied all of the time, some kind of allocation and limitation decision is necessary.

A major thesis of this research is that to the extent that managerial objectives are defined in the context of *recreation* experiences, more clearcut criteria for *use limitation*[1] decisions are made available to managers. The designation of areas as providing certain experiences already exists. The National Wilderness Preservation System provides for the establishment of units that have certain experiences as primary objectives. (In a broader context, the national parks also represent management for specific values.)

The designation of a particular experience to manage for begins to selectively filter out potential pre-emptive resource developments and management actions. The manager can gain additional input for decision-making from users whose experience expectations most closely reflect the values he is managing for. This is essentially what Stankey (1972) has proposed with respect to wilderness. He maintains that wilderness management should be geared to those persons whose attitudes are most in concert with the specific institutionalized values of wilderness as represented by the Wilderness Act. Such a strategy may be more difficult to define when the experience expectations of individuals are the reference point, but this is more a methodological issue than a philosophical one. What has prevented the effective evolution of this approach in the past is the insistence that researchers come up with *a* carrying capacity.

Once the commitment is made to manage for experiences, however, it is possible to focus on the dimensions of the use limitation or allocation problem, and what parameters will successfully serve to indicate the maintenance of the desired experience. The range of possible management actions to handle use levels provides leeway for the manager to act. There may be a number of strategies, such as zoning, site management, or user distribution, that can serve to provide and maintain a particular experience.

Management For Experiences

The present study sought not only to explore the role of experience expectations, but also to integrate this orientation into decision situations that may be useful to managers. We have, therefore, attempted to place this theoretical approach into the context of a management model proposed by Brown (1975). Brown's model has its foundations in the work of many wildland recreation researchers, especially those who have studied wilderness carrying capacity (Brown and Schomaker 1973 , Godfrey and Peckfelder 1972 , Frissell and Stankey 1972 , Lime 1970 , Lime and Stankey 1971 ,

[1] *Although carrying capacity is a widely used term, all empirical and theoretical work on it shows that there is no such thing as the carrying capacity for a given recreation resource. Rather a range of managerial options that may relate to many different situations and circumstances exists. The phrase "use limitation" still does not encompass the full range of these issues, but it at least is less suggestive of a single neat figure, and will be used here wherever possible in that context.*

Lucas 1973 , Lucas and Stankey 1974 , Stankey 1971 , Stankey 1973 , Wagar 1964). The contribution that Brown makes is to identify the management decisions that must be made and to specify in detail the inputs and outputs of each decision.

The first and most important decision that must be made is to select management objectives. The second decision is to select the management tools and techniques to meet the objectives. Finally, existing management objectives and strategies must be periodically evaluated to see if they should be modified; and if so, how.

Socio-psychological inputs play a vital role in all three of the above decisions. When selecting management objectives, it is advantageous for the resource manager to know which of the possible resource outputs are preferred by whom. In the case of Dinosaur National Monument, the white water rivers could be managed to provide opportunities for solitude, challenge, escape, nature education, self-reliance, excitement, esthetic appreciation, or affiliation. The park manager needs input regarding the experience expectations of users when he attempts to establish management objectives. Research has shown that motives are not the same for every individual participating in a given outdoor recreation activity (Davis 1973 , Henry and Driver 1974 , Knopf 1972 , Knopf, Driver, and Bassett 1973 , Potter, Hendee, and Clark 1973). Therefore the first hypothesis of our study was: river users on the Green and Yampa Rivers in Dinosaur National Monument have many motives for taking a river trip.

The manager also needs socio-psychological input from users when he selects management strategies. People's preferences for or satisfactions with river management strategies help the park managers to determine if management objectives are being met. Satisfaction in any situation is dependent upon one's expectations with respect to that situation (Lawler 1973). Limited research on the preferences and satisfaction of recreationists tends to confirm this contention (Bassett *et al.* 1972). On this foundation, the following study hypotheses were derived: Users with different motives for taking river trips differ (1) in the number of people they prefer to see on the trip, (2) in their preferences for maximum group size, (3) in their preferences for river campsite management, and (4) in their preferences for river management policies.

Finally, the park manager needs input from users in his evaluation of management objectives and strategies. If river users in Dinosaur National Monument are *satisfied* with their experience, then managers have accurately defined a socio-psychological carrying capacity. If, however, users are dissatisfied, then managers need to know who is dissatisfied and why. Brown's conceptualization of carrying capacity suggests that providing a great variety of satisfying experiences on the same river at the same time is probably impossible because what would enhance one river experience might detract from another. Discrepancy theory, which states that satisfaction is determined by the difference between desired outcomes and perceived outcomes, supports Brown's contention. On the basis of these theoretical and conceptual considerations, the final study hypothesis to be tested was: users with different motives for taking river trips differ in their degree of satisfaction with the trip.

STUDY DESCRIPTION AND PROCEDURES

Dinosaur National Monument, located on the boundary of Colorado and Utah, includes about 46 miles of the Yampa River and 43 miles of the Green River. Auto access to the rivers is limited to just a few places. Virtually all overnight river trips begin at Deerlodge on the Yampa or Gates of Lodore on the Green. All float trips in Dinosaur end at Split Mountain. The Deerlodge to Split Mountain trip takes 3 or 4 days and the Gates of Lodore to Split Mountain trip takes 3 days. The National Park Service has established 11 campsites for the river users. These sites contain primitive toilets, picnic tables, and fire grates for cooking; camping is permitted in designated sites only.

Data for the study were collected at the Split Mountain take-out point during the months of May, June, July, and August in 1975. Sampled individuals were given a coded postpaid return envelope that contained a cover letter, a questionnaire, and a map of Dinosaur National Monument. The questionnaire was 4 pages long and took about 30 minutes to complete. At the same time, the research technician recorded the date, name, address, and code number of the sample subject. The response rate was 76 percent; 864 useable questionnaires were returned out of 1,150 actually distributed.

The study questionnaire was designed to obtain the following information from river users: (1) background characteristics, (2) trip motives, (3) description of trip, (4) opinions on river management and use, (5) attitudes toward wilderness areas, and (6) satisfaction with the river trip. A 38-item construct scale was developed to measure the nine trip motives believed to be important: solitude, stress release/ escape, autonomy/achievement, affiliation, self-awareness, action/excitement, status, learning, and experiencing nature. Sample subjects were asked to think back to their reasons for taking the river trip and to respond to scale items in that context.

RESULTS

Trip Motives

A factor analysis was done to see if the study's multidimensional motivation scale measured the nine different motives, and whether the items that were written to measure a given motive did load highly on one factor. Seven, rather than the hypothesized nine, factors were extracted. Factor 1 included both the learning and the experiencing nature items so was therefore called "learning about nature". The second factor extracted was named "stress release/ solitude" because it represented a combination of the hypothesized stress release/ escape and solitude items. The remaining five factors contained the motive item-clusters as anticipated. All seven factor scales except "status" had an alpha coefficient of reliability of 0.80 or higher; that of the status scale was 0.68.

Although a sizeable number of individuals rated each motive as at least somewhat important, the relative importance of the motives for the group as a whole differed considerably. The action/excitement and learning about nature motives were very important, stress release/solitude and affiliation motives were moderately important, and autonomy/achievement was a somewhat important motive for most river users. Self-awareness and status had low group means.

Preferences For River Use Density

About 60 percent of river users either had no opinion about the number of people seen on the trip or felt that the number they saw was about right. Of the remaining individuals more felt they saw too many than felt they saw too few. Approximately 33 percent of users had no opinion on what would be an acceptable number of encounters with other people on the river trip. Among those with opinions, most felt that to see 11 to 25 or 26 to 50 people on the trip would be acceptable (only slightly lower than the number of people usually seen on the trip).

Pearson product-moment correlations were computed to test for significant relations between motives for taking a river trip and preferences for river use density. It was anticipated that the stress release/solitude and self-awareness motives would have significant positive correlations with river trip crowding and negative correlation with opinions on appropriate levels of encounter. Because the affiliation motive represents a desire to be with and to meet friends, it was predicted that affiliation scores would have the reverse correlations, i.e., significant negative associations with perceptions of crowding and positive correlations with decisions on appropriate use levels.

All of the hypothesized relations were found to exist at the 0.05 level of statistical significance. However, the actual strength of the correlations was weak; no single correlation exceeded 0.20.

Preferences For Maximum Group Size

A large majority of river users, 84 percent, favored some sort of limitation on maximum group size. River users who favored the limitation of group size were also asked what they thought would be an acceptable maximum group size. User preferences clustered in and around the 21 to 30 person category. These opinions seem to reflect the existing situation; most trips on the river fall within this general size range.

The same motives, for the same theoretical reasons that were considered important in explaining opinions on river use, were also believed to be relevant to the question of limiting group size. The obtained relations were again very low; no correlation exceeded 0.20. The relations between three of the motives and opinions on limiting group size were, however, significant at the 0.05 level of probability. As hypothesized, there was a tendency for

an increase in the stress release/solitude motive to be associated with a shift in opinion toward favoring a limit on group size. The status motive had the opposite association, i.e., there was a weak tendency for individuals who were high in status to be opposed to limitations in group size. The affiliation motive was the only one that had a significant correlation with opinions on what would be an acceptable maximum group size. As predicted, the association was in the positive direction.

Preferences For Campsite Management

More river users opposed than favored campsite development suggestions. However, they were even more opposed to returning the river campsites to a more primitive or natural condition than to the proposed development. These findings suggest that existing river campsites are generally satisfying user needs.

It was hypothesized that scores on the learning about nature, stress release/solitude, and autonomy/achievement scales would each have a significant *negative* correlation with degree to which campsite development is favored and a significant *positive* correlation with support for preservation strategies at campsites. The correlation between motive scale scores and scores on the campsite development and preservation indexes were all below 0.20, but they were all statistically significant in the direction hypothesized (0.01 level of probability).

Preferences For River Management Policies

More than four times as many people favored campsite assignment and trip scheduling as opposed them. The establishment of a seasonal use limit was favored by overnight river users at a 3:1 ratio. The strength of the preference for trip scheduling is particularly striking because this policy does not directly apply in Dinosaur.

Because campsite assignment and trip scheduling would have an impact upon the number of people encountered on the trip and upon freedom of choice while on the trip, it was hypothesized that scores on the stress release/solitude and self-awareness scales would have significant positive correlations and scores on the autonomy/achievement and affiliation scales would have negative correlations with these river management policies. Because the establishment of more river campsites and seasonal use limit would likely reduce the number of contacts with other parties but would not decrease freedom of choice while on the river, it was anticipated that an increase in the stress/solitude and self-awareness motives would be associated with a significant tendency to support the establishment of campsites and a seasonal use limit, but that the affiliation motive would have a negative correlation with these management policies.

When product-moment correlations were calculated to test for the hypothesized relations, all of the correlations between motive scores and preferences for the four river management strategies were found to be very weak. No single correlation coefficient was greater than 0.15. Many of the weak correlations were statistically significant as hypothesized, however (0.05 level of probability).

Degree of River Trip Satisfaction

Eighty-three percent of overnight users either said they were completely satisfied or thought the trip was one of the most thoroughly satisfying experiences of their lives. Another 15 percent were mostly satisfied. Only 4 people out of 666 were somewhat dissatisfied.

Even though river users as a group were satisfied with the river trip, it was hypothesized that relations between individual trip motives and degree of trip satisfaction would differ. Pearson product-moment correlations were computed to test for such differences. Although none of the obtained correlations had an r value greater than 0.21, the correlations between all study motives and degree of trip satisfaction were significant at the 0.05 level of probability. Moreover, all significant associations were in the same direction, i.e., the greater the strength of the motive, the greater the degree of trip satisfaction.

DISCUSSION AND CONCLUSIONS

Although this study provided much information on user preferences and satisfaction that is useful for decision-making, the generally weak correlations between trip motives and both management preferences and

degree of trip satisfaction lowers the apparent value of this particular approach to the assessment of the socio-psychological components of carrying capacity. If river users who seek different experiences on the trip differ only slightly in their preferences for seeing people on the river or at campsites, for limiting group size, for campsite development, for specific river use regulatory policies, and in degree of trip satisfaction, then measurement of trip motives has little practical value for the river manager.

The motive scales used in this study sought to measure the phychological needs of the individual that prompted him to take the river trip. The conceptualization of trip motives at the basic human need level may have contributed to the weak association between reasons for taking a river trip and opinions on river management strategies. For example, individuals with a high need for affiliation may have very different expectations on how this need might be satisfied on the river trip. For some it might be group singing around the campfire, for others it might be preparing a meal together, or a hike up a side canyon with a special friend. These individuals likely prefer very different river management policies. In future recreation behavior research, stronger relations and more meaningful information for decision-making might be gained if the specific experience expectations of the recreationists are measured. When many recreationists in the research population have no previous experience with the activity or the resource in question, as was the case with the river users in Dinosaur National Monument, separate analyses should be performed for the experienced and inexperienced users.

In the measurement of the trip motives of river users in Dinosaur National Monument, more individuals scored high on all or almost all motives or scored low on all or almost all motives than expected. This may be due to response sets among river users. A Likert-type attitude scale is susceptible to such response sets, and the finding that individuals who had strong trip motives also had a high degree of trip satisfaction suggests that this may have occurred. A more accurate assessment of the importance of the various reasons for taking a river trip might have been attained had the river user been asked to *rank* his trip motives.

Because of financial constraints, trip motives were recorded *after* the trip. This approach has several weaknesses. Human behavior is prompted by psychological needs or strains within the individual (Lawler 1973). When the psychological need is satisfied, other wants become dominant. The high rate of river trip satisfaction reported suggests that users may have a difficult time remembering their original reasons for taking the trip. River users in Dinosaur National Monument may have only general expectations of their trip due to lack of previous river experiences. Their motives would therefore be susceptible to change due to actual resource and social conditions encountered on the trip. The post-trip measure of motives may be not so much a measure of inherent reasons for taking a river trip as it is a measure of the trip's capability of providing various kinds of experiences. In future river and other recreation behavior research, motives should be measured prior to the trip.

Trip motives mattered little in determining satisfaction. Virtually every river user was extremely satisfied. This may be due to several factors. First, most river users in Dinosaur apparently do not have well defined expected outcomes. They have not taken a previous river trip, and the experience is therefore exploratory in nature. Second, the trip offers much diversity. The resource and social characteristics of the river trip provide a variety of experience opportunities; and trip scheduling, use conditions, and management regulations apparently still permit the individual to freely choose the desired alternatives. Finally, contrary to the study's theoretical perspective, the actual outcomes of certain facets of the trip may so exceed expected outcomes that dissatisfaction with other aspects of the trip may be more than compensated for.

ATTITUDES OF SALMON RIVER USERS TOWARD MANAGEMENT OF WILD AND SCENIC RIVERS

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ABSTRACT.-- One hundred and seventy-six Salmon River float boaters responded to a questionnaire that solicited their attitudes toward wilderness river recreation experiences and management. Factors relating to health and physical fitness, adventure, awareness of nature, communion with nature, and wilderness preservation were viewed favorably by nearly all respondents. Intensive management practices such as developed campsites, gravel roads and trails, picnic tables, garbage cans, and allowing power boats were rejected by almost all respondents.

Wilderness users have been studied in many contexts. Stankey (1973) studied user opinions about management and carrying capacity of four wilderness areas and related their opinions to wilderness-purist attitudes. His summary provided managers with answers about prevailing opinions among wilderness users. The present study attempts to provide similar information for users of a wilderness river. We include a somewhat broader range of variables relating to demographic data, type of wilderness use, and attitudes toward management practices. We then attempt to describe how this information can be used to develop management strategies.

The major objective of this study was to provide specific data on user attitudes as a basis for suggesting management strategies for the Salmon River Wilderness Area. Responses to scaled items on user experiences and management preferences were also structured to provide insight into management programs for other wilderness rivers.

The second study objective was to define relations between behavioral and demographic characteristics of users, recreation experiences, and user attitudes concerning wilderness river management.

As Hendee *et al.* (1968) point out, wilderness management decisions cannot be made on a purely majority vote basis. But it is still important to know the majority opinion when evaluating management alternatives. Hendee *et al.* isolated a number of factors related to Pacific Northwest wilderness user attitudes. One purpose of the present study was to see if similar attitude dimensions would emerge from data collected from wilderness river users.

STUDY METHODS

Data Collection

Questionnaires were distributed during summer 1973 to a sample of Salmon River

users as they embarked on their float trips from campsites along the river. It was not possible to obtain a random sample of users because of unpredictable departure patterns. Instead, questionnaires were distributed at random times as people departed from campsites along a 75-mile stretch of river from Salmon Falls to the end of the road upriver from Riggins, Idaho.

When groups of 10 or more were departing together, only every 10th person was given a questionnaire. For smaller groups, a questionnaire was given to one randomly selected individual. Selected individuals were given a brief description of the study, handed a questionnaire, and asked to fill it out and return it at the completion of their trip. Of the 250 questionnaires distributed, 191 were returned. Of these, 176 were used in the analysis. Most of the unusable questionnaires had been damaged by water.

Although not complicated, the questionnaire was lengthy. We attribute the rather high rate of response to the users deep interest in management of the Salmon River.

The questionnaire was divided into four sections: (1) questions about the user, his group, mode of travel, length of visit, expenditures, and past and present activities on the Salmon River and other wilderness areas; (2) a series of questions to elicit attitudes about 47 features and activities associated with the Salmon River and the user's recreation experiences; (3) another series of questions to elicit attitudes on 50 items related to existing and alternative Salmon River management practices and facilities; and (4) demographic information on the respondent--age, residence, income, sex, marital status, and organizational affiliations.

Scale items on attitudes toward the wilderness environment were derived largely from Hendee *et al.* (1968). This was done so that we could determine how results of our study of Salmon River users compared to Hendee's studies of nonwilderness river users.

Data Analysis

Responses were coded and punched on cards for computer analysis, and data were analyzed as follows:

Descriptive analysis--Demographic and recreation behavior variables were tabulated.

Factor analysis of attitudinal data--The scaled items on recreation experiences and management practices were factor analyzed separately to define clusters of attitudes and thus provide a simple overview of the data. Five factors were defined for items dealing with recreation experiences, and three factors were defined for items dealing with attitudes toward management practices. Only those attitudinal items with loadings of 0.40 or greater on any of the eight factors were retained for further analysis. Scale directions of individual items with negative loadings were reversed to preserve the statistical and empirical meaning of each factor.

Attitude-behavior patterns--Factor scores were calculated for each respondent based on items loaded on the eight factors defined above. By this process, the 97 individual item scores were distilled into 8 factor scores. Each resulting score represented a dimension that best described the variation in responses to the individual items loaded on the factor describing that dimension.

The eight factor scores, demographic data, and recreational behavior data for each respondent were subjected to a final factor analysis. This analysis produced three attitude-behavior patterns that related attitude, demographic variables, and recreation behavior of Salmon River wilderness users.

RESULTS

Descriptive Results

Demographic and recreation behavior data were analyzed to produce a description of the "typical" Salmon River user.

The "typical" Salmon River user was on his first trip to the Salmon, but he averaged almost two trips annually to other wilderness areas. He prefers to see few people in the wilderness. On this visit to the Salmon River, he went with a guided group, and spent less than $600 for the entire trip. He stayed for 5 nights each of which he slept outside at a satisfactory campsite. He found the Salmon

River relatively unlittered and was very satisfied with his trip. It is not surprising that he camped at night and did little hiking, because all study respondents were floating down the Salmon River.

Attitudes Toward Recreation Experiences

Factor analysis of questionnaire items dealing with aspects of recreation behavior and experiences resulted in the definition of five factors (tables 1-5). To code data for factor analysis, responses for each questionnaire item were scored on a scale of 1 to 9: very unfavorable responses were scored 1, neutral responses 5, and very favorable responses 9. Descriptive factor names were determined by examing the individual items most heavily loaded on them. Factors should not be interpreted as representing consensus among respondents. Due to the nature of factor analysis, both respondents with characteristics or attitudes described by the factor and those with opposite characteristics or attitudes are likely to be present in the sample.

Such variation in response is necessary if a definable factor is to emerge from the data. Item loadings on factors can be viewed as correlations of the item (variable) with the factor, i.e., the strength of the relation between a particular item and all other items comprising the factor.

The items loaded on "adventure and renewal", recreation experience factor 1 (table 1), were highly regarded by most respondents, having a mean rating across the factor of 7.8 out of a possible 9. The presence on this factor of items representing a desire to recapture the pioneer spirit, experience a sense of discovery, seek adventure, and get physically tired indicates that people favoring items on this factor would oppose any management practice that would "tame" the wilderness.

Table 1.--*Adventure and renewal (recreation experience factor 1)*

Item	Mean item rating	Factor loading
Attitude toward:		
Attain new perspectives	7.7	0.82
Improve health	7.7	.81
Recapture pioneer spirit	7.1	.77
Experience sense of discovery	8.0	.72
Relieve tensions	8.0	.68
Do things most people don't	7.2	.68
Experience sense of adventure	8.0	.65
Get physically tired	7.6	.63
Breath fresh air	8.7	.46
Experience self realization	7.8	.45
Factor mean	7.8	

"Convenience", recreation experience factor 2 (table 2), provides a cluster of items relating to more convenience-oriented recreation facilities. People with favorable attitudes toward these items prefer to have all the comforts of home when they engage in wilderness recreation. It should be noted that preference for sleeping outdoors is negatively related to the factor indicating that those who like car camping, developed resorts, etc., would prefer not to sleep outdoors.

Table 2.--*Convenience (recreation experience factor 2)*

Item	Mean item rating	Factor loading
Attitude toward:		
Car camping	2.4	0.77
Developed resorts	2.2	.75
Purchasing souvenirs	1.8	.72
Automobile touring	2.4	.71
Power boating	2.6	.70
Private cabins	3.1	.70
Campsites with plumbing	2.9	.68
Gravel roads	3.3	.60
Sleeping outdoors	8.5	- .43
Factor mean	2.4	

The low mean rating for recreation experience items on this factor (2.4 where 1 is the lowest possible and 5 is neutral) indicates that most Salmon River users reject easy types of recreation. This finding is consistent with results of most other studies of wilderness users. People favoring recreation experiences described by the factor would probably be infrequent wilderness users.

The mean rating of items loaded on "strenuous activity", recreation experience factor 3 (table 3), is 8.0. This indicates that strenuous physical activities are highly regarded by most Salmon River users. Nevertheless it should be remembered that most of the recreationists sampled did little hiking. Perhaps what is sought is the opportunity to do such things, rather than actually doing them.

Table 3.--*Strenuous activity (recreation experience factor 3)*

Items	Mean item rating	Factor loading
Attitude toward:		
Hiking	8.4	0.65
Mountain climbing	7.5	.63
Backpack camping	8.1	.60
Physical exercise	8.2	.54
Factor mean	8.0	

Recreation experience factor 4, "aesthetic pleasure", (table 4), consists of items related to aesthetic enjoyment of elements in the natural environment. All items had high ratings from most respondents, resulting in a higher mean rating (8.5) than that of any other recreation experience factor. This dimension of appreciation of nature and aesthetic enjoyment is important to most Salmon River users.

Table 4.--*Esthetic pleasure (recreation experience factor 4)*

Items	Mean item rating	Factor loadings
Attitude toward:		
Vast areas	8.2	0.72
Timberline vegetation	8.2	.72
Virgin forest	8.4	.71
Rugged topography	8.2	.68
Seeing native wild animals	8.7	.67
Looking at scenery	8.7	.63
Float boating, kayaking	8.5	.62
Awareness of beauty	8.8	.58
Enormous vistas	8.1	.58
Absence of people	8.2	.56
Enjoyment of nature	8.8	.55
Drinking clean stream water	8.8	.55
Solitude	8.5	.53
Tranquility	8.7	.52
Absence of man-made features	8.3	.50
Absence of man-made noise	8.5	.41
Factor mean	8.5	

Recreation experience factor 5, "hunting and fishing" (table 5), deals specifically with attitudes toward hunting and fishing in the wilderness. Whereas not all hunters are fishermen and vice versa, attitudes toward these activities are closely related. But fishing is viewed as generally more appropriate. Hunting has the highest standard deviation (3.05) of any of the recreation experience items included in the study. This indicates a great diversity of opinion with regard to its appropriateness.

Table 5.--*Hunting and fishing (recreation experience factor 5)*

Items	Mean item rating	Factor loading
Attitude toward:		
Hunting	4.4	0.74
Fishing	6.6	.66
Factor mean	5.4	

Attitudes Toward Management Alternatives

Factor analysis of items about wilderness management and behavior resulted in the definition of three factors (tables 6-8). Individual items were scored on a scale of 1 to 3: where undesirable-disagree responses were scored 1, neutral responses 2, and desirable-agree as 3.

The items on management factor 1, "development" (table 6), indicate a dimension of concern for the degree of development appropriate for a river wilderness area. People who reacted positively to these items (and negatively to negatively loaded items) likely perceived the wilderness as idle land that should have more intense use. The introduction of some degree of managed, mechanized civilization would be appropriate to these people. Most Salmon River users in our sample were at the other end of the spectrum as indicated

Table 6.--*Development (attitude toward management factor 1)*

Items	Mean item rating	Factor loading
Attitude toward:		
Power boats in wilderness	1.2	0.69
Helicopters for VIPs	1.3	.64
Leasing land to guides	1.3	.62
Airfields in wilderness	1.5	.61
Continued use of powerboats	1.6	.54
Packing out garbage	2.7	-.53
Leaving garbage in cans	1.4	.50
Motor noise in the wilderness	1.3	.51
Picnic tables at campsites	1.3	.49
Grazing of livestock in backcountry	1.5	.49
Private land inholdings	1.4	.47
Cutting vegetation for bedding and fire	1.4	.44
Removing signs of use	2.8	-.38
Factor mean	1.4	

by the low individual item means and the low overall mean of 1.4. They prefer to see the wilderness undeveloped. As shown by the loadings of the two items concerning power boats and items about helicopters, airfields, and motor noise, they disapprove of noise associated with mechanization. The types of development described by this factor would be unpopular with most Salmon River users.

The items on management factor 2, "secure wilderness" (table 7), all have mean ratings near neutral, producing an overall factor mean of 2.1. These neutral means were produced by great diversity of opinion as indicated by high item standard deviations. All strongly loaded items concern use of signs and helicopters in the wilderness. People who favored these items might desire signs so that they do not get lost, and desire helicopters in case they do. This group of respondents might feel insecure in the wilderness, probably being infrequent wilderness visitors. More experienced wilderness users probably express the opposite attitude. The manager contemplating use of signs or helicopters in wilderness river areas should understand that opinion on the issue is diverse. Infrequent users are likely to approve of these management techniques while frequent users might be opposed.

Table 7.--*Secure wilderness (attitude toward management factor 2)*

Items	Mean item rating	Factor loading
Attitude toward:		
Campsite signing	1.9	.70
Interpretive signing	2.1	.70
Signing of dangerous rapids	2.2	.66
Signs on streams	2.1	.64
Removing existing signs	1.7	- .63
Helicopters for patrols	2.0	.49
Helicopters for administration	1.9	.47
Helicopters for carrying equipment	1.9	.42
Factor mean	2.1	

Six well-regarded items make up management factor 3 (table 8), "controlled access". People responding positively to these items like to see trails minimized in both number and quality. They also favor restrictions on use and like to see wilderness areas managed as separate from surrounding land units. This factor relates to the amount of use deemed appropriate within wilderness areas. Restrictions on levels of use should be favored by most Salmon River users. A similarly favorable attitude toward restrictions on use has been found with other groups of wilderness users (Stankey 1973).

Table 8.--*Controlled access (attitude toward management factor 3)*

Items	Mean item rating	Factor loading
Attitude toward:		
Leaving fallen trees across trails	2.3	.69
Low standard trails	2.5	.61
Limiting group size to 12	2.3	.60
No trails in some areas	2.7	.51
Managing wilderness differently from adjacent lands	2.8	.46
Restrictions on number of users	2.9	.41
Factor mean	2.6	

Attitude-Behavior Patterns

Scores were calculated for individual respondents on each of the eight factors previously defined. These scores were then subjected to another factor analysis along with variables on respondent demographic characteristics and recreation behavior. The analysis resulted in the definition of 3 factors that we call "attitude-behavior patterns" (tables 9-11).

Respondents expressing the attitudes and having the characteristics reflected in attitude-behavior pattern I, "purist-preservationist" (table 9), tend to reject any type of increased development of the

Table 9.--*Purist-preservationist (attitude-behavior pattern I)*

Variable or factor	Pattern loading
Convenience (recreation experience factor 2)	- 0.64
Secure wilderness (attitude toward management factor 2)	- .51
Development (attitude toward management factor 1)	- .50
Controlled access (attitude toward management factor 3)	.48
Preservationist group membership	.48
Number of wilderness trips per year	.43
Number of people tolerated in wilderness	- .39
Years of schooling completed	.32
Amount of littering perceived in Salmon area	.31
Strenuous activity (recreation experience factor 3)	.29
Aesthetic pleasure (recreation experience factor 4)	.28

Salmon River area--particularly developed camping facilities. An individual displaying this pattern would likely be well educated, a frequent wilderness user, and a member of a preservationist organization. Such a person would prefer seeing few other people in the area and view the Salmon River area as being in worse condition with regard to littering than others. They may, in fact, be more discriminating in their perception of wilderness.

People represented by the "purist-preservationist" pattern prefer controlled access and physically rugged forms of recreation. They enjoy the outdoors, reject convenience-oriented camping, and oppose intensive management and development. They are more experienced wilderness users than other Salmon River users, and are intolerant of crowded conditions. People represented by the "purist-preservationist" are more likely to be preservationist group members than are other Salmon River visitors. They prefer management to keep large numbers of people out of the Salmon River area and to preserve the wild character of the area. It is important to note that these more frequent users are most opposed to development.

People described by attitude-behavior pattern II, "hunter-fisherman" (table 10) tend to camp alone, not hire a guide, react more favorably toward convenience facilities and approve of hunting and fishing in the wilderness. They are frequent visitors to the Salmon River, probably coming to hunt or fish. They like to see few other people in the area, which is consistent with the needs of hunters and fishermen. People who display opposite characteristics are likely to be members of a guided tour group on their first visit to the Salmon River.

Table 10.--*Hunter-fisherman (attitude-behavior pattern II)*

Variable or factor	: Pattern : loading
Hiring of a guide	- 0.56
Number of people in group	- .53
Camping with group	- .50
Number of times been at Salmon	.45
Hunting and fishing (recreation experience factor 5)	.38
Development (attitude toward management factor 1)	.35
Number of people tolerable in wilderness	- .32
Secure wilderness (attitude toward management factor 2)	.28

Attitude-behavior pattern III, "wilderness enthusiast" (table 11), represents young, single people who are new to the Salmon River and are looking for a challenging, rewarding experience with nature. Respondents having opposite characteristics would be older people with families who could do without the challenge. The young, adventurous user would be more common on the Salmon River.

Table 11.--*Wilderness enthusiast (attitude-behavior pattern III)*

Variable or factor	: Pattern : loading
Adventure and renewal (recreation experience factor 1)	0.65
Aesthetic pleasure (recreation experience factor 4)	.64
Strenuous activity (recreation experience factor 3)	.49
Age	- .48
Number of children	- .41
Married	- .36
Number of times at Salmon	- .32
Controlled access (attitude toward management factor 3)	.27

DISCUSSION

Study results, when compared to results of other wilderness user studies, provide insight into differences and similarities between wilderness user groups that can be used to develop management strategies.

Relation to Results of Other Studies

Results of this study were similar to results of other studies of wilderness users. The factor analysis on attitudes toward the river wilderness experience showed strong similarity to results obtained by Hendee *et al.* (1968). This suggests that wilderness user attitudes are relatively stable across different kinds of wilderness experiences.

Although attitudes toward the wilderness experience itself were similar, differences were found in attitudes of Salmon River users toward management alternatives. Salmon River users, for example, are likely to have less wilderness experience than other wilderness users. Although Hendee *et al.* found that their sample of wilderness users averaged 6.3 wilderness trips per year, our sample of river users averaged only 1.7 trips per year to wilderness areas.

The finding of the present study that wilderness users would respond favorably toward a management program to restrict use was similar to that found by Stankey (1973). The ambivalent attitude toward the use of signs and helicopters, however, was not expected. Stankey (1973) found that about a third of the users of four wilderness areas would approve signing campsites. About the same percentage expressed approval of such action in our study, but only another third actually opposed such an action. The implication is that there is no universal opinion among Salmon River users as to the appropriateness of campsite signs. Whichever decision the manager made, an equal number of users would be unhappy.

Management Implications

It is important for the manager to understand the attitudes of the users of the area he is managing: not only the degree of similarity in user attitudes, but more importantly, issues on which user attitudes are most divergent.

If the manager directs his management toward those who are of the "purist-preservationist" orientation, interests of an "elite" recreationist group would have been served to the exclusion of a large segment of the public who support wilderness through taxes. The gradations of management intensity associated with different categories of wilderness do not really resolve the issue. The question still remains about the appropriateness of functional exclusion of large segments of the public.

It may be that there is no "right" answer for the manager. Perhaps there are only those that are less wrong. If so, the major guidance for management should come from those who actually use the wilderness. Frequent Salmon River users who were sampled in this study prefer imposing restrictions on number of users, keeping trails few in number and low in quality, minimizing interpretive and directional signs, and forbidding the use of helicopters in the wilderness river.

The problems faced by the wild and scenic river manager are not much different than those faced by managers of other wilderness areas. Both deal with users who have a purist-preservationist attitude toward wilderness management. But the wild and scenic river manager is more likely to face problems associated with use by large groups of users who are inexperienced with wilderness and desire a measure of security.

A FILTER SYSTEM FOR DETERMINING RIVER SUITABILITY FOR NATIONAL WILD AND SCENIC RIVER STATUS

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ABSTRACT.--A system of filter matrices has been devised and applied to rivers in the Appalachian plateau. Based upon subsequent aerial observation and input from users, the system appears to be successful in identifying streams that could logically be considered for inclusion in the National Wild and Scenic River System.

I was part of a study commissioned by the Bureau of Outdoor Recreation (1976) to examine the Appalachian Plateau (exclusive of the Cumberland Plateau Region) to identify those streams which were suitable for study for inclusion in the National Wild and Scenic River System (fig. 1). In conducting this survey we experienced the three problems inherent in any selection process:

(1) Criteria;
(2) Consistency in application of criteria; and
(3) The comparison of dissimilar types--in this case rivers resulting from widely different geological and hydrological characteristics.

We found that many of the early systems used for categorizing rivers which used weighting values to determine river suitability for protection, had an inherent bias in that they favored the extremely long, big, high gradient rivers of the western mountains. In the East, due to the headstart in settlement, development has largely precluded the availability of hundreds of miles of free flowing streams or of rivers with large volumes of flow in pristine condition. This realization in turn caused a little waffling among agencies about the rigidity with which certain criteria should be applied. For instance, rivers are supposed to be 25 miles long or longer in order to qualify for Wild and Scenic River status. Because it is more difficult to find 25-mile to 50-mile continuous reaches of undisturbed streams in the East, the criteria have been softened to allow discontinuous reaches totaling 25 miles. Similarly, in the past any evidence of human intrusion such as dams, parallel

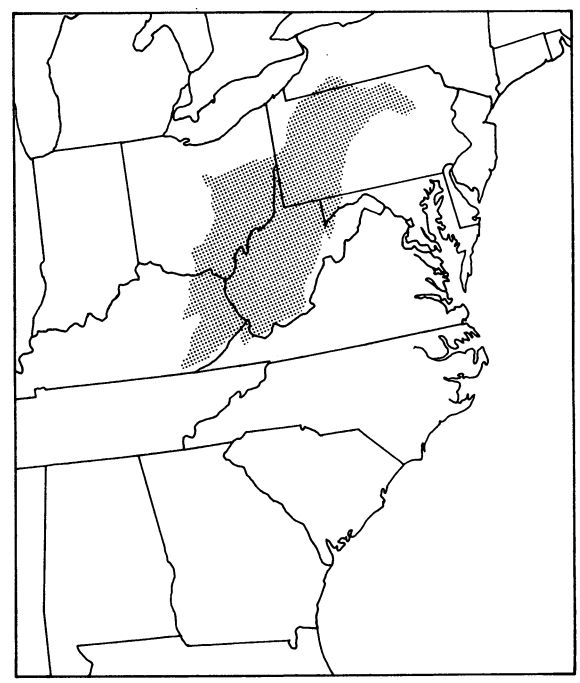

Figure 1.--*Study area.*

roads, or channelization has been enough to exclude a river. Now several rivers that are under consideration have dams in some segments with the Wild and Scenic portions beginning at the base of the dam and continuing through essentially untouched reaches.

Being aware of the relaxation of these criteria and the biases associated with different sections of the country, we felt that there was little use in studying all streams to see if 25 miles could be assembled from pieces of them. We also attempted to incorporate the perceptions of local citizens who, because of their familiarity with the various streams, knew their limitations and potentials. If, in fact, public input was strongly in favor of the consideration of a stream in spite of the fact that it did not meet all the criteria for National Wild and Scenic River status, it was included with appropriate notation.

SELECTION PROCESS

The technique we employed for comparing the various stream segments was a series of "filters" and "filter matrices" through which the streams were screened. A filter matrix is basically a cross check of items against values (e.g., apples and oranges against Vitamin C content, keeping doctors away, etc.). The values may be expressed in levels, giving qualitative or--in some cases--quantitative differences. If an item (e.g., a river) meets the proper criterion level, it is passed on to the next filter. If it does not pass, it is dropped from further study. The various filters are arranged in such an order that the first filters remove the most items from study, with each progressive filter increasing the standards. This allows items that obviously will not meet the standards to fall out early, reducing the number of items requiring detailed study. While there is a degree of subjectivity inherent in the personal observation portion of this technique, the filters and matrices themselves provide a framework of objectivity.

PUBLIC INPUT

User input was solicited from approximately 150 organizations. The groups covered all special interests from Audubon Societies and Sierra Clubs to Ducks Unlimited and Trout Unlimited as well as river-running canoe clubs, commercial rafters and any other groups who surfaced and had a real interest and knowledge of the streams. Our response rate was only 10 to 15 percent but many of these users were extremely specific and detailed in suggesting streams. We attempted to temper the hard and fast criteria applied in the filters with the information and desires we obtained from the dialogue with the various user groups.

Filter One--Stream Length

The initial filter we established was length. Under this filter all rivers and streams of 25 miles or more in length were identified. The U.S. Geological Survey (USGS) shaded relief and topographic maps (1:250,000) were found to be the best for this task. A stream which appeared on these maps was assumed to be of sufficient size to have recreation potential. This eliminated many of the small, first order streams and undoubtedly dropped some scenic small streams. Exceptions were made under this filter. We found that user input does not generally discriminate by length, therefore, some short segments were considered. Also, some of the recreationally important streams which did not conform to Filter One criteria but possessed unique characteristics which merited further consideration were passed on for further study.

Filter Two--Water Quality

The streams which passed Filter One were sequentially surveyed for water quality (figs. 2-6). The criteria required the stream or stream segment to meet or be capable of meeting within the next ten years, the water quality standards for water contact recreation. Several problems were encountered under this filter. There was a surprising variance among States' water quality standards and some States did not have separate standards set for categories of recreation, drinking, fishing, etc. For a number of stream segments, especially in West Virginia and Ohio, there was no data available. Where this occurred the streams were passed through to the next filter. The really hard item to get a handle on was the future water quality of each stream. In many cases it could not be determined whether or not the stream could meet the criteria within the 10-year time frame. Still, this filter was applied

stringently where the data was available. Any rivers identified by user input as valuable and recovering from water pollution were inserted into the analysis process. The water quality filter included the following parameters: (1) coliform bacteria (fecal), (2) dissolved oxygen, (3) pH (level of acidity), (4) toxic chemical, (5) heavy metals, and (6) β - particles.

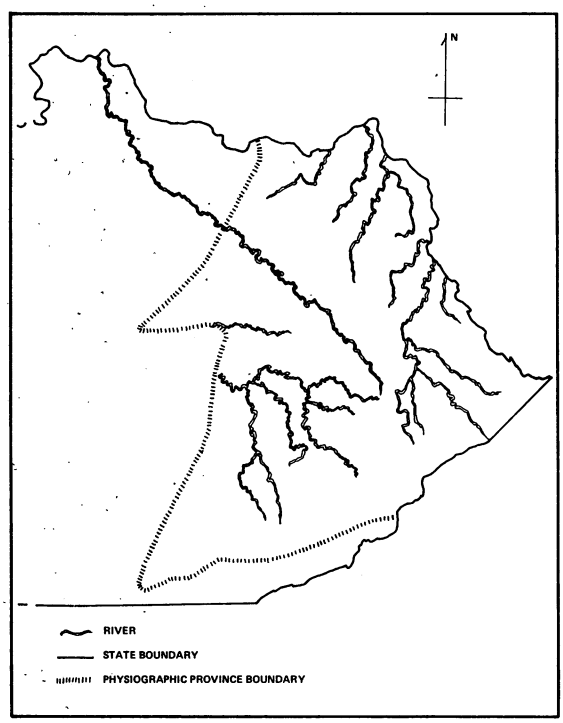

Figure 2.--*Location of surveyed rivers--eastern Kentucky.*

In restrospect the only water quality parameter which should have led to exclusion was frequent occurrence of high numbers of fecal coliforms during low-flow conditions. Such fecal coliform low-flow pollution may pose an actual health threat, whereas acidity, phenolic content, and heavy metals from infrequent, casual contact do not, though they may preclude wildlife.

This filter removed only 47 of the 150 streams passing Filter One because of the incomplete or widely varying water quality data.

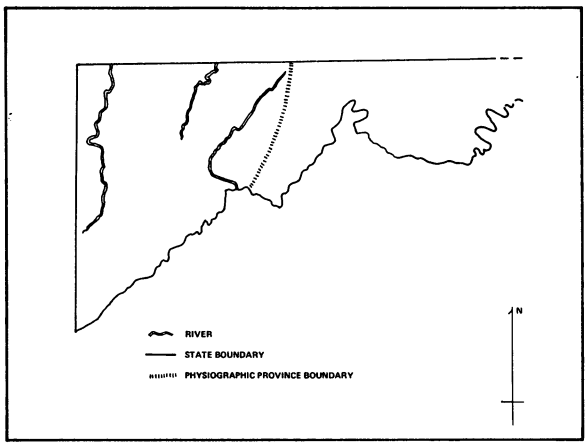

Figure 3.--*Location of surveyed rivers--western Maryland.*

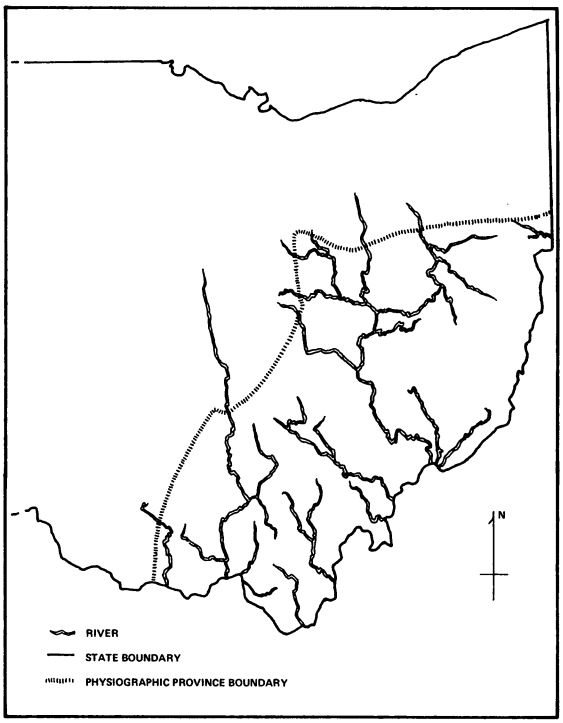

Figure 4.--*Location of surveyed rivers--Ohio.*

Filter Three--Urbanization

While many streams "fell out" due to water quality, the greatest impacts on streams are man-made intrusions and alterations. This most important filter was

produced in an effort to detail and quantify the degree of urban and agricultural development for each stream and to rank each river on an "urbanized" scale. We simply mapped a 0.5-mile river corridor on a suitable map and counted all noticeable cultural intrusions by down-river mile. This allowed for a mile-by-mile inventory of linear and nonlinear intrusions.

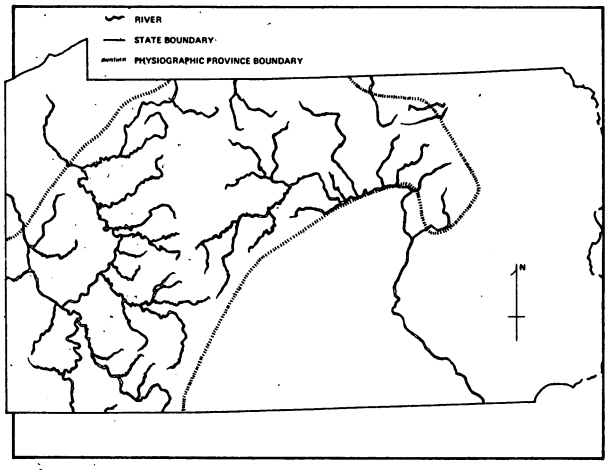

Figure 5.--*Location of surveyed rivers--Pennsylvania.*

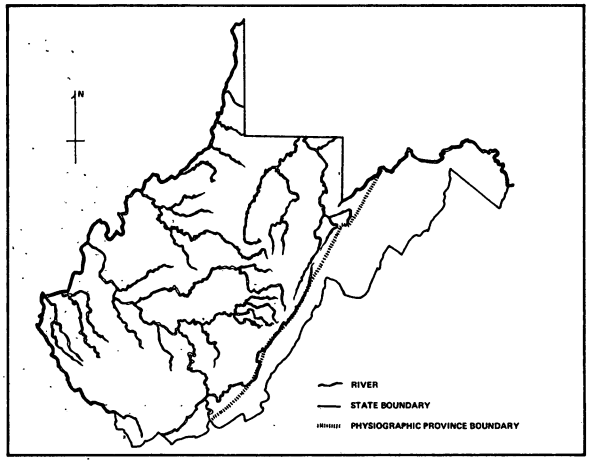

Figure 6.--*Location of surveyed rivers--West Virginia.*

Each intrusion was recorded by mile number and assigned a value on a scale from 1 to 100 by increasing human activity and visual intrusiveness, as tabulated below.

Weighted Value	*Intrusions (Linear and Nonlinear)*
1	Trail ending
2	Trail parallel, gauging station, water well
3	Road (dirt) ending, railroad grade crossing, ford
4	Road (dirt) bridge, gate
5	Road (dirt) parallel, road (gravel) ending, railroad ending, road (paved and rail), culvert, crossing, railroad grade parallel, orchard, ranger station, foot bridge, wayside park, country club, swimming pool, bathing area, cabin, dwelling
6	Road (gravel) bridge
7	Road (gravel) parallel, road (paved) ending
8	Road (paved) bridge, railroad bridge, covered bridge, pipe and power line crossing
10	Road (paved) parallel, railroad parallel, storage tank, cemetery, dock, levee, power and pipeline parallel, Forestry Headquarters
15	Campground, business, railroad station, post office, apartment building, radio tower, multibuilding camp, fish hatchery
20	School, church, armory, community hall, power substation, race track, recreation area, camping lodge, hospital, nursing home
25	Railroad yard, road construction
30	Mine, gas and oil well, sand and gravel pit, quarry, highway garage, correctional institute
35	Pumping station
40	Road (4-lane) bridge, resort, motel, drive-in, sewage plant, saw mill, trailer park
50	Factory, airport (small), 4-lane interchange
75	Road (4-lane) parallel, incorporated area, industrial section, auto dump, oil field (more than 3 wells), garbage dump
100	City, dam, canal

These values resulted from the synthesis of the perceptions of professionals familiar with river recreation, planning, and visual design. For example, trail

endings received a value of 1, intrusions such as a dirt road had a value of 3, a railroad crossing had a value of 8, etc., until we reached the top of the scale where a city on one bank would carry a value of 100. With this ranking system each river segment surveyed was weighed mile by mile and then compared against a baseline river, the Chattooga River in Georgia. This river was selected because it is familiar to the study personnel and it is generally recognized as an ideal eastern Wild & Scenic River. One section of the Chattooga that had been classified as Scenic had an average point value of 23 points per mile. On the other hand, Section IV of the Chattooga which had been classified as a Wild River averaged only 5 points per mile. Using these 2 figures as a baseline, final standard values of 0-10 points/mile (Wild) and 11-30 points/mile (Scenic) were established. Those rivers or river segments exceeding 30 points per mile were considered to be too highly developed for Wild and Scenic status and were dropped at this point. However, here again, an option was left open to reinstate rejected segments if citizen input warranted reconsideration. It should also be pointed out that many of these streams could be of excellent recreational value despite the corridor development. A value breakout for recreational rivers was not made because of the great variability in recreation activities.

It is obvious that the relative ranking system, the various categories, and the classification standards for Wild and Scenic Rivers is arbitrary. However, the intrusions were systematically recorded on a per-mile basis, thus allowing anyone to attach his own weighting system to the data if desired. It also allows streams to be compared on some consistent basis from area to area and stream to stream.

This filter removed the majority of the streams under consideration at this phase and had been accomplished primarily from map interpretation. In order to make sure that this paper survey gave a fairly accurate picture of the urbanization of the corridors and that no drastic human development had accrued since the updating of the maps, Filter Four was employed.

Filter Four--Direct Inspection

This filter consisted of field examination of the remaining rivers either from the air or on the water. During these surveys checklists and photos were used to record and document observations. From this analysis detailed descriptions of streams and land use characteristics, physiographic resources, and unique resources were also developed. On the positive side, "field truthing" also prevents the unnecessary exclusion of streams where recovery has already begun or development is along a ridgetop or in some other fashion hidden from the river traveler's view. An example of this is the New River where railroad yards, small towns, and various industrial developments occur on top of the New River Gorge within less than 0.5 mile of the stream but out of sight and without intruding on the user's perception.

The information from all four filters plus user input was used to draw up a tentative final list-of-stream segments for Wild and Scenic River recommendation (figs. 7-11). Before final clearance, however, application of one last filter was attempted.

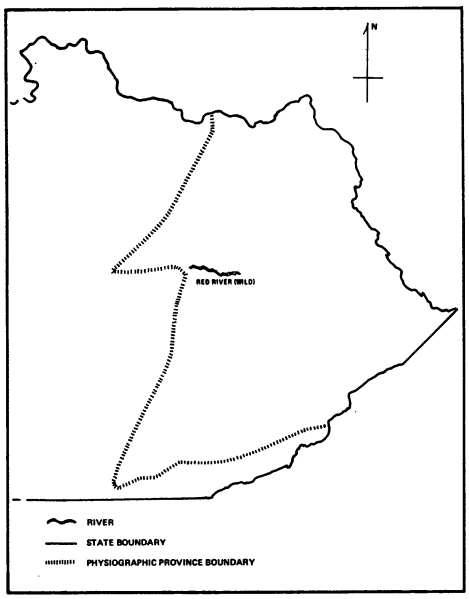

Figure 7.--*Rivers recommended for further study--eastern Kentucky.*

Filter Five--Water Flow

This filter included one of the six criteria for National Wild and Scenic Rivers: that a stream have sufficient volume of water during normal years to provide water-based recreation during a significant portion of the prime recreation

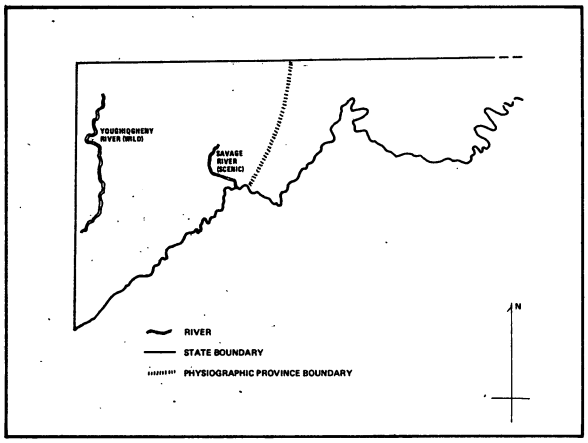

Figure 8.--*Rivers recommended for further study--western Maryland.*

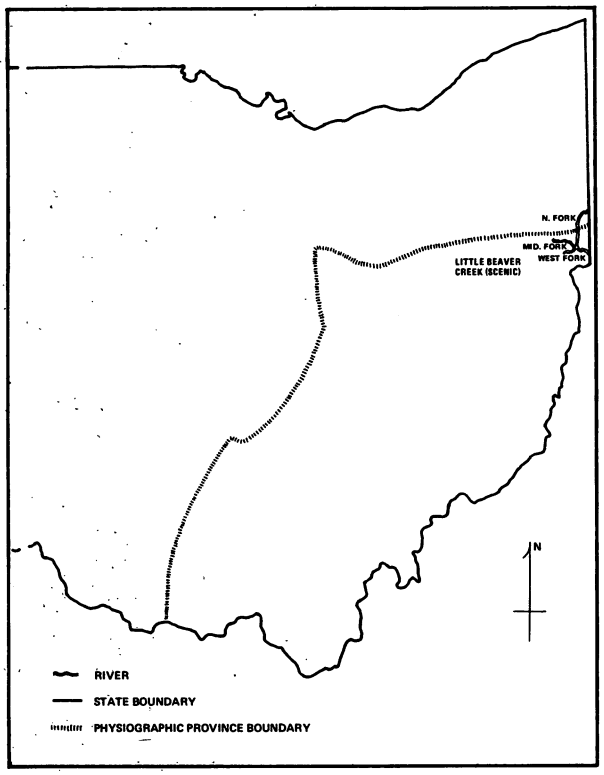

Figure 9.--*Rivers recommended for further study--Ohio.*

season. This dictates that stream hydrology be evaluated to determine use time. Data were collected from several sources and records on water resources were searched. Unfortunately, the data available were too scarce to adequately compare the streams surviving the other filters. As a result, the objective for this task was changed and instead of use as a filter, this data was used mainly for illustrative and informational purposes.

This may indeed be enough to determine stream suitability for potential study since recreation periods can be shifted to coincide with optimum flows. A good example of this is the Deep South Coastal Plains rivers which are nearly dry during the summer months, but provide ample recreation potential during spring, fall, and winter. These (what might normally be called off-season periods) in fact offer enjoyable recreational times in terms of climate, insects, and reptile contact. In other words, the nonsummer months when northern streams are generally not useable could be considered the prime recreation period for Deep South streams. Until certain terms such as "sufficient flow", "significant portion", and "prime recreation season" are defined, any filter developed using flow will remain weak and questionable.

STUDY CONCLUSIONS

We were not asked by the Bureau of Outdoor Recreation to rank the streams left after all the filters were applied, but one river did stand out as dictating examination for National Wild and Scenic River status. That river is the Gauley in West Virginia and it deserves mentioning at this point for a number of reasons. First of all, the Gauley may never be considered for Wild and Scenic River status because of political reasons. The Youghiogheny River in Pennsylvania, the New River in West Virginia, and several other lesser known rivers in roughly the same area are all being examined currently for Wild and Scenic River status. As a result of this clustering of qualified rivers, the political process may balk at declaring so many rivers in one area as Wild and Scenic and leave the Gauley unstudied.

Another reason for mentioning the Gauley is that although it stood out clearly as being desirable for study for Wild and Scenic status, it is not pristine in terms of the concept of western rivers. A dam sits at the head of the Gauley and a railroad track runs down the valley floor.

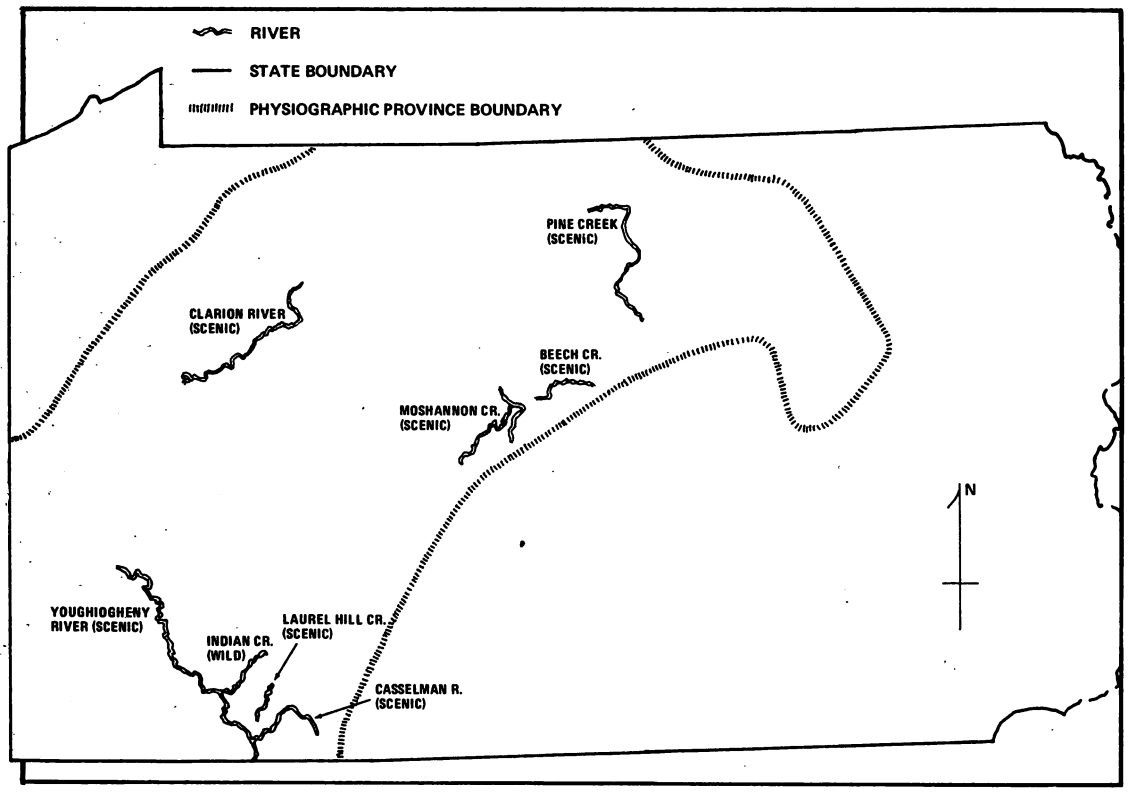

Figure 10.--*Rivers recommended for further study--Pennsylvania.*

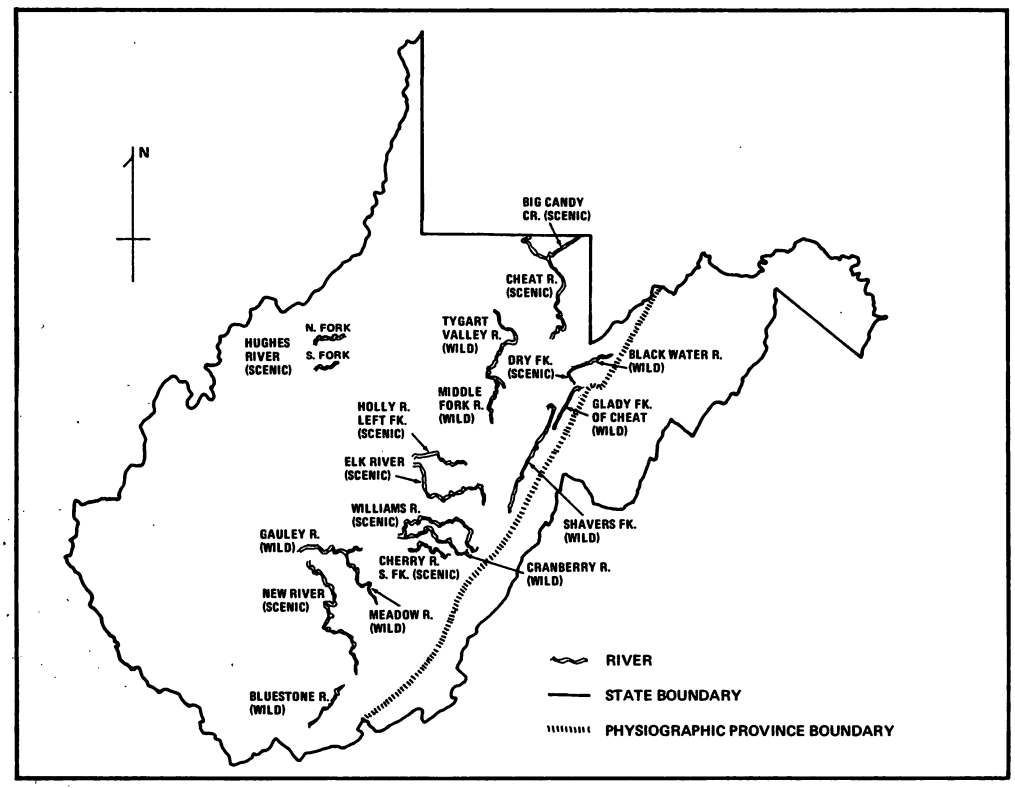

Figure 11.--*Rivers recommended for further study--West Virginia.*

However, the railroad is out of sight of the river traveler and is rarely used while the river gorge is magnificent with high walls and quality vegetation. Even the Summerville Dam can be used as an asset to actually enhance recreation use by creating large volume flows (comparable with western rivers) during periods of low flows in other streams. What this demonstrates is that first looks can be deceiving and an open, flexible evaluation system must be maintained. Rivers are like people, they have their own personalities and attributes that are not always easily discernible. This does not mean that justification of any and every river can occur, but rather that a cookbook approach to such a selection process must be tempered with common sense, evaluation of various potentials, and user perceptions.

One measure of importance that we did not formulate, but that should be considered in future procedures and refined analysis of rivers already studied, is esthetics, including auditory and olfactory stimuli. The sensations that the river corridor elicits and the quality of these sensations are all important in the final analysis. Such an undertaking would have to be conducted in the final analysis of the evaluation periods because it requires on-stream interpretation.

An esthetics survey can be facilitated by analyzing segment by segment the stimuli and moods evinced by the river setting. Subjectivity could be largely removed from this analysis by utilizing several observers all of different psychological bent and aggregating their results. That river providing the greatest variety of stimulating environmental settings and thus soliciting the widest variety of travelers' moods would have the greater esthetic appeal. Such an undertaking might again temper the original bias which exists for large, fast flowing rivers.

In summary, the results of the study (table 1) showed that the most important, hard (quantitative), criterion by which to evaluate rivers for Wild and Scenic status is degree of development or urbanization. Simple and inexpensive to use, the filter is easily adopted by any agency regardless of their in-house expertise. While it is subjective, it can, especially if universally adopted, provide a common basis for rapidly excluding most of the unqualified rivers. This is especially true when this filter is combined with overflights, public input, and on-river inspection to determine esthetic qualities. This process can be used to compare and rank qualified and near-qualified streams, those streams that were not chosen for advance study, or streams already in the Wild and Scenic System.

Table 1.--*Numbers of rivers, river segments, and miles of river examined and retained in filters 2-4, and final proposals by State*

State	Water Quality--Filter 2			Development--Filter 3			Field Examination--Filter 4			Final numbers proposed		
	Number of			Number of			Number of					
	Rivers	Segments	Miles	Rivers	Segments	Miles	Rivers	Segments	Miles	Rivers	Segments	Miles
Kentucky	24 (21)[1]	32 (29)	1479 (1269)	21 (5)	29 (6)	1269 (136)	5 (1)	6 (1)	136 (40)	1	1	40
Maryland	3 (2)	4 (3)	164 (49)	2 (1)	3 (1)	49 (26)	2 (2)	3 (2)	43 (31)	2	2	31
Ohio	33 (29)	44 (36)	1862 (1258)	29 (2)	36 (3)	1258 (39)	5 (3)	8 (4)	108 (40)	3	5	48
Pennsylvania	50 (23)	72 (40)	2470 (1124)	26 (12)	43 (14)	1187 (306)	12 (7)	14 (7)	306 (124)	9	9	243
West Virginia	40 (28)	76 (45)	2507 (1253)	31 (16)	54 (20)	1552 (481)	20 (18)	33 (22)	738 (507)	18	23	567
Total	150 (103)	228 (153)	8482 (4953)	109 (36)	165 (44)	5315 (988)	44 (31)	64 (36)	1331 (742)	33	40	929

[1]First number is number examined in each filter, the second in parentheses is number retained.

A MODEL FOR ESTABLISHING WATER QUALITY STANDARDS FOR RIVERS

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ABSTRACT.--An approach is presented for setting water quality standards for a river based on the following functional relation: R = f (Q, CQ, S, RC). Where R = recreation activities (in number of units), Q = water quality level, CQ = cost of achieving or maintaining a specific water quality level, S = recreational supply of the resource, and RC = recreational consumption. The basic assumption was that the recreational use of a river is the most demanding of a high water quality compared to the other uses of the river.

Water quality levels for rivers have characteristically been set by trial and error. Recent technological advances in the field of river water quality, however, now make it possible to explore the possibility of setting certain water quality standards. In this paper we provide an approach for public decision makers to use when choosing a water quality level for a river.

The approach is based on the following relation:

$$R = f(Q, CQ, S, RC)$$

where:

R = recreation activities (in number of units)
Q = water quality level
CQ = cost of achieving or maintaining a specific water quality level
S = recreation supply of the resource
RC = recreational consumption

This relation shows that the number of recreational visits depends upon the relation between the overall water quality, the cost of raising the quality of the water (or maintaining a specific quality), and the overall supply/consumption of that particular water resource. The basic assumption is that recreational use of the river is the most demanding of high quality water. The model is analytical but was based upon synthetic data and determined by analogy.

Model development involves three phases of study:

1. Determining water quality of the river.
2. Estimating recreation potential for the river.
3. Calculating alternative costs.

If the decision maker knows the costs of the various water quality levels and the commensurate recreation capacities, he can choose what water quality level and amount of recreation supply the river can provide with existing appropriations. Therefore, the model allows the manager to present his decision to those involved with general approval and/or funding in terms of dollars and cents, amount of use, increased water quality, and resource supply, and consumption in use of the resource.

PHASE I. DETERMINING PRESENT WATER QUALITY

To determine the existing water quality of a river, some definite variables must be established as indicators. Examples of indicators in three basic categories and their associated specific variables are listed below:

1. Physical variables:
   a. water temperature
   b. turbidity
2. Chemical variables:
   a. dissolved oxygen content
   b. ammonia content
   c. biochemical oxygen demand
   d. pH
3. Bacteriological variable:
   a. coliform indicators

Criteria for these and other variables are available from the Federal Water Pollution Control Administration and from State Water Pollution Control Boards.

To obtain the above water quality data, sampling stations will be needed. Generally, it is convenient to stratify the river into zones, with a sampling station just upstream of each zone.

After deciding what indicator variables are to be measured and where on the river they are to be measured, several water quality levels or strata should be determined. This step involves developing a series of water quality levels ranging from unacceptable to acceptable for each activity or use of the water. These ranges should be consistent with the kind of recreation activities involved. For instance, obviously higher quality water is necessary for swimming than for canoeing.

Generally it will be possible to construct these activity-dependent quality ranges by contacting experts in the field, by consulting available research data, and by making some theoretical evaluations. The ranges will vary by activity so it will be necessary to synthetize these quality levels by activity into one complete schedule of water quality ranges. From these water quality levels (table 1), it is possible to observe the changes or increases in water quality that must take place to allow the activities (table 2).

Table 1.--*Water quality parameters (example)*

Variable	Water quality level			
	L_1 (lowest)	L_2	L_3	L_4 (highest)
Turbidity	50	40	30	25
Biological oxygen demand	8	5	4	3
Coliform	800	200	160	120

Table 2.--*Matrix of recreation activities and critical water quality levels (example)*

Activity	Water quality level			
	L_1 (lowest)	L_2	L_3	L_4 (highest)
Swimming	0[1]	0	X[2]	X
Fishing	X	X	X	X
Boating	X	X	X	X
Waterskiing	0	X	X	X
Sightseeing	0	X	X	X

[1]0 Signifies that the specific activity may *not* take place at that level of water quality.

[2]X Signifies that the specific activity *may* take place at that level of water quality.

To construct table 1 pinpoint the lowest (L_1) and the highest (L_4) acceptable water quality levels by variable and by activity. Once these two loci on the water quality spectrum are identified, it becomes a matter of defining proportional levels between the two extremes.

PHASE II. DETERMINING RECREATIONAL POTENTIAL

The recreational potential of a river can be found by following these five steps:

Step 1. Assemble a list of all recreational activities (table 3) that are (1) compatible with the agency's objectives or mission, (2) compatible with the river resources, and (3) have an expected demand not being met elsewhere.

Step 2. Analyze the suitability of the river to accommodate the selected activities. This analysis should include the amount of each activity that can be allowed and the location at which the activities can occur. Generally, a resource inventory will be required.

Specifically, the analysis should provide the following quantitative data: (1) current capacity or production rate, (2) planning period capability, and (3) ultimate capability.

For most land uses, capacity standards will have to be developed to ensure that a quality experience is provided. For example, a given site could have a capacity for 10, 50, 100, or 1,000 picnickers, depending on the quality of experience desired. In fact, when more than one quality of experience can be provided, each should be considered a different land use. For example, family camping and back country camping are two different land uses.

Step 3. Conduct a market analysis for each use to determine need. Need is the deficit of demand after all supplies (suppliers) for a given land use have been exhausted in the land's market area for a given planning period. The market area encompassing the region (distance) surrounding the land from which people would normally take advantage of the use. For example, the market area for each land use of a park will generally be different because the distance people will travel to a given area varies with the recreational acitvities they pursue.

Step 4. Calculate the maximized output (potential) for the planning period. Maximized output is the smaller of "need" or suitability. For example, if 100 people want to fish and the river's capacity for fishermen is 60, the maximized output would be 60 fishermen. However, if 50 people wanted to fish the same river, the maximized output would be 50 fishermen.

PHASE III. DETERMINING COSTS

The final phase is to calculate the estimated costs for treating the river to maintain the alternative water quality levels and provide the various recreational opportunities. The costs should include both operating and amortized capital expenditures. When Waller[1] applied the model to the Big Muddy River in Illinois, the costs were calculated on a per day basis by zones. Examples of water treatment costs are presented in tables 4 and 5 and recreation costs in table 6.

[1] *Waller, Louis R. 1973. Water Quality Standards as Determined for the Big Muddy River in Southern Illinois Through the Process of Model Development. Ph.D. Dissertation, Southern Illinois University, 200 p., illus.*

Table 3.--*Recreation potential in Zone 1 of a hypothetical river*
(In number of visits)

Activity	Current production level	Potential production level (suitability)	Market area			Maximized output (potential)
			Demand	Supply	Need	
Sightseeing	3,010	40,000	46,746	31,454	15,292	15,292
Boating	10,000	16,316	48,500	27,500	21,000	16,316
Fishing	45,300	121,400	172,145	100,000	72,145	72,145
Swimming	10,000	2,935,082	4,200,000	40,000	4,160,000	2,935,082

Table 4.--*Increment water quality supply costs (example)*
(In dollars per day)

Alternative	Water quality level			
	Level 1	Level 2	Level 3	Level 4
	$ 82	$ 118	$ 523	$ 979
Zones 1, 2:				
Zone 1 - Level 0	255	1,211	2,206	3,012
Zone 1 - Level 1	210	301	870	2,140
Zone 1 - Level 2	210	301	870	2,007
Zone 1 - Level 3	210	301	870	2,007
Zone 1 - Level 4	210	301	870	2,007
Zone 1 - Level 0				
Zone 2 - Level 0	941	4,658	8,539	11,681
Zone 2 - Level 1	941	1,109	3,549	8,539
Zone 2 - Level 2	941	1,109	3,549	8,539
Zone 2 - Level 3	941	1,109	3,327	8,539
Zone 2 - Level 4	941	1,109	3,327	8,539
Zone 1 - Level 1				
Zone 2 - Level 0	941	3,327	7,246	11,238
Zone 2 - Level 1	941	1,109	3,771	8,798
Zone 2 - Level 2	941	1,109	3,549	8,539
Zone 2 - Level 3	941	1,109	3,327	8,539
Zone 2 - Level 4	941	1,109	3,327	8,539
Zone 1 - Level 2				
Zone 2 - Level 0	941	3,327	7,246	11,238
Zone 2 - Level 1	941	1,109	3,771	8,798
Zone 2 - Level 2	941	1,109	3,549	8,539
Zone 2 - Level 3	941	1,109	3,327	8,539
Zone 2 - Level 4	941	1,109	3,327	8,539
Zone 1 - Level 3				
Zone 2 - Level 0	941	3,327	7,246	11,238
Zone 2 - Level 1	941	1,109	3,771	8,798
Zone 2 - Level 2	941	1,109	3,549	8,539
Zone 2 - Level 3	941	1,109	3,327	8,539
Zone 2 - Level 4	941	1,109	3,327	8,539
Zone 1 - Level 4				
Zone 2 - Level 0	941	3,327	7,246	11,238
Zone 2 - Level 1	941	1,109	3,771	8,798
Zone 2 - Level 2	941	1,109	3,549	8,539
Zone 2 - Level 3	941	1,109	3,327	8,539
Zone 2 - Level 4	941	1,109	3,327	8,539

In estimating water treatment costs for the Big Muddy River in Illinois, the various treatments did not affect all the quality variables (turbidity, biological oxygen demand, coliform, etc.) equally. In addition, changes in the water quality variables were calculated relative to the length of flow downstream, the historical variable levels at the sampling locations and the preceding zones water quality level. The water quality needed to safely allow a particular recreational activity to take place in Zone Three and the cost of achieving that level were dependent upon the level of treatment in either Zone One or Zone Two or both. For example, if the historical values for turbidity were 100, 92, and 112 for the three zones, respectively, what would the turbidity value in Zones Two and Three be if Zone One turbidity were reduced from 100 to 50?

Table 5.--*Total water quality supply costs (example)*
(In dollars per day)

Alternatives	Water quality level				
	Level 0	Level 1	Level 2	Level 3	Level 4
	$ 0	$ 82	$ 118	$ 523	$ 979
Zones 1, 2:					
Zone 1 - Level 0	0	255	1,211	2,206	3,012
Zone 1 - Level 1	82	291	383	952	2,222
Zone 1 - Level 2	118	328	420	988	2,126
Zone 1 - Level 3	523	732	824	1,392	2,530
Zone 1 - Level 4	979	1,188	1,280	1,849	2,986
Zone 1 - Level 0					
Zone 2 - Level 0	0	941	4,658	8,539	11,681
Zone 2 - Level 1	255	1,197	1,364	3,804	8,795
Zone 2 - Level 2	1,211	2,153	2,320	4,760	9,750
Zone 2 - Level 3	2,206	3,148	3,316	5,534	10,746
Zone 2 - Level 4	3,012	3,954	4,121	6,339	11,551
Zone 1 - Level 1					
Zone 2 - Level 0	82	1,024	3,409	7,328	11,320
Zone 2 - Level 1	292	1,233	1,401	4,062	9,090
Zone 2 - Level 2	383	1,325	1,492	3,932	8,923
Zone 2 - Level 3	952	1,893	2,061	4,279	9,491
Zone 2 - Level 4	2,222	3,164	3,331	5,549	10,761
Zone 1 - Level 2					
Zone 2 - Level 0	118	1,060	3,446	7,364	11,356
Zone 2 - Level 1	328	1,269	1,437	4,099	9,126
Zone 2 - Level 2	420	1,361	1,529	3,969	8,959
Zone 2 - Level 3	988	1,930	2,098	4,315	9,528
Zone 2 - Level 4	2,126	3,067	3,235	5,453	10,665
Zone 1 - Level 3					
Zone 2 - Level 0	528	1,464	3,850	7,768	11,760
Zone 2 - Level 1	732	1,674	1,841	4,503	9,530
Zone 2 - Level 2	824	1,765	1,933	4,373	9,363
Zone 2 - Level 3	1,392	2,334	2,502	4,720	9,932
Zone 2 - Level 4	2,530	3,471	3,639	5,857	11,069
Zone 1 - Level 4					
Zone 2 - Level 0	979	1,921	4,307	8,225	12,218
Zone 2 - Level 1	1,189	2,131	2,299	4,960	9,988
Zone 2 - Level 2	1,281	2,222	2,390	4,830	9,820
Zone 2 - Level 3	1,850	2,791	2,959	5,176	10,389
Zone 2 - Level 4	2,987	3,929	3,639	6,314	11,527

Table 6.--*Recreation supply costs by water quality level and activity (example)*
(In dollars per day)

Activity	Water quality level L_1	L_2	L_3	L_4
Zone 1				
Boating				
Launch	$ 1.10	$ 1.10	$ 1.10	$ 1.10
Parking Lot	.06	.06	.06	.06
Sightseeing		.09	.09	.09
Swimming				
Beach			44.76	44.76
Parking Lot			31.03	31.03
Roads	1.62	1.62	1.62	1.62
Total	2.78	2.87	78.66	78.66
Zone 2				
Boating				
Launch	$ 3.90	$ 3.90	$ 3.90	$ 3.90
Parking Lot	.46	.46	.46	.46
Sightseeing		.30	.30	.30
Swimming				
Beach			45.00	45.00
Parking Lot			41.34	41.34
Roads	8.56	8.56	8.56	8.56
Total	12.92	13.22	99.56	99.56
Zone 3				
Boating				
Launch	$ 3.30	$ 3.30	$ 3.30	$ 3.30
Parking Lot	.19	.19	.19	.19
Sightseeing		.27	.27	.27
Swimming				
Beach			37.30	37.30
Parking Lot			31.97	31.97
Roads	4.02	4.02	4.02	4.02
Total	7.51	7.78	77.05	77.05

APPLICATION OF THE MODEL

Tables 1 through 7 provide a model that can be used as a basis for making resource management decisions such as:

1. the type and amount of recreation activities that can be allowed, as circumscribed by the considerations of the model, on a river
2. the water quality required for the various recreation activities
3. the cost of obtaining the various water quality levels and providing the necessary support facilities for the recreation activities

The usefulness of the model will be discussed via two hypothetical situations.

Situation One. Assume that recreational activity would take place only in Zone One and assume that three activities--fishing, boating, and sightseeing--will be provided. To meet the total needs for these facilities it will be necessary to raise the water quality of the river to the L_2 level (table 2) which would cost a total of $121 per day (table 4 $118 and table 6 $3) and would provide the necessary facilities for 103,753 recreation visits throughout the season (table 7).

Table 7.--*Recreation need by activity and zone (example)*
(In number of visits)

Activity	Zone 1	Zone 2	Zone 3
Sightseeing	15,292	50,994	44,980
Boating	16,316	41,307	36,461
Fishing	72,145	187,489	109,547
Swimming	2,935,082	2,951,749	2,445,902

Situation Two. A resource managing agency responsible for the entire river would like to evaluate the alternative costs (per day) for developing the recreational potential of the river. Assuming boating, fishing, and sightseeing will be provided in all three zones, the following data on swimming can be obtained from the model:

Alternatives	*Water Quality Costs (table 5)*	*Recreation Costs (table 4)*	*Total Cost*
No Swimming	$1,529	$ 24	$1,553
Swimming, Zone 1	1,933	100	2,033
Swimming, Zone 2	2,098	110	2,208
Swimming, Zone 3	3,969	93	4,062
Swimming, Zones 1 & 2	2,502	186	2,688
Swimming, Zones 1 & 3	4,373	169	4,542
Swimming, Zones 2 & 3	4,315	179	4,494
Swimming, All Zones	4,720	255	4,975

If the resource agency is limited to a $3,000 per day expenditure, the most favorable alternative would be to meet the total recreation needs except for swimming in Zone 3.

The decision maker could continue to make use of the model on related alternative problems associated with the initial question. For example, for an additional $481 per day or $602 ($523 + $79) per day it would be possible to provide higher quality water and meet the swimming needs (2,935,082 more visits). On the other hand, the decision maker may take the point of view that for $36 less per day, it would be possible to provide facilities and have high enough water quality, (L_1), to allow just boating and fishing.

SYMPOSIUM REPORTS

WORKSHOP #1

STRATEGIES FOR COUNTING RIVER RECREATION USERS

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About 40 persons participated in the workshop. Leo Marnell's talk, "Methods for Counting River Recreation Users" (published in this proceedings) focused on two major approaches for counting river recreation users: (1) total accounting of all users, and (2) estimation of users. Generally, total accounting, because of the cost involved, is used if there is limited access to a river or if management controls such as mandatory user registration or permit systems have been introduced. The more common method used to measure river recreation use is estimation. This approach requires statistically sound sampling strategies.

Following Marnell's talk, participants discussed current river use monitoring approaches and the direction they believed strategies for counting river users should take.

Reporting systems, surveys, and remote-sensing were discussed as techniques to acquire river recreational use data. Reporting systems include permit systems and user registration. Ground and aerial observation, interviews, and survey questionnaires were mentioned as survey techniques. Time-lapse photography and electric-eye counters were discussed in some detail as remote-sensing methods.

TIME-LAPSE PHOTOGRAPHY

The main topic was the use of time-lapse photography as a means of counting users. One concern was that cameras could be misconstrued by the public as an invasion of privacy. Photography may be legal for counting users but may not be the most politically expedient method. Agencies have attempted to protect the user's rights by rigidly controlling data gathering efforts with cameras. For example, Marnell noted that when studying use along the Ozark National Scenic Waterway, movie cameras were kept slightly out of focus making it virtually impossible to identify any individual. Also, once the film had been developed and counts made, the film was destroyed.

Technology could be developed to computerize cameras so that photographs would be developed within the camera (similar to the Polaroid process) and then transformed by the computer into graphic images plotted and mapped on another medium such as paper, film, or microfiche. In this way, all information except the identity of individual users would be retained.

Participants agreed that the camera is an excellent tool for monitoring river use but improvements could be made in techniques. Rather than simply mounting cameras in stationary positions to record use at particular points along a river, perhaps cameras could be mounted to scan up and down the river and monitor use along an entire river corridor. For instance, if several cameras are used along the same river, it might be possible to synchronize scans and overlap fields of coverage to obtain a complete history of use along the river.

In many situations current technology would suffice because most pictures contain much more information than has been used in past management and research efforts. In Marnell's study, only the number and type of watercraft on the river were analyzed. Those interested in space and time patterns of use within a river corridor could obtain data of this type from photographs. The degree of interaction between different types of groups could also be studied from pictures. Also, data on fluctuating water levels and impacts of use on the amount of change in streambank vegetation and the kinds and numbers of wildlife along the shoreline could be examined.

ELECTRIC-EYE COUNTERS

The practicality of using electric-eye counters to monitor river use was briefly mentioned. Three problems in using the electric-eye counter were noted: (1) the electric-eye will count two or more boats, side-by-side, as only one, (2) water level changes may put the boats above or below the counter's "line-of-vision", and (3) the electric-eye has a limited range.

The first problem could be overcome by using the electric-eye counter with other procedures such as observation or photography.

It is possible to modify a photoelectric-cell system so that changing water levels do not affect its operation. When water levels rise, the eye may become submerged and thus inoperable. The water level problem could be solved by attaching the counter to a vertical floating track that would automatically raise or lower the eye as the water level changed.

Solving the range problem would require designing a farther reaching electric eye.

OTHER USE-MEASURING METHODS

Unfortunately, there was almost nothing said about other techniques to count users even though such methods as human observation, permits and registration systems, and aerial counting systems were mentioned by Marnell in his presentation. Managers should be aware of the advantages and disadvantages of each of these methods before attempting to collect use data. Also, managers should not overlook the possibility of using two or more use-monitoring approaches in conjunction to meet their specific needs. For example, a manager could count the users on a river with electric-eye counters, permits, or a mandatory registration system, and monitor activities at specific river locations by means of time-lapse photography or human observation techniques.

COLLECTING DATA FOR MANAGEMENT NEEDS

A few participants remarked that oftentimes use data collected for national or regional planning purposes are of little value to managers at the local level. If local manager's needs are known before collection of higher level management data begins, then their goals along with those of a comprehensive data gathering plan can be designed to incorporate all levels of management objectives.

STANDARDIZING USE MEASUREMENT UNITS

One participant mentioned that it was difficult if not impossible to compare use data collected by two agencies because of the different units of measure used. For example, there are at least five ways to describe the length of time a user is in a recreational area. The problem exists chiefly at the national or regional level, rarely, if ever, at the local level because managers seldom need to interpret data another agency has gathered. To resolve this problem an effort to establish standard use units among agencies needs to be made at the national level with input from all agencies responsible for monitoring recreation use.

WORKSHOP #2

CLASSIFYING RIVER RESOURCES AS TO THEIR RECREATION POTENTIAL

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The workshop, "Classifying rivers as to their recreation potential", had two objectives: (1) to create a more thorough understanding of techniques available to assess river quality, and (2) to explore ways in which given methods might be amended to make them more applicable or how they might be changed to reduce cost where less intensive data will suffice.

PRESENTATIONS

The workshop was attended by approximately 150 individuals. Two papers were presented. The introductory paper, "River recreation potential assessment: a progress report", was presented by Michael Chubb and Eric Bauman[1] and appears in this Proceedings under Chubb's authorship. A second paper was presented by invited panelist Louis Hamill, "Development of understandable methods for describing and evaluating the recreational and scenic potential of rivers", and does not appear in this Proceedings.

Chubb and Bauman summarized their paper, focusing most of their attention on the method they developed to assess river recreation potential. The method, called RIVERS (River Inventory and Variable Evaluation for Recreation Suitability), involves assessing 67 physical, biological, land use, esthetic, and accessibility variables for each mile of river and evaluating the potential for 16 recreational activities. They proposed that future work should:

1. Focus on reciprocation and systemization of the technique so it can be applied more easily and more quickly.

2. Include test applications on more types of rivers, ranging from urban to wilderness.

3. Include test applications where agency personnel undertake the inventory, analysis, and application.

4. Include testing to evaluate continued application in many types of administrations.

5. Include experiments with light aircraft photography.

6. Evaluate various aspects of computer mapping.

7. Determine the relation between the variables used in the inventory and the public's perception of these variables.

8. Evaluate the field cost of application.

9. Evaluate the suitability for incorporating results in management plans and environmental impact statements.

10. Bring together and compile information about the method into a manual to be used in training and in applying the technique in the field.

Hamill discussed background information, major concepts, and procedures applicable to river recreation classification. Over the past 18 months Hamill has analyzed river recreation classification methods developed in the United States, Canada, England, Scotland, and other parts of western Europe. He concluded the state-of-the-knowledge has advanced to the point that it is now possible to develop a set of standardized classification methods. He proposed that the research community analyze available methods to identify those that work and those that do not. It would then be possible to synthesize them into one or more "standard" method.

[1] *A major portion of the investigation on which the presentation is based were carried out by Bauman while he was a Graduate Research Assistant at Michigan State University.*

Hamill went on to discuss the importance of public participation in the classification process and the need for methods that meet the technical requirements of planners and managers but that are also comprehensible by the public. He noted that, "there has been a conflict between those who favor simple and workable methods and those who seek perceptual and technical sophistication in concept and procedures".

From his research Hamill concluded that the most important information needed to evaluate the recreation potential of rivers may be supplied by methods that:

1. Evaluate the potential for recreational use of rivers by paddle and rowing crafts.

2. Identify and evaluate the recreation potential of rivers for power boats and sailboats.

3. Evaluate the recreation potential for swimming and beach activities.

4. Evaluate developed recreation sites and facilities in river corridors.

5. Evaluate potential sites for recreation facilities and accommodation facilities.

6. Evaluate recreational potential of adjacent land areas for dispersed types of recreation.

7. Describe and evaluate scenery.

He felt it is possible to put together procedures that will adequately meet the needs of each of the seven methods. Procedures already developed that could provide needed information include the classification of rivers based on the International Classification of River Levels, classification of overall difficulty based on the International Scale of River Difficulty, and the classification of skill levels as developed by the Appalachian Mountain Club.

DISCUSSION

Participants voiced concern about the cost of using a technique, such as the RIVERS Method, especially the high cost of surveying each 1-mile segment of a river. Chubb noted, by analogy, that other resource inventories and classifications are routinely conducted and they too are often expensive. He concluded that the importance of rivers as recreation resources will be recognized and funds allocated for more inventory and classification surveys in the future.

Participants questioned whether a method developed in one area of the country would be applicable in other areas. Discussion pointed out that classification schemes should have capabilities over a wide area and should be flexible enough so that, with some modification, they could be used on a large scale throughout the continent. The RIVERS Method needs further testing in areas outside of the Midwest to determine its suitability for other regions.

Public participation in the formal designation of rivers (Through Federal and State programs, for example) was discussed, especially in terms of the level of public participation during the designation process. No real conclusions were reached, but, Hamill noted that the public should be provided with detailed information at all levels of the designation process if public participation is to be useful.

Some participants felt that classification schemes should utilize data collected for other purposes, such as wildlife habitat management. Hamill, Bauman, and Chubb agreed that any method should be able to accommodate such information, but, cautioned that such data are often collected with rather broad objectives and hence may not be reliable.

SOME THOUGHTS ON RIVER CLASSIFICATION

Much attention has been given to developing classification schemes purporting to identify those attributes of rivers that are significant in assessing their recreation "value". An intensive search of the literature on river classification, evaluation, and assessment revealed at least 50 studies that focused on these topics. Chubb and Hamill, in this Proceedings, reviewed a number of these techniques. Other papers in the Proceedings including Doehne, Branch and Fay, Borden, Kuska, Pfister, Walker, and McCurdy testify to

the importance of such procedures for planners and managers.

Most of the classification schemes utilize physical, cultural, or esthetic features of a river or a river corridor. Nearly all divide rivers into small segments rather than attempting to classify entire waterways or drainages. Unfortunately, most schemes do not incorporate the river's location relative to population centers or alternative recreation resources. Also, they tend to overlook the legal attributes of rivers in terms of recreation development potential.

Most classification schemes focus on remote river resources. The more general purpose rivers--those more to the center of the river recreation opportunity spectrum--have received much less attention. And, schemes to evaluate and classify urban rivers have received little or no attention. Assessment of urban river recreation potential could help alleviate pressures on other rivers serving a more specific recreation purpose.

Some evaluation and classification schemes have utilized peoples' preference for water-based landscapes. Most of these techniques relied on peoples' reaction to slides or photographs of various scenes. Results obtained in this manner should be used with caution. For example, consideration should be given to the social/cultural backgrounds of the respondents. Dearinger *et al.* (1973) noted that people generally agree on what is very beautiful and very ugly but not on the in between, and that occupation and lifestyle have an effect on individual concepts of natural beauty.

RESEARCH AND RELATED NEEDS

We hope this workshop established a point from which new and more dynamic research may proceed. Several topical areas that I believe need research consideration are listed below. The items mentioned are not all inclusive nor are they ranked in order of priority, but I feel research is needed to:

- Incorporate the concept of social and biological carrying capacity more fully into evaluation and classification schemes.

- More fully determine the attributes of rivers that are important to people in their pursuit of river recreation (see Cherem and Traweek and deBettencourt and Peterson in this Proceedings).

- Incorporate data from studies of user perception into evaluation and classification schemes.

- Develop computer techniques that will store, retrieve, and graphically display classification and evaluation data.

- Develop simulation models that describe the effects of alterations of river resources, such as timber harvesting, stream channelization, mining, etc. These models should be capable of providing reasonably accurate predictions of how environmental changes affect the recreation potential of river resources.

- Objectively analyze the state-of-the-knowledge--about river recreation classification. (Hamill is currently working on this).

- Develop techniques suitable for classifying urban rivers.

- Develop techniques that allow for more accurate assessments of public participation in formal river recreation designation efforts. For example, techniques are needed to determine if the views of vocal citizen groups are representative of the more general public and what value should be placed on public input.

Throughout the Symposium a reoccurring theme was that there is an "explosion" occurring in river recreation use. This explosion has placed enormous pressures on management agencies and has presented a tremendous challenge to researchers and other concerned persons. Roderick Nash, in his opening remarks admonished Symposium participants that river recreation management in the future will be challenged with the task of keeping the options open for Americans and matching a particular environment to its optimum use. This *is* a formidable undertaking. But if there are to be high quality and diversified river recreation opportunities in the future, it will be because of what we are doing today.

WORKSHOP #3

STRATEGIES FOR STUDYING RIVER RECREATION USERS

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There were too many people present (100) to allow the meeting to function as a true workshop. Rather, what was held was a subsession of the conference in which the focus was on a single formal paper with more opportunity for questions and discussion from the floor than in a general session.

EXPECTATIONS FROM THE AUDIENCE

The workshop participants expressed concerns in the following areas:

1. Correlation between the human psychological response to the physical environment and actual conditions of the physical and visible environment.

2. Methods for defining and differentiating among different types of river users.

3. Measurement of users' needs, including identification of the most successful strategies for measuring needs.

4. Methods for assessing or predicting user-related problems before they occur, so that users can be managed and problems prevented.

5. Methods for identifying and describing conflicts among different types of uses.

6. Strategies for measuring use in different environmental settings and under different intensities of use.

7. Strategies for integrating the methods and findings of different sciences and different scientists.

8. Methods for measuring and predicting trends or shifts in user needs.

9. Nonreactive methods.

DISCUSSION OF ROGER CLARK'S PAPER

The Clark paper serves as an excellent framework for discussing different approaches for obtaining information about recreationists. It is well conceived, thoughtfully organized, and clearly written. It should be studied carefully by anyone in or about to enter the business of collecting data for management or study of recreationists. The framework could well be recommended as a guide for the wise and a law for the weak. To those who are experienced, mature, and wise in this kind of research, the Clark framework is a welcome organizer of concepts and the associated commentary is a useful review. There is danger, however, of oversimplification and unnesessary limitation, if the creative and responsible researcher feels compelled to work strictly within the limits of any framework. On the other hand, the inexperienced or untrained would do well to pay strict attention to the paper. There is simply too much sloppy, inefficient, and misleading information drifting about.

The central issue is, of course, that information gathering methods should be designed to meet the needs of the researcher or manager in need of the information. The information should be valid and reliable. The methods should be cost-effective and should address efficiently the questions being asked. It should be recognized that a given problem may have unique requirements that call for creative techniques. In some cases, special restrictions may force the researcher to use methods that otherwise might be inferior. The important questions are: (1) is this the *best* method that can be used under the circumstances, and (2) are the products useful and worth their cost? Sometimes it may be advisable to use several methods that can be cross-checked for validity and reliability.

One type of methodology that may not fit well in the Clark framework is the simulated choice experiment. This is an experiment in which the recreationists' choices are observed in a simulated situation, e.g., among photographs, verbally described alternatives, etc. It is tempting to sweep such techniques into the general box of self-reports. In fact, such methods are a special type of direct observation. Reliable measurements can be made by such methods, and, under certain conditions, the results can be shown to be valid. However, to design such a method is a highly technical undertaking.

Another kind of technique not easily fit into the framework is illustrated by the so called "ink-blot" test and the "Environmental Response Inventory". In these tests, the subject responds to carefully selected stimuli that have been selected through extensive research for their ability to differentiate among people who tend to behave in different ways. Indeed, we have much to learn from other disciplines, e.g., psychology and marketing, where researchers have been working for many years to develop specialized methods for describing and predicting various aspects of human behavior.

The presentation and ensuing discussion from the floor emphasized the following issues:

(1) nonreactive measures; (2) longitudinal techniques; (3) coordination of different methods; (4) weaknesses in self-report methods; (5) the importance of efficient sample design; (6) the potential usefulness of secondary data sources, such as information in license and permit files, sales records, etc.; (7) problems of invasion of privacy; (8) use of deceptive research methods; (9) the political and public relations effects of different research methods; (10) the need for cross-validation by means of several methodologies; (11) the need for researchers to get their act together so as to present a more coherent and legible interface to the managers who want to apply their work; (12) the need to recognize that study planning should be a continuing process of improvement; (13) the too prevalent tendency to "cop-out" and use "traditional" methods such as self-report surveys without examining critically whether the best or even good methods are being used; (14) the need for familiarity with the limits and capabilities of a variety of strategies so that alternatives can be considered intelligently; (15) the need to be sensitive to the important management needs; and (16) the need to understand the limitations of the data produced by a given method or a specific study so as to avoid over interpretation.

MISCELLANEOUS REFLECTIONS

To describe and explain human behavior is not easy. Too often the phenomena are so complex that order cannot be found on which to build a theory, or the variables are not accessible and apparently cannot be defined in ways that allow them to be observed and measured, or the needed experiments and observations cannot be made because they would violate ethical principles. Thus, when we criticize recreation research, we should distinguish between inadequacy caused by the nature of the problem and inadequacy caused by careless or incorrect methods. Because of the demanding nature of the task, we can excuse conflicting conclusions or missing facts when these are not the fault of undisciplined work. But undisciplined work is not excusable no matter how difficult the task. Indeed, to climb Mt. Everest requires much more skill, specialized equipment, stamina, and determination than to climb Pike's Peak. One cannot excuse the failure of a poorly planned assault on Everest on the grounds that the objective is difficult to achieve. The added difficulty of the task is reason to demand the highest qualifications of those who try. But even with the best possible planning, the probability of failure on Everest is much higher than on Pike's Peak, and Pike's Peak was climbed long before Everest was.

Observation of human behavior and measurement of things such as perceptions, motives, etc., are highly technical undertakings. If you want valid and reliable results, you don't just throw together a questionnaire and go do a survey. Clark has emphasized this in his paper and has given us a primer on research methodology. But even with this primer in hand many specialized skills are needed before the job can be done right. Would-be researchers would do well to recognize this and get special help when entering areas beyond the limits of their competence.

It also needs to be recognized that

there has not been a lot of money focussed on recreation research. Support has been meager and disjointed. Too often we have had to make do with inadequate resources, and recreation research has had to accept amateur status. Here we must differentiate between (1) good work that is of limited value because of financial malnutrition, and (2) poorly conceived and executed research.

Another source of confusion about the quality of recreation research is the problem of the conflicting objectives of applied and basic research. To the resource manager faced with everyday decisions, highly specialized, theoretical research is not of much value until it is translated into applicable facts, principles, or procedures. On the other hand, applied research is often disdained by theoretical purists. Clearly, it would be a mistake to require all research to be theoretically pure. Somebody who understands both the practical problems and the esoteric theory has to do applied work. It would also be foolish to require all research to be strictly directed to some specific practical problem of resource management. A diverse spectrum of applied and theoretical work is needed, but such a spectrum of diversity is likely to foster, as it has, some confusion and controversy, because individual scientists generally cannot see the whole picture.

A problem that may always be with us is that individual researchers have traditions, prejudices, and attachments that tend to bias each toward a peculiar modus operandi. Such a researcher who attacks only those problems to which his "trick" is applicable is more defendable than one who applies his trick to whatever problem comes along without questioning the appropriateness of his approach.

This kind of problem is compounded by the immaturity of the field. There are good sociologists who apply sociological methods and traditions to the social facets of recreation. There are good psychologists who apply psychological methods and traditions to the behavioral aspects of recreation. But there seems to be no established discipline of recreation research with an associated baggage of time-tested methods and accumulated traditions. On the one hand this is good, because it enhances the probability that problems will be attacked creatively with fresh perspective. On the other hand, the risks and hazards are greater. The traditions of a scientific discipline are an accumulation of successful strategies, culled and evolved through a process of trial-and-error, state-of-the art review, and rigorous criticism. There is and has been a lot of disjointed trial-and-error going on in recreation research. Whether we will ever get ourselves together some day remains to be seen, but in the meantime we do need more contributions (like the Clark paper) that propose frameworks, and identify and scrutinize alternative research strategies. This kind of work helps guide researchers toward good methodology, and it encourages badly needed standardizations, which, in turn, enhances comparability among studies.

The Symposium in general was a valuable exposure to a rich diversity of viewpoints on river recreation management and research. A lot of ideas were exchanged, and, it is hoped, many minds were broadened. But the experience was not without its frustrations. There was a little too much "holier than thou" preaching about the virtues of wilderness, with resulting polarization, and not enough rational deliberation about the value of preserving variety of choice, about the fact that wilderness resources are scarce and will disappear from the spectrum of choice without appropriate intervention, or about the fact that there are many substitutes for the uses that compete with wilderness recreation and few if any substitutes for the wilderness uses.

There was a little too much detail about legal technicalities and not enough perspective about the role of law and legislation in river management.

There was a little too much advocation of special interest points of view and not enough recognition of the need to separate technical matters from political or ideological issues. We have a system founded in the constitution that provides for a nonviolent alternative to war for resolving conflicts that are arguable on ideological grounds or that involve competition among individuals for limited resources. That alternative is the political-legislative-judicial process, and that process comes to its own conclusions. I perceived that there was a tendency on the part of some participants to argue for technical solutions to political problems, which would preempt rights belonging to the people.

There was a little too much hasty presumption that the answer to each problem is some sort of management by the government. Government intervention may prove to be the best answer in each case, but there seemed to be too little readiness to ask whether there might be some self-regulating market processes that might solve the problems, or whether the issue is properly a matter of private conflict that is more appropriately resolved through litigation and judicial review, or whether there were deficiencies in the legal framework that need to be corrected legislatively.

There was a little too much discussion of rivers as if they were owned by government bureaucracies rather than being owned by the people by whose consent our government exists and from whom the bureaucratic rights and powers are derived.

There was too much myopia, as if it were a symptom of ignorance of (or unwillingness to consider) the many facets of each problem.

There was a little too much preoccupation with remote and wild recreation opportunities and not enough concern for the masses of people who are captives of the urban way of life with little opportunity for access to the idyllic river resources.

There seemed to be too little concern for the implications of an uncertain future that teeters precariously on the whims of unpredictable and uncontrollable climatic trends, disappearing energy resources, and economic malaise.

There was too much preoccupation with the mystique of being alone in the wilderness and not enough attention to the reasons why people are concerned about encountering others on a river and the situations in which the concern becomes significant.

I guess what I am trying to say is not that it was a bad symposium. It was an excellent symposium, one of the best conferences I have attended. But it was like a bag of jigsaw puzzle pieces, all mixed up from many puzzles, with some pieces missing, and no pictures to follow in trying to sort out the pieces and put them together. Somebody should have written, and should still write, an integrating paper that provides a framework of planning theory and social policy issues that would help us to organize a well balanced attack on each question.

WORKSHOP #4

RATIONING RIVER RECREATION USE

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The rationing of access to recreational resources is a recent phenomenon, a result of steadily increasing use pressures, coupled with dwindling supplies. Rationing is generally seen as a means of controlling resource impacts and loss in recreational quality. But rationing what traditionally has been a "free" resource--even a right to some--has been controversial and difficult. Questions of how, when, and where to ration resources plague managers, and their best answers have been often criticized as arbitrary and capricious. In some cases, the courts have been approached for redress to real or imagined shortcomings.

The paper of Sam Warren outlines the rationing system that managers on the Middle Fork of the Salmon River in Idaho have adopted. In brief, the system uses a lottery for distributing "places" and these are distributed among commercial outfitters and private river runners. Applications are accepted from users with three choices of dates permitted. A lottery is held in February and successful candidates are notified by mail. A maximum of seven launches per day is allowed. Parties who arrive at the river without a permit (either because they are unaware they need one or because they simply hope to "beat" the system) can obtain permission to launch their craft provided the limit of seven launches per day has not been exceeded. Warren notes that while 150 private permit applications had to be turned down in 1976, commercial allocation quotas were not filled. Thus, the issuance of permits to "drop-ins" can prevent underutilization of the river resource. However, the system has been criticized by commercial and private river runners alike, a fact evidenced by Warren's estimate of the threat of one lawsuit per month directed at the rationing program.

The rationing program on the Middle Fork is founded upon three fundamental assumptions: (1) the USDA Forest Service will seek to maintain a healthy outfitting industry; (2) the permit system should give all persons a fair and equitable chance to run the river; and (3) the system used must be within the budget and personnel limitations of the agency.

Some criticism during discussion was directed at these assumptions. Forest Service support of the outfitting industry was seen by some as unnecessary at best and as discriminatory to the interests of private river runners at worst. Although it was not made explicit during discussion, the Forest Service's support of this commercial interprise appears to have its roots in broad Federal statutes supporting rural development and local economies. Although the extent of Forest Service support and the specific types of economic activity involved might be debated, the general assumption the agency has taken with regard to the outfitting industry appears to be legitimate and proper.

Much discussion centered on the specific mechanisms that might be employed to ration use. Concerns with equity and fairness were expressed by many participants. However, there seemed to be considerable confusion over the issue of rationing as opposed to the issue of allocation of use permits. Rationing, which was the focus of this session, centers on the mechanisms through which opportunities to use the river system are distributed to users. Allocation concerns the relative proportion of the available openings given to different clientele groups; e.g., commercial outfitters versus private river runners. The distinction between these issues is important. Rationing is a complex problem, but the choice of mechanisms is an issue

that is substantially within the prerogative of the manager. Management experience, research data, and good judgment can be used to improve the delivery of services to people. Allocation, on the other hand, is an issue that deals with the normative question of "who should get what" and, as such, is an inherently political issue, largely outside solution by managers and scientists.

With specific regard to rationing, several important points were raised. First, there is a range of rationing mechanisms that managers might consider. For example, solutions suggested by participants included entrance fees, lotteries (the present Middle Fork rationing program is a lottery), and user licenses.[1]

Second, it was recognized that any rationing system has shortcomings and can be "beat"! As mentioned above, people who arrive on the Middle Fork without a permit can still obtain one by waiting until the daily launch limit of seven crafts is not reached. While this is a safeguard against underutilization, and can help accomodate visitors who are legitimately unaware of the rationing program, it also opens an avenue to people who do not want to deal with the system. One participant suggested private river runners have a greater opportunity to "beat" the system because commercial river runners must operate under a special-use permit issued by the USDA Forest Service and are therefore more closely regulated. However, Sam Warren pointed out that outfitters can affect demand for their services through advertising.

Third, several participants stressed the importance of providing a range of options for users, both in the kinds of recreational experiences that rivers provide and in the regulatory measures used by managers. Al Wagar of the USDA Forest Service made an especially important point: it is imperative that our management programs be conceived within the framework of a *system* of opportunities. Where our horizons are restricted to an area-by-area perspective, decisions as to what kinds of experiences are to be provided and what management techniques are to be used can quickly become tangled in a web of concerns about appropriateness, equity, and utility.

Finally, participants recognized that rationing, defined as the direct control of use through regulatory measures, is only one of the management techniques available to managers. Other sessions of the symposium dealt with these measures, but in general, discussants agreed that many nonregulatory measures exist that should be considered for controlling impacts on rivers before direct regulation is instituted. In Michigan, for example, managers have utilized design features to control impacts. Camping sites have been kept away from river banks, access to rivers has been controlled to prevent random entry, and litter control measures have been instituted. However, it was clear that some of these measures are simply not feasible on all rivers. On the St. Croix River, for instance, most of the access points along the 252 miles of the river are not under control of the managing agency. Where possible, nevertheless, participants agreed that management should institute only those measures necessary to achieve the desired end, rather than automatically implementing rationing.

The third fundamental assumption underlying the rationing system--that it must be within the budget and personnel limitations of the agency--is a real world constraint that is frequently forgotten in a world increasingly tied to computers, sophisticated programming, and related electronic wizardry. While such tools and techniques do offer great promise in grappling with difficult resource management problems, we need also remember that many programs and policies are implemented at field levels where, as Sam Warren noted, the manager feels lucky to have a telephone and desk calculator.

One important by-product of the rationing program on the Middle Fork has been the development of accurate, up-to-date management information. Estimates

[1] *Two other generic rationing systems, queuing (first-come, first-served) and reservations (a variant of queuing, with future rights to openings assigned to people by pre-registration) drew little discussion. However, the assignment of permits to drop-ins when daily launch limits have not been reached on the Middle Fork represents, in essence, a queuing approach to rationing.*

of use--how much, what kinds, when, and where--notoriously bad in many of our dispersed recreation settings such as wilderness, have been greatly improved by the permit system. In addition, because the USDA Forest Service issues all permits to river runners, private and commercial, there has been an excellent opportunity for informational contacts with visitors concerning river management policies. This two-way interaction between manager and user all too often is missing in many of our recreation areas and probably helps contribute to the misperceptions of each group about the other. Important management objectives can be often achieved by obtaining public understanding, thereby reducing or even eliminating the need for more direct restrictions. For example, Warren noted that when the rationing program was first begun, visitors were issued litterbags which were then checked by rangers after completion of the trip to determine compliance with pack-it-in, pack-it-out regulations. This check on visitor behavior has now been dropped because litter clean-up has become the norm among river users.

What of the future? Both Warren as well as most symposium participants see increases in use on the horizon. The explosion of use on America's rivers has truly been staggering, as several papers in the proceedings graphically attest. The growth in use is almost certainly more than just a fad; it is unlikely we will ever again see the level of use on the country's rivers that prevailed a decade ago. At the same time, it seems important that we obtain as accurate a grasp on the growth phenomenon as possible. For example, it is a common assumption that official designation (e.g., establishment as a Wild River) is, in a sense, a "kiss of death" because it makes the area a target for "trophy" collectors. This is certainly a plausible notion; naming an area officially probably does promote recognition. However, it could also simply reflect the greater attention that managers must now give to the area in question and the often-cited spectacular increases in use might be largely a result of the belated recognition of use conditions that have prevailed for some time. Separating conventional wisdom from fact is an important responsibility of managers, researchers, and users alike, as we attempt to place scarce management dollars and skills in the most deserving places.

Participants questioned the future role of the commercial outfitters on the Middle Fork. In the opening remark of the question period, Joe Hoffman of the University of Idaho proposed de-regulation of the commercial outfitting industry. The USDA Forest Service would retain control over the total number of users permitted on the river and would set safety standards with which outfitters would need to comply. Visitors obtaining permits would be free to choose running the river on their own or with an outfitter. In this way, Hoffman argued, market place mechanisms would lead to the proper number of outfitters on the river. His argument was countered in later discussion, however, by an individual who argued that de-regulation would not necessarily lead to the survival of the "best" outfitters. Success, it was argued, would be largely a function of capitalization, and large, well-funded outfitters would enjoy an advantage over smaller entrepreneurs. Thus, outfitters specializing in unique styles of river running that appeal to only a minority of visitors would probably be forced out of business.

Conditions on the Middle Fork will almost certainly change in the future. Warren agreed that political pressures might eventually force shifts in the allocation of permits between private and commercial sectors. The notion of "percentage of disappointment" raised by Rod Nash of the University of California at Santa Barbara represents a plausible alternative for re-establishing the allocation ratio. Given the problems of "no-shows", for whatever reason, Warren estimated that 80 percent of capacity will probably be the maximum level of utilization to ever occur. As noted earlier, demand from private runners exceeded their allocated capacity while commercial users have underutilized theirs. Revisions of the private-commercial allocation should be sensitive to this relation as it provides a logical basis for reassignment of the ratios. However, a very real future possibility is the exclusion issuance of individual permits, dropping the commercial-type trip altogether. Constant monitoring and reassessment of policies and programs seems absolutely necessary if the USDA Forest Service is to avoid being caught in the position of managing the river with a set of assumptions and mechanisms that are simply out of touch with changing realities of use.

RATIONING--AN OVERALL ASSESSMENT

As the discussion above suggests, many specific ideas and general impressions surfaced at the session. Summarizing them all into some cohesive and logical fashion is difficult, but it seems to me that several issues warrant specific recognition.

First, rationing seems to have fair public support as a legitimate management action. Much of the debate over its use centers on how it is applied, where, and so forth, but most users appear to agree that rationing is an appropriate action to protect river resources and recreational experiences.

However, my second impression is that misuse of rationing might jeopardize its use as a management tool. A range of visitor management actions needs to be considered--from subtle, light-handed techniques such as providing information to people about alternative opportunities to more restrictive actions such as regulation of access. In choosing what measure is appropriate in any given situation, the lowest level of regulation necessary to achieve area management objectives should be instituted--the principle of minimum regulation. In other words, if visitor impacts can be held within acceptable limits simply by providing information to users, it would be inappropriate to use any more restrictive measure, such as rationing.

One can even visualize this type of variability within the rationing measures themselves. For example, there was considerable discussion about the idea of regulating use by the issuance of licenses--rationing by merit. Such a measure would require users to pass some kind of test (e.g., demonstration of knowledge, skill, or both). One implication of such a measure is that by raising visitor skills, thereby reducing per capita impact, the need for absolute restrictions on total visitor numbers could probably be postponed. In effect, improving visitor behavior could raise an area's carrying capacity.

This leads me to a third observation. I am struck by the lack of clear management objectives for rivers to help guide management actions. One participant noted that the perception of what kind of experience rivers produce differs between managers and users. Moreover, there were varying notions about what benefits rivers, even those within the Wild and Scenic Rivers System, should provide. However, the general concerns about solitude and naturalness suggest that many hold a wilderness-bias with regard to what kinds of experiences rivers should yield.

The lack of clear objectives means these personal biases as to what river experiences should be provided can be substituted for more formal specifications of goals. From this, it is an easy step to assuming that *any* increases in use or *any* increase in resource impact constitutes a loss of quality that can be counteracted only by the relative drastic action of directly rationing use. Such a step is unwarranted and creates an undesirable set of conditions for managers and users alike.

Rivers, like any recreational resource system, can and should provide a satisfaction for people seeking a variety of experiences--from those dependent on intense social interaction to those that rely upon isolation for their fulfillment. This can only be achieved, as Al Wagar suggested, by considering rivers within the context of a *system of opportunities* rather than simply on a river-by-river basis. By managing on a regional basis, with the system of rivers specifically managed to yield a package of diverse experiences, many of the concerns about equity can be more easily addressed.

We also need to consider visitor management and rationing from a regional perspective. With a broad range of opportunities, represented by a system of areas with differing management objectives, a range of visitor management techniques will be necessary and appropriate. Thus, users will have a broad range of choices--not only of opportunities suited to their particular tastes but also of the level and nature of managerial control. This diversity seems absolutely necessary if we are to meet our responsibility as professional resource managers to the American people.

One of the major concerns about rationing is that some people will always find themselves discriminated against by the system. My fourth observation is simply this: any rationing system discriminates against certain people; in fact, it is this discriminatory feature

that makes rationing work. If it didn't, what good would a rationing program do? The relevant question is not how to prevent rationing from being discriminatory, but rather, how to spread those discriminatory costs across the spectrum of users?

Again, a system of areas can help us spread these costs. The objective should be to make sure that when rationing becomes necessary, the specific techniques utilized (e.g., lotteries, merit, fees) should vary among areas so that users are able to make choices that allow them to accommodate the rationing costs in the best way. For example, reservations discriminate by favoring those able, willing, or both to plan for the future; fees discriminate on the basis of who is able or willing to pay the monetary costs, etc. Each system favors certain groups and discriminates against others. By providing a system of areas where rationing mechanisms vary, the effect should be to minimize aggregate equity costs.

Finally, I was struck by the virtual absence of any discussion about river carrying capacity. Rationing implies that some finite number of openings has been reached and because of excess demand for those openings, some mechanism for distribution has to be implemented. Thus, rationing hinges on the integrity of the carrying capacity calculations.

Although carrying capacity was not discussed in this session, it is clear that rationing decisions will be challenged increasingly in the future, and these challenges will be often tied to the carrying capacity estimations made by managers. Carrying capacity is ultimately a judgmental issue and managers, researchers, and citizens alike all have important roles to play. Managers define the various constraints they must consider and are charged with making the final judgments as to what constitutes acceptable consequences in light of these constraints. Researchers must supply clear measures of the consequences and implications of alternative use conditions so managers can make decisions based on reasonably accurate estimates. Citizens have the responsibility to make their views and values known as well as to make judgments about the trade-offs they are willing to make. Only through open dialogue among these three groups can the complex issues of rationing, carrying capacity, and river management be adequately resolved.

WORKSHOP #5

METHODS TO CONTROL NEGATIVE IMPACTS OF RECREATION USE

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The "negative impacts" workshop emphasized problem identification and methods for control of physical and social impacts on wild and scenic rivers. Impacts on other rivers, where recreational opportunities are more variable and possibly more complex, were generally ignored. Unfortunately, problem identification, research needs, and management procedures covering the full spectrum of river recreation were not developed during the session. Certainly this omission does not reflect either disinterest on the part of managers and researchers or the absence of problems associated with nonwilderness river recreation.

SOCIAL PROBLEMS

"People management" surfaced as a key issue. William Craig, the introductory speaker, and several other participants emphasized the serious consequences of failing to gain local support before establishing wild or scenic rivers. Lawrence Merriam called river use a "social activity", and suggested that designating a river as "wild" changes its use and displaces many predesignation users--mostly local people. For example, wild river designation leads to road closures in the reserved corridors. Local residents who customarily used the roads resent and resist the closures unless the value to them of establishing a wild or scenic river can be demonstrated. Craig reported cases where trees were felled or wires were strung across rivers to impede traffic, often capsizing boats. Locals then charged fees to recover equipment lost in the river. Shooting at recreation equipment has not been uncommon; facilities of all types have been defaced or destroyed; four-wheel-drive vehicles, trucks, and motorbikes have been used to circumvent closures; and incendiarism has more than tripled following road closures. Such vandalous public reaction is difficult to stop where roads are publicly owned, and it is virtually impossible to control where river access is over numerous privately owned roads.

Coping with acts of vandalism is extremely complex becuuse guilty persons are nearly impossible to identify (Alfano and Magill 1977). Fortunately for river managers, local people, as a group, have been recognized as responsible for acts perpetrated following wild and scenic river designations. Several managers and researchers suggested that all aspects of wild and scenic river proposals--in fact, any river management proposal--should be thoroughly discussed with local residents and its importance *to them* should be clearly specified to gain their acceptance before any action is taken. This approach is supported by social scientists who generally agree that increasing two-way communication between managers and users, building more effective educational programs, and devising means for gaining public involvement are necessary if vandalism is to be effectively controlled (Alfano and Magill 1977). However, even carefully planned public involvement programs are unlikely to convince everyone; some problems will still obtain, but hopefully they will be fewer and less serious.

ROAD CLOSURE MECHANICS

William Craig, in his introductory paper, suggested constructing double barriers of earth ranging from 7 to 10 feet high to stop unauthorized use of closed roads. This solution may be effective, but it is also obtrusive. An obvious reason for designating rivers as wild or scenic is to preserve visual quality, not only along the river but throughout the preserved area. Thus, effective but visually acceptable road closure techniques are desirable. Heavy-duty steel gates with steel lock

cages and posts anchored in concrete are proven alternatives which are less obtrusive. A workshop participant offered an innovative alternative: blend the closed road into the surrounding forest--make it disappear by establishing a new segment of forest. A mechanical tree planter can be used to extract trees from nearby land and replant them in the roadbed. Sufficient numbers must be planted to completely conceal the road, and stumps or logs and forest litter may be added to provide a finishing touch.

WASTE DISPOSAL

Waste disposal was another serious concern of workshop participants, and most concern was with disposal of human excrement during boat trips. The ultimate solution may be designation of "no discharge" streams where sewage disposal is totally prohibited regardless of treatment levels. Boats may be required to carry portable toilets to be emptied only at designated locations. Dumping is sometimes allowed on large beach areas provided a deep pit is dug and covered. Stewart Aitchison reported such procedures are used in the Grand Canyon of the Colorado River, but said beaches with high clay content fail to absorb liquids. Obviously, such locations must be identified and avoided. Fecal coliform bacteria tend to remain at high levels in beach sands for more than a year according to Aitchison. This suggests that self-contained toilets may need to be dumped at the end of trips to avoid creating health hazards.

Contamination of soils and waters by liquid cooking wastes is another problem addressed by Aitchison. Such wastes make beaches smell bad and attract insects, birds, and other animals. Some animals attracted to the beaches are in poor health and may be hazardous to humans.

Litter and trash pose expensive cleanup problems along all types of rivers just as on land used for dispersed or developed recreation. In wilderness areas, including wild and scenic rivers, the "pack it in, pack it out" policy seems to be gaining in success, but more public educational efforts are needed. "Riverside" cleanup trips may prove useful just as have wilderness cleanup trips, but prevention is the better solution. Providing litterbags helps prevent onsite refuse disposal, but does not encourage pickup of existing litter (Clark, *et al.* 1972). Research indicates that incentives may be offered to encourage pickup in campgrounds, but the method seems less plausible along streams.

SOILS AND VEGETATION

Human impact on the soils and vegetation along rivers and methods for controlling it received little attention during the workshop. Yet, retaining soils and maintaining vegetative cover along streams and in watersheds are essential for insuring water quantity and quality, maintaining forest visual integrity, and providing an attractive and useful refuge when river users choose to rest.

Aitchison, speaking of the Colorado River in the Grand Canyon, aptly said that the most heavily used areas are not necessarily the most heavily impacted. The reason for this anomaly may be attributed to variation among resources and users. Some resources may exhibit greater resistance to heavy use, and the actions of different users may impact resources more or less severely. Additionally, managers who are unfamiliar with local plants, soils, and wildlife or the interactions between resources and people may not recognize subtle changes in river ecosystems that indicate the need for increased resource protection or remedial action. These observations are valid for other rivers regardless of intensity of development and use as well as for nonriver recreation areas.

Damming the Colorado River has prevented scouring of river bars and beaches with resultant increases in native and introduced vegetation, according to Aitchison. New growth provides food and cover for wildlife as well as screening for campers, but as the vegetation continues to increase it encroaches on usable camping space. When that happens, trampling and cutting prove beneficial by restricting growth and spread to acceptable levels.

Damming the river has also caused a scarcity of firewood because flood waters previously carried it down and deposited it on the beaches. Without a replenished supply of firewood, river runners will need to carry portable stoves.

In his paper, William Craig said compacted soils are one of the major user impacts, and they must be cultivated. However, his advice should be weighed against soil characteristics and plant and soil relations. Several studies have shown that soil compaction may prove beneficial by effecting greater root firmness and increasing growth rates through increased supplies of soil moisture and nutrients and reduced microflora competition for nitrogen (Lull 1959 , Hartesveldt 1963 , Magill and Nord 1963). Bare areas around tables and stoves and in tent sites become dusty and are particularly annoying on windy days. Mulching with forest litter or applying clear, nontoxic, chemical dust control agents may control dust, thereby avoiding the alternative of spreading such unnatural appearing materials as hay or pea-gravel.

Eliminating vegetation is another major impact on recreation sites. As Craig noted, research and experience gained from protecting and restoring vegetation in wilderness and lake areas can be adapted to river management. In addition, research done by LaPage (1967), Magill (1970), Echelberger (1971), Fay (1975), and others may guide research and management of sites used for river recreation.

Resting or rotating sites or allowing users to stay only at designated sites have been suggested to protect or rehabilitate the soils and vegetation on heavily used areas. Managers are well advised to be aware of the difficulties associated with these management options before implementing them. They should be alert to the climate, soils, and vegetation and to the interrelations unique to their geographical location. Research and management guides useful in the Northeast may not work in the Lake States, and likely not in the arid West. For example, resting a site by merely preventing visitor use may restore vegetation in lush Eastern forest types. However, the dry and relatively sparse forest types of the Southwest may require planting or seeding, cultivation, fertilization, and irrigation along with extended closure if wornout sites are to be rehabilitated. Research has shown that such practices can be effective (Herrington and Beardsley 1970 , Beardsley and Wagar 1971 , Magill and Leiser 1972), and they may also be used to maintain recreation sites even during recreational use (Beardsley, Herrington, and Wagar 1974). In addition, site rotation requires suitable replacement sites for those being rested or retired. However, replacement sites may not be available, especially where good sites are rare and high recreational use has obligated most of the best ones.

Site protection goals allow river managers two courses of action, according to William Craig. They can allow camping anywhere or they can allow camping only at designated sites. If users are allowed to camp wherever they choose, impacts are spread over numerous locations in a wide area until high levels of use prevail. Then, the resource base may begin to deteriorate, recreational experiences may decrease in quality, and more intensive management may be needed. On the other hand, if use is restricted to designated sites, the resource base may be protected, but use must also be limited to the available space. This suggests the need for "capacity controls"--a reservation system--if the number of parties seeking entry exceeds the availability of sites. Computerized reservation systems are presently being used by several State park systems and on some western national forests with a high level of acceptance by users and managers (Magill 1976a , 1976b). Furthermore, capacity controls or other kinds of manual reservation systems are also being used to control wilderness use where camping is restricted to designated sites for resource and experience protection. A computerized reservation system capable of providing individual reservations has been proposed for wilderness use, but it has not been field tested.

The large attendance and keen interest at the "negative impacts" workshop demonstrated the recognition of managers and researchers of their need to work closely to develop scientifically based management for the protection and maintenance of our river recreation resource and the delivery of quality recreational experiences.

WORKSHOP #6

LAND MANAGERS ARE FINDING WAYS TO GET RESEARCH DONE WITHIN THEIR OWN ORGANIZATIONS

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The importance of this topic was demonstrated early in the symposium when Milton Krona, a park planner with the Minnesota Department of Natural Resources, stated: "Researchers give us answers to questions we didn't even ask!" On the surface this comment would appear to be an indication of gratitude; but the tone and context made it clear that the speaker was expressing a widely held opinion that researchers are insensitive to the needs of land managers who are on the front line of decisionmaking and land-use problems.

At the risk of creating conflict where it may not exist, I will suggest that land managers may even feel threatened by "ivory tower" research which, more often than not, points a critical finger at the way things are being done. An individual or agency that must deal with land use on a day-by-day, crisis-by-crisis basis is understandably resentful of those who criticize without having the responsibility for the consequences of their decisions. In some cases the consequences may mean facing a judge in a court room.

However one views the issue, there is general agreement that a great deal more should be done to integrate management and research. Only by working together can we hope to solve the complex recreation land-use problems that are developing to crisis proportions. As Wilbur LaPage put it, the signs are encouraging, at least research is in demand, Land managers have put out the "wanted" signs.

There are numerous ways of improving the responsiveness of research to management problems. The most obvious is to simply have researchers and managers listen to each other. However, a more structured approach is often felt necessary. Our workshop focused primarily on a technique that might be labeled "in-house field research personnel method".

Kenneth C. Chilman described how this system has worked in a field-based research program at Ozark National Scenic Riverways. He emphasized that the "in-house" model is especially applicable to small-scale, capacity-oriented studies. The field researcher is assumed to be knowledgable and well disciplined in his task. He brings with him the skills that will enable the management agency to: 1) initiate research, 2) evaluate research proposals, 3) negotiate contracts, and 4) interpret research results.

Leo F. Marnell described his experiences as a field researcher with the staff of Ozark National Scenic Riverways. His primary assignment was to document use through various monitoring techniques. This information was needed to help resolve immediate problems associated with increased use, safety, environmental impact, and conflicts between commercial and private users. The field researcher may also have the role of liaison or buffer between managers and the public, although Leo emphasized that managers must have realistic expectations, i.e. they should not expect the research results to make decisions for them.

Randall R. Pope, former Superintendent of the Ozark National Scenic Riverways, provided insights into the manager's point of view. He stated that the increased use of field research personnel was largely a response to "crisis" situations. Tough decisions had to be made. These in turn had to be justified by data; pressure groups and the courts were demanding documentation to support management policies.

The discussion that followed the formal presentation helped to reveal some of the conflicts prevalent between research and management. Robert Knepper of Minnesota's Department of Natural Resources suggested that the primary value of research for man-

agement fell into two categories: 1) it enables managers to document use for purposes of allocation of resources and distribution of users, and 2) it provides insights into public perceptions and values that can help to refine management goals.

Perhaps we have used the term research in too broad a sense. The 1962 Outdoor Recreation Resources Review Commission (ORRRC) Report recognized three categories of research: 1) data collection, inventory, and factfinding; 2) applied management research; and 3) fundamental research. Some may argue that the first is not really research at all in that is merely involves the collection of information. Yet many of the same tools are utilized (e.g., sampling techniques, statistical analysis) and the same discipline and scientific honesty are required. Possibly these skills and attitudes are the major contribution a field researcher can provide to management.

The cardinal sin of the researcher is, of course, showing bias. He must deliberately and continually seek to avoid bias at all stages of the investigation process: structuring the research model, sampling, and interpreting results. In-house research presents some special temptations that must be consciously dealt with.

The manager has a tendency to seek information that will help him defend his established programs and alliances. He will also tend to interpret data in the same way--and research seldom produces results that are not subject to more than one set of conclusions. A management agency has an understandable desire to treat immediate problems (which are often symptoms) rather than underlying causes. Research directed toward the latter is more likely to lead to long-run solutions; however, it is also more likely to challenge the agency's basic assumptions and management policies. In other words, the problem illustrates a common forester's malady--"he doesn't see the forest for the trees".

Wilbur LaPage, Roger Clark, and Leo Marnell pointed out some additional problems with in-house research. The researcher may feel cut off from his colleagues and the stimulation and resources provided by a university environment. The kind of research required by management is not likely to be very glamorous or publishable. It may be beneficial to establish a modified reward system so that he is not so dependent on publications as a measure of his productivity. Publication may even be discouraged by careful internal review, deemed necessary because of the direct management implications of research results.

Isolation can create other problems. One of the major shortcomings of much recreation research is the lack of comparability. In-house, small-scale research may aggravate this problem. Perhaps a better communication network between researchers could do much to alleviate this condition.

All of this suggests that it may be well to consider a variety of ways to integrate research and management. At one end of the spectrum managers are simply exposed to research results produced by independent institutions or agencies. This sort of relation is probably best suited for research that challenges basic assumptions and long-range policies. At the same time, other arrangements can be made to deal with the immediate needs of management. These can range from the contracted job to the in-house research staff. In all cases the researcher must be provided with an environment of complete intellectual freedom--even if it means that at times management will get "answers to questions it didn't even ask".

As the workshop concluded, Uel Blank of the University of Minnesota agreed with an earlier comment that "No research is 'right'; we can't defend it with our lives". Perhaps the most important benefit that can be derived from a closer integration of research and management is a greater appreciation of the limitations of research. No research results are going to take the place of the manager's responsibility to deal directly with the resource and the people. Uel concluded his comments by suggesting that by working together, agreeing to the process and to the role of research results in decisionmaking, we can achieve a degree of harmony. This approach requires involvement of all participants: managers, planners, researchers, politicians, and the public. If all are a part of the process all should be willing to accept the results.

WORKSHOP #7

MANAGING RIVER RECREATION USE OTHER THAN RATIONING

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To understand the intent of this workshop, a definition of rationing must first be developed since we wanted to look at nonrationing management options. *The American Heritage Dictionary* indicates that to ration is to "restrict to limited allotment". Applied to river recreation management, this means restricting human use of a river resource to some fixed upper limit, applied either to all users equally, or differentially to different groups or types of users. Implied is a problem of too much use for the capacity of the river. This, apparently, is one of the major concerns of river recreation managers and researchers.

Thus, the assignment for this workshop session was to explore ways to manage river recreation use by means other than by putting absolute ceilings on the amount of use, in total or by group, to be allowed upon a river. Even though we did not deal with absolute ceilings, it will be obvious to the reader that much of the discussion did focus on ways to moderate use pressures.

The moderator of the workshop was Carl Rust (Stanislaus National Forest, California). His challenge to workshop participants was to suggest viable nonrationing management options for dealing with the overuse problem. Joyce Nielson summarized the paper she and Bo Shelby coauthored and then the session was opened for suggestions from the floor for river use management.

The following paragraphs summarize the workshop participants' suggestions of management options and offer some reactions to Nielson and Shelby's paper and to the participants' comments. We point out how participants' emphasis on protection of the resource from overuse evolves into options for obtaining more benefit from the river resource. Some contradictions will be noted among the suggestions for river management options. These contradictions reflect apparently divergent, but healthily divergent, opinions concerning how managers should exercise their responsibilities.

SUMMARY LISTING OF SUGGESTED MANAGEMENT OPTIONS

Prevention of Overuse

Types of river recreational uses which interfere with one another can be separated through spatial or time zoning.

Heavy use can be limited by limiting the capacity of facilities and sites that are complementary to river recreation. These would include parking spaces, sanitary facilities, camping spaces, and access points. This is better than zoning because of the negative attitude people often have toward zoning.

Natural barriers or constrictions can be used to effectively limit use to reasonable levels. Too often managers remove thorny or noxious species of plants, dynamite constrictions in the rivers, eliminate aggravating insects or otherwise remove natural constraints on use pressures. Managers may even see a need to "create" some of these barriers.

Where dams exist upstream, amount and type of use can be influenced by controlling the level and periodicity of river flow.

What people expect and perceive and how they behave on rivers can be influenced through promotion and advertising; e.g., selective dissemination of information describing such things as types of opportunities and "crowding" conditions. Sometimes publicity must be avoided because of the chaos it creates.

Charging a user fee will limit amount of use. Varying the amount of the fee can help to level out the peaks and valleys of use pressures.

There is a need to take a long-range look at current cases of overuse. There is a distinct possibility that heavy-use conditions may be short lived because of probable future shortages and fuel rationing. Thus, care should be exercised in implementing long-lasting solutions to potentially short run, heavy-use problems.

Levels and types of use can be controlled by prohibiting certain activities on a river system.

Increasing Benefits to Users

Keep the attention that is focused on "wild" rivers in proper perspective. Often too little attention is given to all the other rivers, even though they comprise about 97 percent of our total river resource. Emphasize greater use and satisfaction from nonwild rivers.

A first step in river management for recreation is to understand the users' wants and the resource's capabilities. From this, meaningful management objectives can be established that will greatly help humans benefit from river resources.

Once meaningful objectives are defined, managers should stick to them and not become caught up in cycles of change that reflect every fad that surfaces. As Nielson and Shelby have pointed out, "It is [very] possible that user preferences and attitudes grow out of the kinds of experiences managers provide". Consistent management aims should enhance user satisfactions as well as reduce management complexities.

Managers need to be more observant of user behavior. We know that people adjust their behavior and maybe even their attitudes according to situations encountered. With the help of researchers, we need to find ways of satisfying users more and protecting the resource through a knowledge of behavior.

One way to reduce dissatisfactions is to group homogeneous or compatible types of users. This will help lessen distasteful user interactions.

An option we should always keep in mind is doing nothing. Sometimes it is obvious that too much management is worse for enhancing user experiences than doing nothing at all.

Site hardening can be used to effectively eliminate some of the problems which managers perceive as being caused by overuse. Instead of reducing use to make it compatible with existing resource conditions, consider modifying the site to accommodate more users.

Managers sometimes become too confident with standards or principles of management that may no longer be viable. Management should not become so stagnant that obvious indicators of needed change are overlooked. Preferences, management technology, recreation equipment, and environmental conditions do change.

There is need to explore more ways of using rivers for recreation. For example, rivers may be considered a means of access to historical, archaeological, and recreational experiences or other participatory opportunities along their banks. In this case, the way the river is managed and developed will be different than if the river is viewed as the recreational end in itself.

COMMENTS CONCERNING THE MANAGEMENT SUGGESTIONS AND THE PAPER

Two different philosophies or schools of thought seem to exist in the above statements regarding management of rivers for recreation. First there is the school that places emphasis on limiting amount of use. This school appears to conceive of the river resource as a place to experience a unique, wilderness-oriented recreation experience. As such, the focus in management is on techniques that will protect the integrity of the resource and at the same time create conditions that would tend to maximize the average level of user satisfaction. Under this philosophy, pressures for greater use of a river are viewed as a constraint on goal achievement.

The second school of thought seems to focus attention on an array of recreational uses of rivers that is broader than just wilderness-oriented experiences. Though protecting the wilderness integrity of the

river resource is within their list of management options, they also are open to the more intensive uses. The goal of this school is to *maximize the sum of user satisfactions* derived from river recreation experiences.

The preceding listing of management options suggested by the managers attending this workshop has been divided roughly into the two schools of thought. The eight suggestions for preventing overuse offer obvious promise with broader application and testing. But a point for some concern is that there was no really strong evidence from the statements made during the workshop that a clear management objective had been conceived. It is very likely that many of us strongly reflect our personal biases for "proper" use of a river resource when we begin to define our management options. In this case that bias was toward low levels of use.

While this certainly is not an improper philosophy or attitude, it must be kept in proper perspective with respect to the full range of recreational experiences which river users or potential users may want. Management of a public resource must be undertaken with a responsible openness to a wide range of potential uses, only one of which is wilderness oriented.

Under the options headed "Increase Benefits to Users" the theme of understanding more about the actual and potential user and employing this information to set management objectives is prominent. This theme, of course, is aimed at maximizing total recreation satisfactions. The on-site management procedures offered were directed at manipulating the resource--within reason--to fit user needs.

Although the goals underlying these two schools cannot and should not be viewed as antipodal, they do lead to different management strategies and actions. Too often misunderstandings develop because it is not clear which goal management is trying to achieve. Usually only general statements of goals can be ascertained such as, "we're managing for user satisfactions".

This lack of specificity in defining the satisfaction-achievement goal was also evident in the Nielson-Shelby research. It is obvious from the measurement technique used that average level of individual user satisfaction was the variable of concern. Yet some of the commentary within the paper seemed to deal with the sum of the satisfactions achieved by all users. For example, conclusion #1 on page 177 states that "Managing for user satisfaction implies extremely high density levels". If the management goal is to maximize aggregate satisfactions, then this statement is true. If it is to maximize the average, per-user satisfaction, then this conclusion probably is not true.

It is important that the goal of achieving satisfaction be clearly articulated if proper management actions and attitudes are to be adopted. This is particularly true with respect to actions which directly govern use levels (fig. 1).

Assuming that the shape of the total satisfaction function is reasonably correct, it can be seen that if maximization of the average level of individual satisfaction is the goal, then managers should indeed seek to limit use amounts to "a" so that overcrowding can be avoided. But if maximum total satisfaction (summed individual satisfactions) is the goal, then use amount "b" should be sought. The amount of use represented by "b" is almost twice the amount represented by "a". Policies and management would be very different for achieving one or the other of these two goals.

The need for clear definitions of goals is exemplified here and meeting this need could reduce misunderstandings considerably. In addition, and perhaps more important, a clear understanding and articulation of the management goal enables management to be assessed more objectively and makes selection of management options more defensible. Thus, if the goal is to maximize the average level of satisfaction among users (which goes hand in hand with maximum resource protection), then the first set of management options should be emphasized. If the goal is to obtain the highest level of aggregated user satisfactions, then the latter set of options would receive more emphasis.

Several references were made to social carrying capacity during the workshop and in the research paper. Most of these further indicated lack of clearly defined management goals. A principle well worth repeating

is that *carrying capacity cannot be determined* if goals are not first established and clearly defined. For example, if the goal is to maximize average satisfaction per user, then the social carrying capacity of a river would be "a" (fig. 1). If the goal is maximum total satisfaction, then the capacity of a river would be "b" (fig. 1). Thus depending on the adopted goal, the social carrying capacity of the same river could be greatly different.

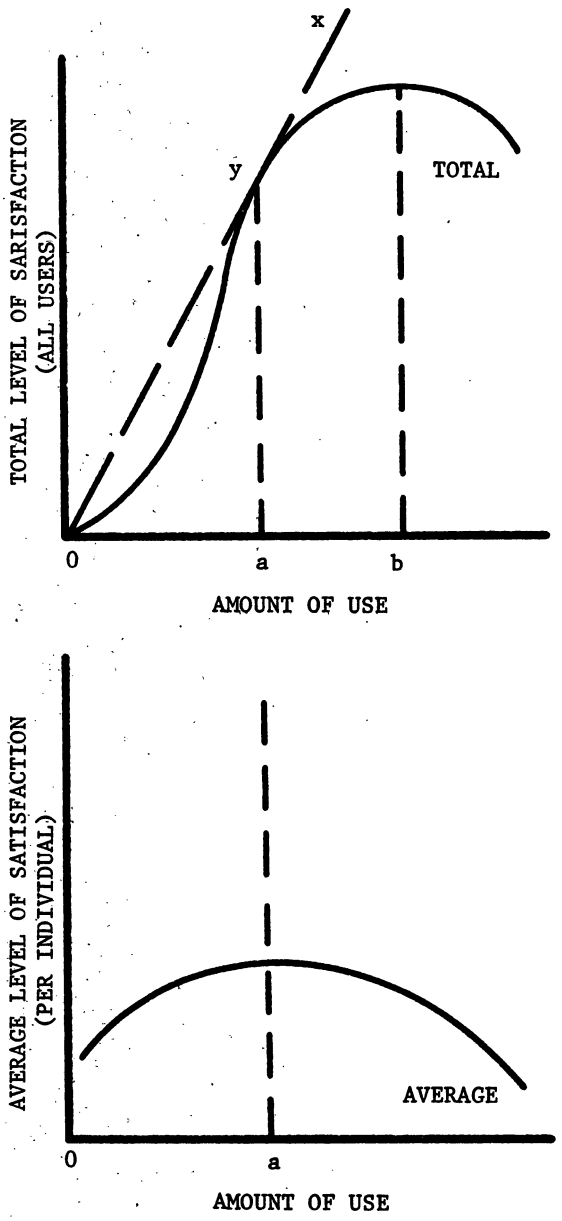

Figure 1.--*Relation between total and average levels of satisfactions and amount of river recreation use. (The average satisfaction level is graphically calculated by extending a ray (0x) from the origin of the total satisfaction curve (0) to its point of tangency (y) with the total satisfaction curve.)*

OTHER OBSERVATIONS CONCERNING THE NIELSON-SHELBY PAPER

It is obvious that the reported research makes a valuable contribution to the kind of river recreation and resource situation addressed. Some potentially important insights into recreationists' behavior are offered. But it is not obvious how far we can go in applying these results to other situations or environments. The Grand Canyon is a very unique resource and it is likely that user motivations there differ substantially from the motivations of users of other, less-renowned rivers. For example, Conclusion #2 on page 177 indicates that attitudes and preferences seemed to develop during the recreation experience. The uniqueness of the Grand Canyon river run and the fact that not many people ever experience this kind of excursion makes lack of well-articulated expectations and preferences very understandable. For other, better known types of rivers, attitudes and preferences may well be much more in evidence.

There is an apparent need for similar research on a broader array of river environment types. With the kind of information provided by Nielson and Shelby many of our management decisions can be made more objectively and defensibly. This kind of research should answer two important questions.

First, how do we reliably measure user satisfaction? Some progress has been made, but we still find it very difficult to interpret the satisfaction measures used. We not only need to know whether a person is satisfied, but we also need to know how satisfied. We further need to be able to aggregate satisfactions for groups of users. As was pointed out earlier, the assumption that maximizing the average level of satisfaction automatically leads to maximum aggregate or total satisfaction simply has no basis.

Second, how do we indicate the shape

of the total satisfaction function? In figure 1 a sigmoid shape is shown. Despite some evidence to support this shape, it still remains largely an assumption. Knowledge of the amount of change in satisfaction that occurs per unit of increase in use is necessary for evaluating the tradeoff between use loadings and satisfactions. This, of course, is a first step in assessing the consequences of alternative policies and management practices designed to influence amount or kind of river recreation use. It is strongly recommended that research such as that by Nielson and Shelby explore the direct relation between amount of use and satisfaction levels. For example, on page 170, last paragraph, an indirect correlation (or lack of it) is discussed. Determining the direct correlation between user satisfaction and amount of use would have been much more meaningful and usable. The next step should be an attempt to measure the actual function.

WORKSHOP #8

THE FUTURE OF STATE AND FEDERAL WILD AND SCENIC RIVER PROGRAMS

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The historical background and status of the Wild & Scenic Rivers Act was reviewed by Mr. Eastman in his paper: "River preservation and recreation programs--a status report". The paper generated the following discussion.

Upon enactment of the Wild & Scenic Rivers Act the Secretaries of Interior and Agriculture agreed that additional criteria were needed in carrying out the Act. It was realized that: (1) The established wording of the Act needed more specific explanation, and (2) definitions were needed for the extent, geographic distribution, and balance of the three types of rivers (recreation, scenic, wild) to be included in the system.

Since the Wild & Scenic Rivers Act was passed in 1968, specific guidelines have been developed by the two Secretaries. Additional direction has evolved through the study process and will continue to become more definitive as more studies are completed. However there is a real need to determine the extent, the geographic distribution, and the balance in wild, scenic, and recreation rivers for the nation as defined by the Act; and to recommend to Congress those rivers that should be studied for possible inclusion into the System. To answer this need the Bureau of Outdoor Recreation (BOR) has begun to inventory and classify all significant rivers or river segments 25 miles or longer that appear to be free from impoundments, have acceptable water quality, and provide for a quality recreation experience. The objective is to uniformly evaluate all significant rivers in the U.S., and to develop a "Minimum System" list of rivers that can be recommended to Congress for study. The "Minimum System" list, in addition to providing a systematic approach for determining the extent, geographic distribution, and type balance, will provide the Office of Management and Budget with valuable information in determining the appropriate dollars to be used for river studies.

The inventory and evaluation of the rivers will be carried out with full involvement of the public, private organizations, and State and federal agencies, before a recommended list is submitted to Congress. There will be at least two opportunities for the public and concerned agencies to become involved in the process. It is hoped this will be during the "filtering" stage, when rivers will be rated according to their desirable qualities rather than after the Minimum System list has been finalized.

The recommended list will not preclude other rivers from being nominated for study or inclusion into the system. Instead, it will provide a reliable information source for evaluating all significant rivers in the country, and rank those recommended for study. A river may "filter out" as a low priority, yet Congress or a State may see fit to study or include it in the appropriate river system. If several rivers within the same locale are rated equal, all of these rivers could be forwarded to Congress for consideration.

In Fiscal Year '77 BOR received sufficient funding to concentrate on an inventory of rivers east of the Mississippi. Public input for these rivers will probably occur in early summer of 1977. It is hoped that BOR will be financed to extend the inventory to the western half of the nation in Fiscal Year '78.

There has been some question and perhaps confusion as to the need for the "5-D" river category that now exists. Since the establishment of the Act, a number of the original 5-D rivers have been added to the "study category" and additional

rivers have been placed in the 5-D category. The National Environmental Protection Agency (NEPA) requirements for environmental statements and the Water Resource Council requirements for adherence to the "Principles and Standards" have provided some protection for rivers in the 5-D category. However, it appears that the 5-D category will continue to serve a useful purpose upon completion of the Minimum System list. While the Minimum System list will emphasize the top rivers recommended for study, the 5-D river category will focus attention on other rivers that may be worthy of study.

The advantage of maintaining a 5-D list is that is has legislative importance, assuring the public that this list cannot be easily overlooked by agencies who may be considering river uses not compatible with the Act. It also encourages the involved agencies to closely coordinate their river planning and projects with others to achieve the best public use of the river corridor.

State river programs have a wide degree of variance, with some States being very active in their own or federal programs, and other States having no program at all. In some cases, the federal study program has stimulated State programs or sharing in the program with the federal government. Because no two State programs are alike, it is difficult to generalize as to how some States can be motivated to participate in a river program. Two methods suggested during the workshop were: provide special federal funding in addition to the Land and Water Conservation Fund, or increase the ratio of Federal to State contributed dollars in the Land and Water Conservation Fund program.

In addition to the preceding discussions, Dr. Claude E. Terry illustrated with slides, "A filter system for determining river suitability for national wild and scenic river status". A copy of his paper is included in the Symposium Proceedings.

WORKSHOP #9

MANAGING RIVER CORRIDORS IN MULTIPLE OWNERSHIP

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The purpose of this paper is to summarize key issues, ideas, and discussion topics that were covered during the Symposium Workshop on "Managing Corridors in Multiple Ownerships". The session was chaired by Michael Priensnitz, Supervisor, River Section, Minnesota Department of Natural Resources. Priensnitz and James Harrison summarized the workshop introductory paper contained in this Proceedings. Henry Goetz, Manager, Lubrecht Experimental Forest, Greenough, Montana, and Jerry Stokes, Outdoor Recreation Planner, Bureau of Outdoor Recreation, Denver, Colorado, also discussed their experiences related to managing rivers in multiple ownerships. As session recorder, I have attempted to summarize my impressions of what transpired during the workshop. No attempt will be made here to identify comments of individual workshop members, rather, this should be reviewed as a product of all workshop participants.

River planners and managers are often confronted with the seemingly insurmountable problem of organizing, developing, and managing river corridors under conditions of multiple ownership. Indeed, it is a rare occurrence when all land along a river corridor is under a single ownership. Thus, the river manager is more often than not confronted with the problem of forging a chain that is made up of links owned by different people. The manager knows that a single weak or missing link will cause failure of the entire river management and preservation system.

Although managing rivers in multiple ownership corridors is an exceedingly difficult job, workshop participants felt that it can be accomplished if the manager is willing to make the necessary effort.

But there are no easy solutions. To even approach the problem, we must recognize that individual land owners, each acting in their own best interest, do not guarantee preservation of a river. Rather, an environment must be created that allows individual owners to cooperate and act in the long-run collective interest. It is the job of the river managers to create this environment.

In trying to get individuals to act together, the river manager must realize that individuals are self-oriented. Yet, a way must be found to foster mutual cooperation. Individuals must understand that nobody really owns a river. Although numerous laws and institutions establish rights to river ownership, in the long run, nobody really owns a river, and nobody is really responsible for what happens to it. River property owners need to understand that they all share mutual responsibility for river preservation.

Thus, an overriding issue exists in the trade-offs between individual freedom of choice inherent in property ownership, and collective freedom and long-term land stewardship. When discussing long-term preservation of a river corridor, we must talk about a desirable balance between these two extremes. Such a balance must be weighted toward collective freedom if a river is to be preserved.

NEW SYSTEM OF SOCIAL ACCOUNTING NEEDED

The system of laws and institutions that govern river management developed under conditions of resource abundance. The problem then was a general scarcity of goods, and resources were used freely to produce these goods. Concern for resource preservation was minimal. These same laws and institutions that were forged to solve problems related to an expanding frontier, underutilization of resources, and need for economic organization, govern actions of today's river manager who must search for solutions to problems related to a

closed frontier, scarcity of resources, and the need to manage for social amenities.

Existing institutions do not provide mechanisms that allow or motivate individuals to act collectively; even if they desire to do so. Individual acts committed for the public good go largely unrecognized. The river manager must consequently work within a largely inflexible institutional structure to achieve the goal of long-run river preservation.

What is needed is a new social accounting system--a system that allows individuals to achieve their own objectives while also achieving broader, social objectives. Such an accounting system must be based on institutional arrangements that overcome divergence in perceived individual interest and the larger collective interest. The manager must try to strike this balance in negotiating programs to preserve and manage rivers.

It is difficult to visualize a new system of social accounting that would not erode individual freedom. Hardin (1968) argues that such a system must be based on mutual coersion that is mutually agreed upon. This idea is not new. Societies throughout history have set up mutually coersive systems to allow maximum collective freedom by curtailing individual freedom. Our system of domestic and international law provides the framework that guarantees collective freedom, yet the system represents a form of coersion, mutually agreed upon.

In dealing with multiple owners, the river manager must foster a spirit of cooperation, where all owners will agree to give up some of their ownership rights for the benefit of the whole. But the agreement on which the cooperative effort is based must be clear to all and must treat all individuals equally. Where individual rights are unreasonably affected, the individual must have recourse and be eligible for just compensation.

Ultimately, a new system of social accounting must be based on a redefinition of common property. Regarding rivers, the definition must recognize that all of us, but not any one of us, have claim to a river resource. Such a system would be predicated on the understanding that collective resources are finite and increase in value as population increases.

ORGANIZING FOR ACTION

Know the Cause for Action

As Schelling (1971) points out, under the immediate pressure of extreme emergencies, people can be expected to act together to their mutual and individual benefit. But if there is nothing heroic, no apparent need for coordinated effort, most people will only cooperate half-way.

In approaching the problem of organizing river management under multiple ownerships, the manager must understand that people will not cooperate unless there is some threat to their own personal interest. Once identified, the manager who is trying to organize cooperative effort can use the issue to promote mutual action. Workshop discussions indicated that the issue to stimulate mutual action can originate from many directions--pressure for commercial development, government or citizen group pressure to designate as a wild and scenic river, or plans to physically change the river itself in a significant way. Whatever the issue, it must be of sufficient concern to all owners involved to get them to act together to their mutual benefit. This issue will serve as the call for action and should be understood by all involved.

Get All Interests Involved

Decisions regarding designation and management of a river have far-reaching impacts. In trying to organize action, the river manager must be sure that all interests are represented and have input into the decision and planning process. Participation of diverse interests cannot be forced, but by providing information and inspriation, the river manager can get most interests involved. It is important that nobody be forgotten and that special attempts be made to involve diverse interests. Where such diverse interests exist, a system should be developed to provide compensation where particular groups or individuals are adversely affected. Channels should also be established to provide arbitration of individual grievances.

Decide How To Organize

There is no best method to organize land owners or river management councils.

Workshop participants discussed various approaches that proved successful under specific conditions. Land owner corporations, land owner coalitions, land trusts and conservation easements were presented as alternative ways to organize land owners toward achieving a mutual goal. Whatever system is used, it must treat each individual involved as an equal and ensure that all have the chance to have an input. Additionally, the system must insure that all owners act together and equally share risk.

Once a system for preserving a river in multiple ownership has been devised, a mechanism must be developed to manage the river. Again, this can be accomplished in many ways, depending on circumstances. Advisory boards, councils, public commissions, government, etc., were discussed as alternative approaches. Whatever system is used, careful thought should be given to the decisionmaking body's advisory or regulation function. Also, the means by which individuals are appointed to the management body need to be carefully considered. Whatever system is used, its responsibilities, scope of activities, and authority must be defined at the outset.

What Incentives Can Be Provided?

Frequent divergence occurs between what people are individually motivated to do and what they might choose to do collectively if given a choice. Individual owners of river corridors must be given an incentive to act together. The problem of self sacrifice in the public interest becomes particularly severe when the individual who acts unselfishly in the public interest finds his neighbor reaping a financial benefit because of his unselfish act. A rational individual response would be to maximize personal gain by getting other owners to act in the "public interest". Unselfish individual acts in the public interest are easily thwarted, and an accelerator effect in the opposite direction may occur.

The river manager must be sure that sufficient recognition and incentives are given to individuals who act unselfishly. But the available incentives are limited. Community recognition may be among the most useful. Tax incentives through reassessment of property values, differential rate structures, or reduction through tax deductible contributions are alternative incentives. Less direct incentives include personal involvement in a project beneficial to the community, involvement in the planning and management process, and rewards obtained through mutual accomplishment. The river manager must rely on all of these incentives to obtain mutual cooperation. But whatever he does, he must remain sincere in his efforts to obtain cooperation.

The River Manager's Responsibility

The river manager occupies the central leadership role in organizing river preservation and management systems. As a public servant, the river manager is given the responsibility to coordinate diverse interests. In this role, he must facilitate activity, rather than direct it. He must act as a missionary in a foreign land, always meeting people on their own terms. In his dealings with land owners and the community, he must establish credibility and foster a spirit of mutual cooperation.

Perhaps more than anything else, the river manager must understand that he is dealing with human nature. He must understand that most individuals act to foster their own best interests. The river manager must try to direct these interests toward collective goals, but he must realize that he cannot change human nature. Rather, he must get individuals to look beyond themselves in achieving long-run collective goals.

SUMMARY

In summary, workshop participants agreed that managing rivers under multiple ownership is a difficult but not insurmountable problem. If the right incentives are provided, if owners are informed and involved, they will generally cooperate. Collective action to achieve river preservation is preferred to outright public purchase, which often creates controversy and discord.

SYMPOSIUM SUMMARY

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ATTENDANCE

Nearly 400 people showed up for the first-of-a-kind symposium on river recreation management and research. This attendance far exceeded the expectations of the symposium planners and was strong evidence of the high level of interest in the topic of river recreation, especially in light of the well publicized severe winter weather that had gripped the eastern and mid-western parts of the country. It seems fair to assume that the 400 people came to Minneapolis in January in response to unmixed professional motivations. Even widespread drought that greatly reduced flows in many streams apparently did not dry up interest in river recreation.

The discussions also revealed a high degree of interest. There was never a lull, and session moderators had their hands full trying to field the constant flurry of questions from the floor in a fair and orderly way. Even in the waning hours of the symposium the attendance remained high; the usual dwindling of the audience was not evident. Similarly, almost no one delivered a paper and then slipped away, as is all too common at such meetings.

Evening sessions were developed on a volunteer, unofficial basis by a number of conference participants. Attendance was surprisingly good, another tangible indication of the deep interest in the subject of river recreation.

Symposium participants were diverse as well as numerous; geographic representation was widespread. Almost all States amd most Canadian provinces were represented. A map near the registration desk was covered with red pins showing the origin of participants--a remarkably wide, even distribution. Two persons from Anchorage, Alaska, took the prize for long-distance travel.

Participants were also diverse in terms of interests and affiliations, although there were some gaps. Government river managers were numerous, representing Federal, State, and special, local districts. Lawyers were there, as were university professors, students, and government researchers. Commercial outfitters, especially from the western white-water rivers, were out in force, but some other segments of the private outfitting industry had little or no representation. Private river runners and their organizations were present, but probably under-represented proportionately. (The lack of expense accounts might be a partial explanation for the shortage of representatives of the private parties.) Absent or very scarce were representatives from some groups with major roles in river recreation--including politicians, river developers and dam builders, equipment manufacturers, youth-serving organizations, and organizations representing urban people and their needs.

GENERAL IMPRESSIONS

The symposium reflected careful planning and much hard work in advance. The preliminary proceedings, including all tha papers, was sent to all participants who pre-registered. Despite a wry comment by Tom Heberlein that this procedure resulted in a high level of "collective guilt feelings" because of failure to read the proceedings in advance, it was my impression that many people had done their homework and the floor discussions showed it.

Papers were summarized, not read, and this worked reasonably well. Most authors highlighted major points effectively within the limited time allotted to them.

Discussions were always active and searching, although there were a few speeches from the floor disguised as

questions. Generally the questions and exchanges of viewpoints were constructive and reflected mutual respect, although acrimony was not entirely absent and at least once the questioning resembled a Perry Mason cross-examination.

It seemed to me, and a number of the workshop reporters as well, that the symposium was a success. I conducted a thoroughly unscientific survey in the halls during breaks and the evaluations were unanimously favorable. I think most of us learned a good deal about a new subject. There is great regional variation in river recreation situations, and this was the first time people had gathered from such a large area to exchange their ideas and experiences.

I thought I sensed some increased understanding and even a little added empathy for "the other side". It was hard not to appreciate just how difficult a position river managers find themselves in, especially if use must be limited. It was also clear that conscientious outfitters face a difficult, changing situation. The growing numbers of private parties also are up against tough problems.

The broadened horizons and empathy were the main results of the symposium, I think, along with many valuable new contacts for future communication. Group conclusions and resolutions were not sought and would not have been appropriate, especially at the first symposium on such a complex, rapidly evolving topic.

The workshops were useful, but the unexpectedly large attendance forced them to become something more formal than workshops. More than 100 people attended most workshops, and that many people with only a little more than an hour available just cannot function as a workshop. However, there were more in-depth discussions of specific topics than were possible in the general sessions. Perhaps if the large attendance had been foreseen, more workshops might have been scheduled.

The program and the papers were better balanced than the discussions. Perhaps because of the background of many of the participants or maybe because of the perception of what are the most pressing current problems, the discussions tended to concentrate on rivers in wilderness-type settings and largely overlooked the intermediate, pastoral, and urban rivers. Several of the workshop reporters also saw this wilderness emphasis in discussions, despite a number of good papers and interesting oral summaries of the urban end of the river recreation opportunity spectrum.

SPECIFIC THEMES DEVELOPED

The emphasis on wilderness was related to the strongly recurring theme of allocation, i.e., for a river on which use is rationed (and these are generally wilderness-type rivers) how is the permitted use allocated to different classes of users--specifically, how much is allocated to commercial outfitters and how much to private parties? This problem surfaced in Roderick Nash's opening paper, kept recurring in other papers, and was vigorously debated from the floor. (Several people seemed to have attended the symposium mainly to defend or enlarge the allocation to their interest group.)

As George Stankey points out in his report on the rationing workshop, allocation is a normative question and is inherently a political issue, largely outside solution by either managers or scientists. However, there surely are aspects of the issue that research could clarify, and opportunities for objective knowledge to narrow the range of disagreement and to single out the normative value judgments from what are basically questions of fact. It was unfortunate that little discussion was aimed at identifying the researchable components of the problem, for, obviously, the symposium was not intended to decide on the politics of allocation.

Another overriding theme throughout the sympsoium was the complexity of the river recreation environment. To a degree usually unequalled elsewhere, rivers are enmeshed in an intricate web of mixed legal jurisdictions, management responsibilities by numerous agencies, diverse ownership, and conflicting recreational and commodity users.

Concepts of rivers as recreation resources have themselves changed drastically in recent history, adding to the complexity of the situation. Rugged, white-water rivers, especially, have been redefined in a revolution in resource perception, described by Roderick Nash. A few decades ago such wild rivers were viewed as dan-

public must play a major role in defining objectives, evaluating management policies and actions, and weighing the tradeoffs involved in many decisions. Agency personnel seemed to accept this role for the public and to see involving the public effectively as a professional responsibility. There were some interesting examples of public participation, particularly the Georgia experience described by Claude Terry.

There were occasional reminders from the audience of the need to be concerned about the loss of free-flowing rivers as a result of dams, diversions, and ground water depletion, but the momentum of the discussions focusing on immediate or short-range river recreation management problems seemed too strong to overcome, and the preservation issue continued to be shortchanged.

River recreation needs to be put in perspective, to be viewed as a part of larger systems. It is one part of an outdoor recreation system, which in turn is part of a much larger system intended to meet a variety of human needs. Temporarily, in focusing on rivers, I think we forgot all about the larger systems they fit into.

Research needs surfaced constantly. One of the most obvious is for basic descriptive data, especially of recreation use. One workshop concentrated on recreation use measurement. Better knowledge of the benefits derived from river recreation and how management affects them was also a common theme, often related to the capacity issue and also the allocation issue. For example, do visitor benefits increase with greater self-sufficiency during the visit? At times, as a researcher, it was a bit disconcerting to see how much was being expected of research, as though some managers had confused scientists with wizards. But, then there were jolts of healthy skepticism, as some managers stressed the need for research's aid in developing practical managerial tools that could pass some sort of cost/benefit test. But, it is important for all to remember that research results will not make the managers' decisions for them--research can only provide a better understanding of the probable consequences of different actions or events and improved knowledge of processes. Managers must still make the decisions in light of objectives and constraints, making use of information from research.

THE FUTURE

This first symposium on river recreation was, on balance, unusually sucessful and made a good start in improving both river recreation management and research's contribution to it.

The symposium could lead, and I hope it will, to continued communication among managers, the public, and research scientists. This communication should lead managers to consider a wider range of policies and actions and choose those that most effectively provide benefits to people. Better communication should also contribute to expanded, improved, and more relevant research.

If the symposium has any of these results, it was indeed unusually successful.

gerous, foreboding, and unnavigable. Controlling and harnessing them seemed to be obviously desirable. Changing ideas, new equipment, and development of new skills led to exploding recreational use and growing concern for keeping some rivers free-flowing.

As a result, use pressures are mounting on a finite, dwindling resource, a point made by Darrell Lewis the first morning and many other symposium participants. This situation is the basic source of the river recreation management problem.

Another key idea, expressed several times by different people, but usually rather quickly forgotten in discussions, is the need to consider individual rivers in a broader context of a system of rivers. A system of rivers must provide diversity in types of use, amounts of use, level of development, and nature of the landscape setting. How to define a balance in types of opportunities within a diverse river system is a critical question.

The need to define clear, specific management objectives for individual rivers was emphasized often during the symposium, but there was also agreement that this has usually not been done well. Management objectives must be the starting point for any consideration of carrying capacity. Capacity is not an intrinsic quality inherent in the rivers--a number that exists, waiting to be discovered. It is a more complex concept, basically an assemblage of impacts on resources and recreational experiences resulting from a given pattern and level of use that are acceptable in the light of management objectives, intensity of management, visitor behavior, visitor perceptions, and site characteristics.

There was much interest in improving visitor behavior to reduce impacts and, in effect, raise capacities by developing a system to license river runners. Obtaining a license would require proof of the would-be river runner's knowledge and skill. The details of operating a license system could become complicated, but the general idea seemed to be favored by many symposium participants.

Tom Heberlein, Joyce Nielson, and Bo Shelby reported that, at least for some rivers, social carrying capacity may be less clearly defined than in other settings studied. Particularly on the Colorado River in Grand Canyon, visitor expectations in terms of solitude were not well crystallized and satisfactions were not strongly influenced by numbers of other visitors encountered. The symposium participants found it hard to believe that crowding and loss of solitude were not still important, and the consensus, reflected in Ken Cordell's workshop report, seemed to be that further research, especially on a wider range of types of rivers, was needed. Concern was also expressed about the need to consider individual, as opposed to aggregate, satisfaction related to congestion. The authors concluded that maintaining certain levels of solitude was desirable, but that social norms, rather than satisfactions, were the key to defining optimum solitude levels. This conclusion seems to bring their work back into the mainstream of previous wilderness carrying capacity research.

Management of river recreation is potentially complex. Many aspects of the setting and its use can be influenced by management in various ways. For example, there are many alternatives to rationing use that deserve thorough exploration by managers before they resort to such restrictive actions.

There seemed to be agreement that river recreation management is in its infancy. Not only has it suffered from a lack of clear objectives, but it has tended to be reactive to crises rather than leading. As management develops and matures, increased coordination will be necessary because of the complex mixture of jurisdictions. The Western Interagency Whitewater Committee is an example of a response to the coordination need for one region of the country.

The roles of public agencies and private businesses, landowners, and organizations are still not well defined, and some sharp differences of opinion on this issue surfaced at the symposium. Many assumed that governmental control was the obvious approach to most if not all river problems. This view was challenged; for example, Wilbur LaPage said, "If you say you don't trust private interprise you are only admitting you are incompetent to work with the private sector."

The necessity for involving the public in government decisionmaking for river recreation was generally recognized. The

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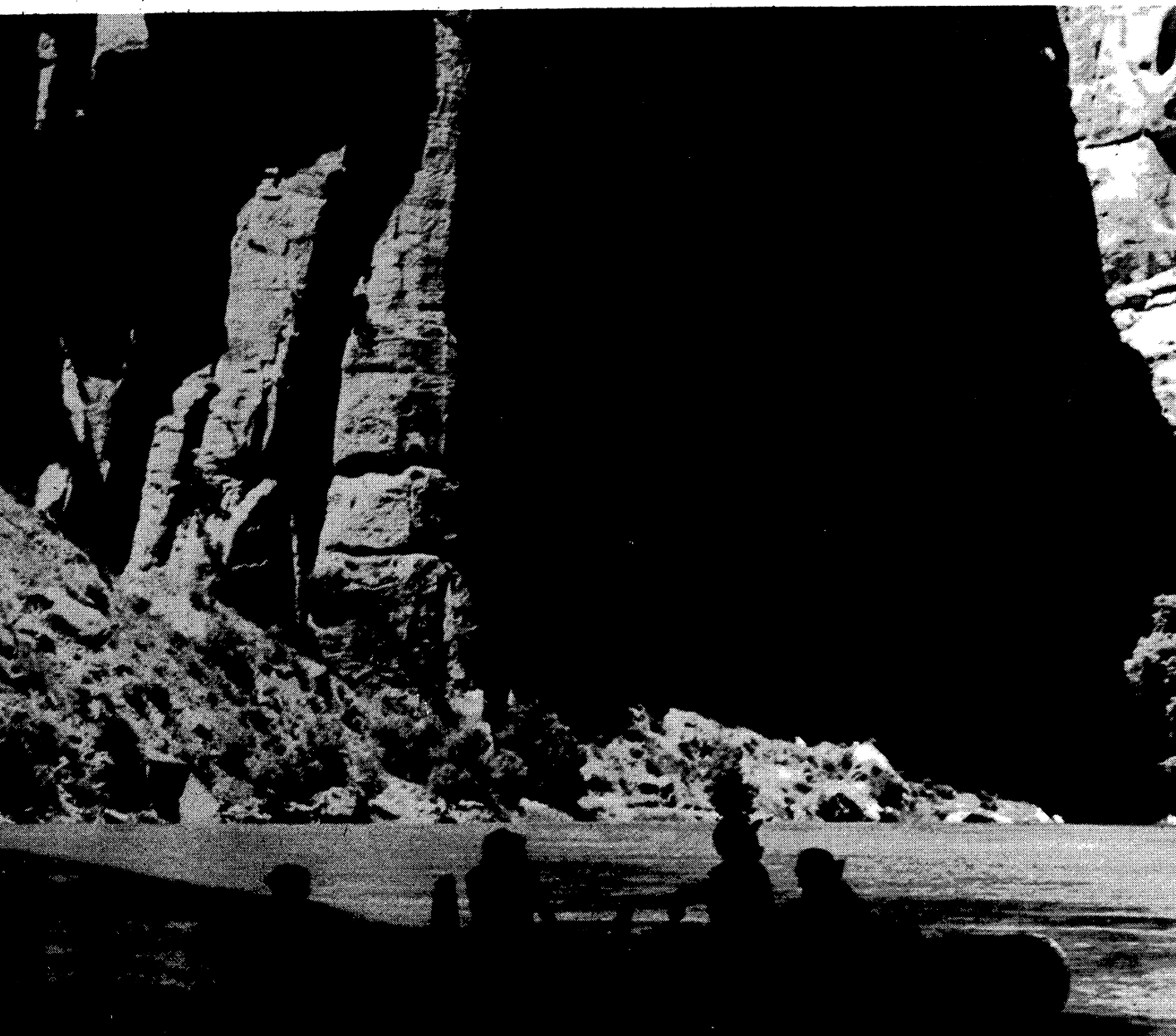

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