# 1976 Inter-University Symposium on Renewable Resource Assessment and Programming: Executive Summary

PACIFIC SOUTHWEST
Forest and Range
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## CONTENTS

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The Forest and Rangeland Renewable Resources Planning Act of 1974 directs the Secretary of Agriculture to prepare an assessment of the nation's renewable resources and a program that will assure an adequate future supply of these resources. Responsibility for this work is assigned to the Forest Service. An inter-university symposium was held in 1976 to evaluate the first *Assessment* and *Program*. The workshop reports and the preparatory studies are summarized here, along with policy recommendations proposed.

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**BILLY G. PEMBERTON** was under contract to the Pacific Southwest Forest and Range Experiment Station as a technical writer to compile, condense, and synthesize the Symposium workshop reports and preparatory studies for publication.

In the Forest and Rangelands Renewable Resources Planning Act (RPA), which became law on August 17, 1974, Congress directed the Secretary of Agriculture to prepare an *assessment* of all the renewable resources in the nation and, for the resources on lands controlled by the Forest Service, U.S. Department of Agriculture, a *program* that would assure an adequate future supply of these resources while maintaining the integrity and quality of the environment.

The first assessment was to be ready by December 31, 1975, and is to be updated in 1979 and each tenth year thereafter. The first Program was also to be ready by December 31, 1975. It was to contain a four-year plan for 1976-1980 and a plan for each succeeding decade through 2020, subject to revision in 1980 and every 5 years thereafter. Each revised program is to cover at least the four successive decades.

The Secretary of Agriculture assigned these responsibilities to the Forest Service, which published drafts of the Assessment and the Program in August 1975 and the finished documents in December. The drafts were reviewed by interested public and private groups, including universities, industries, state and local governments, and other federal agencies.

In September 1975, the College of Natural Resources of the University of California, Berkeley, proposed that the Forest Service join it in sponsoring an undertaking titled "The 1976 Inter-University Symposium on Renewable Resource Assessment and Programming (ISRRAP)." The Forest Service agreed to this proposal and assigned responsibility to the Pacific Southwest Forest and Range Experiment Station at Berkeley, California.

The objectives of the Symposium were to encourage academic participation in constructive criticism of the first *Assessment* and *Program*, so as to provide the Forest Service with assistance in developing future assessments and programs. Certain qualified individuals at universities across the United States were invited to conduct preparatory studies on their campuses during the first 3 months of 1976. At the end of that time, each participant was to submit a report suitable for discussion at the three-day Symposium.

Studies were conducted at and reports were submitted from 10 universities.[1] The Symposium was convened at Pajaro Dunes, California, May 18-21, 1976, where five workshops discussed and reported on the *Assessment*, the *Program*, and the preparatory studies conducted earlier.[2]

This report summarizes the workshop reports and the preparatory studies.[3] Although it was not formally reviewed either by the ISRRAP organizing committee or by the Symposium participants before publication, it does provide a concise overview and synthesis of Symposium material. Specific policy recommendations in this summary were expressed in the workshops, but they do not reflect group judgment by Symposium participants.

The report is organized under three main headings: (a) Congress and the Law, (b) *Assessment* and *Program*, and (c) Information and Analytic Systems. The first chapter covers shortcomings

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[1] Participating institutions are listed in Appendix A.

[2] Symposium participants are listed in Appendix B.

[3] This publication — a condensation and synthesis of Symposium workshop reports and preparatory studies — was prepared by Billy G. Pemberton, a technical writer, under contract to the Pacific Southwest Forest and Range Experiment Station.

and assets of RPA, suggestions for mending the shortcomings, and some reservations about the intent of Congress in enacting the law.

The second chapter covers general and specific criticism and commentary on nine main issues of the response by the Forest Service to RPA. The partitioning of the National Forest System (NFS) into six resource systems — the first of the nine issues — found no explicit support among the critics, although some perhaps lent tacit support by accepting the divisions without comment. Most of the participants, however, took occasion to comment, and most of them emphasized, to varying degrees, the need for an ecosystem perspective that makes classifying the parts secondary to defining the whole system.

The third and final chapter contains material that might more properly have been included as a subdivision of the second chapter. Because this first attempt to fulfill the requirements of RPA strongly suggests that the greatest single need is for more and better and more accessible data, information and analytic systems deserved to be discussed separately. Indeed, if the last system described is as good as it sounds, and if the money can be found to develop it, most of the problems associated with assessing and programming renewable resources would seem to be solved.

## CONGRESS AND THE LAW

A broad and very general summary of the Resources Planning Act of 1974 is provided by the conclusions drawn by one team of critics who submitted the document to network analysis in a computer. RPA, as is true of most legislation, is a simple linear program with few articulate linkages. It functions implicitly, for essential bits of information and process are missing. Through implementation, however, the functional elements will become a more complex pattern of events, and linkages will inevitably become more articulate through experiment, usage, and precedent.

Though the conclusions drawn from such an analysis are themselves rather general, it will be seen that the specific conclusions drawn from non-electronic analyses support them remarkably well.

## ASSETS OF RPA

The RPA has three obvious assets: (1) Establishing a five-year program will help relieve the problems that make managing natural resources on a year-to-year basis impossible. (2) Theoretically, there should be little fluctuation in the annual appropriation without a clearly substantiated change in the program on which the budget is based. (3) The Secretary of Agriculture's required annual reports evaluating the components of the program will improve the Forest Service's accountability and help Congress in its role as overseer.

That the Forest Service must include all 1.6 billion acres of the nation's forests and rangelands in its assessment implies other assets. The assessment could provide the data base for identifying the roles of other Federal land-managing agencies, for providing incentives for private industries and state agencies, and for identifying areas of needed research.

And finally, RPA is a step toward achieving an appropriate inventory of the nation's renewable resources, which, when accomplished, will permit better legislative and executive direction of Federal land-managing agencies.

## SHORTCOMINGS OF RPA

The major flaw (some characterized it merely as an "interesting dilemma") of the RPA is vesting in one agency the responsibility for assessing all renewable resources in the United States, regardless of ownership. Program-planning requirements, limited to lands under the jurisdiction of the Forest Service, seem simple by comparison, and yet their fulfillment would have meant not only anticipating private resource supplies, but carefully articulating the plans between Federal agencies and between Federal and state agencies.

The *Assessment* and *Program* that were developed show that some cooperation occurred, but there is no evidence to indicate exactly how. Apparently, given the time constraints and the obviously deficient data, only *ad hoc* "coordination" was achieved.

To correct this problem, Congress should either give the Forest Service authority commensurate with its responsibility or reorganize appropriate Federal agencies into a Department of Natural Resources. In the second alternative, of course, authority would still be needed to ensure coordination between Federal and non-Federal agencies.

A concommitant flaw lies in Congress' failure to recognize that no methods exist for organizing the kind of data it calls for in the RPA. The Act should have specified such methods, and it should have specified the means of dealing with attendant problems. For example, the RPA requires the Forest Service to plan for meeting steadily increasing demands with steadily increasing supplies, but nowhere does it suggest the possibility of modifying demands.

A third flaw, exposed in a vigorous minority report, is the mountains of paperwork required to satisfy the demands of the RPA. Though such protests seldom have the desired effect, the reservations expressed below add force and cogency to this one.

In RPA, Congress had the opportunity to integrate the assessment and program of the nation's natural-resource subsystem with the full range of public objectives, yet there is much confusion and uncertainty about the intent of the Act. The inventory the Act calls for is time-consuming and expensive, which suggests a strong, committed intent, yet the 1975-76 budget suggests that Congress, in fact, intended very little. The Forest Service may thus be pressed into developing Assessments and Programs which are nothing more than promises "to be good guys and to try hard," legally bound to meet the operational requirements of RPA, but doomed by an inadequate budget to miss the chance to make truly important gains in the management of natural resources.

An obvious hazard is that the full range of landownership and sub-system problems may not be considered in developing the Program. When a demand is defined as exceeding probable supply, for example, the Program may develop a bias favoring a Forest Service activity and precluding a more efficient investment in private resources.

Such a risk could at least be reduced if Congress would confirm its ostensible intent with a budget proportional to its demands. Such confirmation would permit the Forest Service to develop and apply one or more of the analytical techniques described hereafter. Using such techniques — the reliability of which will depend on the specification of the model, which in turn will automatically define the inventory and assessment needs — will ensure that decisions have been based on obvious logic.

**Schematic assessment and program interaction**

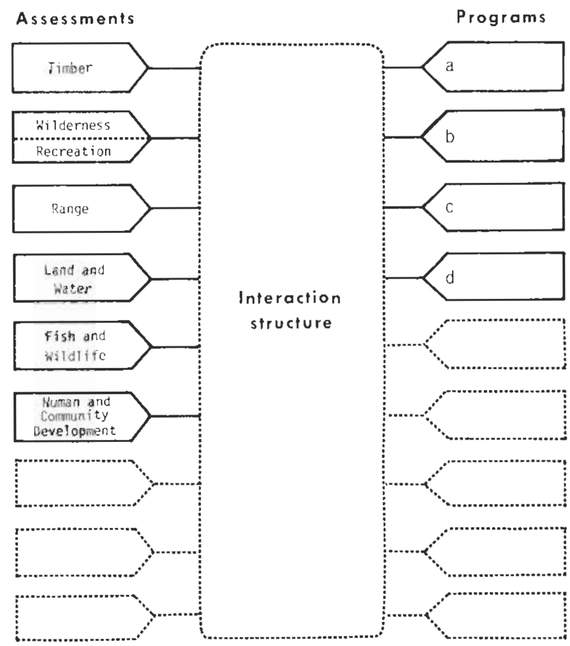



**Figure 1**—The required interactions of Assessment and Programs under the Forest and Rangeland Renewable Resources Planning Act (RPA) are suggested in this structure.

## ASSESSMENT AND PROGRAM

The critics of the 1975 *Assessment* and *Program* universally agree that, given the time constraints, the Forest Service did a remarkable job. And almost universally they add, "Nevertheless, a better job should have been done."

The most significant weakness of the composite *Assessment* and *Program* is the absence of an explicit structure explaining the relations among the various assessments of demands and the various programs that resulted from those assessments. Although the Forest Service is best qualified to judge its own analytical capabilities, the following abstract structure suggests a common formal procedure for dealing with the required interactions (*fig. 1*).

Essentially, the structure should...

1. Be capable of functioning independent of geography, technology, and scale of activities;

2. Accommodate alternative networks consisting of interrelated operations based on (a) a general statement of goals, objectives, and methods; (b) a list of tasks with coordinating events ordered according to their nature; and (c) a test of the

structure for conformity to intuitive experience; and

3. Provide for development of interactive programs that permits continual reworking to deal with problems such as exceeding constraints.

The intent is to create a more rigorous planning process that increases accountability by allowing the agency to retrace planning decisions.

A general criticism of the *Program* is that the Forest Service fails to include a significant discussion of policies, laws, regulations, and such, that might significantly influence the use, ownership, and management of forest, range, and other associated lands. The Forest Service does describe the policy set that acts as a constraint on agency goals and activities, but it does not mention, for example, investment in submarginal timberlands, fee policies for various classes of resource users, or the effect of log-export controls on timber trade.[4]

## SIX RESOURCE SYSTEMS

Most critics agree that the presentation of the six resources creates the impression that the National Forest System (NFS) is made up of discrete systems rather than of integrated, mutually-related parts. To obviate this impression and to maintain the integrity of the NFS, a better approach would be to show these "resource systems" as they really are: outputs of a single system, generated from a single collection of inputs (*fig. 2*).

Contributing to the apparent disintegration is the failure to show explicitly the reciprocal relations between and among the six systems. Obviously, a change in one affects all the others; although such mutual effects are without doubt difficult to assess, some attempt must be made. Substituting "resource *component*" or "resource *element*" for "resource *system*" would provide at least a partial answer.

A more profound failure of this partitioning of systems, and possibly also an effect, is that it stresses the sociopolitical part (economic, political, and technological relationships) of the biosocial system at the expense of the biological part (ecological relationships). The absence of ecological relationships should probably be attributed to the failure to view renewable resources as inherent and inseparable elements of a total ecosystem.

[4] A more comprehensive list is found in Appendix C.

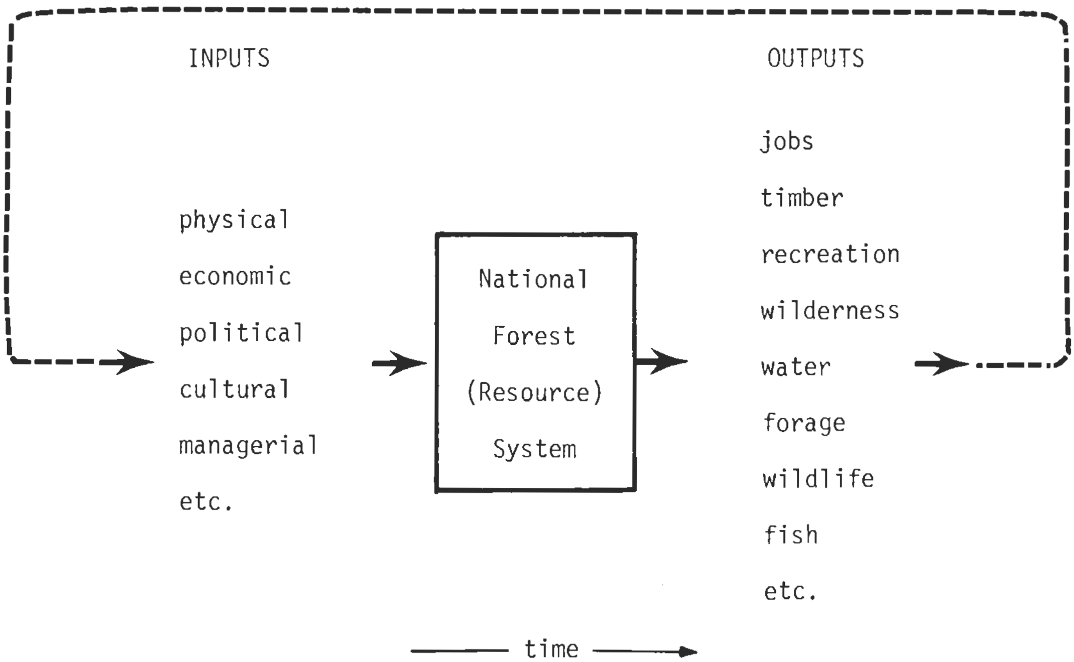



Figure 2—Resource systems of the National Forest System are actually outputs of a single system, generated from a single collection of inputs.

During the Symposium, detailed analyses were done by one or more critics on each of the six resource systems, except Human and Community Development, which as a new resource offered little for analysis. In the interests of economy and because these analyses reveal the same kinds of deficiencies, only the Timber analysis is summarized in detail. What is said about Timber can be taken as generally applicable to the other systems, again excepting the unique Human and Community Development resource, for which a summary of comments and recommendations is provided. The major distinction between the problems found in the treatments of the various resource systems lies in the Forest Service's attempt to assign economic values to essentially non-economic resources, such as Outdoor Recreation and Wilderness.

**Timber**

The timber resource drew a great deal of comment, none of it favorable. One critic found the supply curves unreasonable, the esthetic units unclear, the cost and supply data improbable, the supply-response projections unlikely, the criteria for allocating public funds spurious, and the environmental analyses disquieting. Turning to the major omissions of important objectives, this critic found that there was no discussion of the real alternatives in forest management, including accelerated harvest; no discussion of the necessarily different applications of the *Program* to at least some of the different regions and sites; and no discussion of uses for wood other than for structural materials and paper.

Assessments should be more localized, though quick, modestly detailed studies of a few representative areas should provide approximations sufficient for actual application. And the *Assessment* should include the world requirements for and supplies of timber and timber substitutes in order to provide consideration of timber export as a program alternative.

Though the Forest Service is moving in the right direction with its attempt to provide demand schedules, its projection of timber demands assumes that product prices will remain constant at 1970 levels relative to alternative materials. This is a faulty assumption, for the cost of alternative materials, which are non-renewable and which require more and more expense for extraction and processing, will probably accelerate more rapidly than the cost of wood.

And finally, the data in the "supply" columns imply that production will defy nature by increasing as prices drop, decreasing as prices rise. This paradox leads to the conclusion that the data in fact represent *demand* estimates.

**Range**

Both the *Assessment* and *Program* suffer more from data deficiencies than from a procedural deficiency. Both are vague as to what range improvements should be implemented, where, at what cost, and with what result.

**Wildlife and Fish Habitat**

The data on wildlife and fish habitat are insufficient. Habitat requirements are not known for most species, and systematic estimates of population levels are made only for waterfowl and a few game species.

**Land and Water**

The Forest Service excluded the mineral deposits that underlie much of its land, on the grounds that those resources are not renewable. Nevertheless, provision should have been made for the possibility that decreasing energy supplies will lead to removal of these minerals by strip mining, a process that often leads to erosion and water pollution. Erosion and pollution are directly contrary to Forest Service commitments to improving soil productivity and water quality.

**Outdoor Recreation and Wilderness**

Although the *Program* anticipates continuing increases in population and per capita income by projecting a steadily increasing supply of recreational goods and services, it does not consider whether various alternative goals will induce desired effects for society. There appears to be no recognition that assumptions about population growth and user-fee assessment imply substantial subsidies to users of recreation services; and there is no accounting for the claim that the entire backlog of proposals will be completed by the year 2000 at a cost of 2.9 million dollars, while the single recreation project of the National Registry of Historic Places requires 9.4 million dollars for completion.

### Human and Community Development

First, the Forest Service suggested that Human and Community Development was made up of discrete systems. Then the agency compounded the error by making it a separate and distinct resource system equal to the others. This conceals its relationship to the other "resource systems" and makes it subject to direct control, whereas it is really an output of the whole land system. The Forest Service ought to consider society not as something to manipulate and develop, but as something on which its manipulations of legitimate resources will have an effect. It should ask, for example, how its decisions and programs will affect the job market and the economy.

The business of the Forest Service is to manage the forests and rangelands and the related natural resources, where it has the knowledge to do a good job. The U.S. Department of Health, Education, and Welfare has agencies not only with the knowledge and skill to manage human and community development, but with legislative directives to do just that. If the Forest Service continues with its Human and Community Development as a resource system, it will inevitably duplicate the efforts of and come into conflict with better qualified agencies; and it will waste time and money that could be much better spent.

## SOCIAL-IMPACT ASSESSMENT

Only three sections (3, 4, and 7-d) of RPA refer to social-impact assessment, and they do not directly answer the question of whether social-impact analysis is required for both the Program and the Assessment. Rationally, the answer is "no," because the scope of the Assessment is too broad (covering all the nation's renewable-resource lands) for such an analysis to have much meaning. The Forest Service, therefore, should assess only the social impact of the Program and only on a national scale. Whether analysis should be conducted at lower levels depends greatly on resolving problems relative to other sections of RPA (for example, the aggregation problem).

Four categories of intangibles lie outside the compass of economic analysis and yet are relevant to social-welfare accounts.

### Opportunity Spectrum

Beyond the traditional economic elements are the concepts of *option value* and *existence value*, one of which may be applied to the social impact resulting from an irreversible decision or the implementation of a program. For example:

1. Range and diversity of goods and services provided: The widest range and diversity of goods and services yield the greatest number of consumption opportunities. Restricting this range causes a social impact.

2. Maintenance of options: Some management decisions or the implementation of some programs will characteristically preclude options. They may be termed irreversible and should be evaluated as future options foregone. The dimensions of the impact can be measured by its duration, distribution, and scope.

3. Non-substitutable and irreplaceable goods: Another type of option maintenance is the management decision that irreversibly reduces the supply of resources and intermediate goods for which there are no substitutes (amenity resources, for example). The social impact is measured by the degree to which this supply is reduced and the future options foregone.

4. Existence value: Not all social benefits from renewable resources derive from direct use or contact. Some vicarious benefits come simply from knowing that a resource exists. Management decisions on such a resource cause an impact on these existence values.

The Forest Service should identify the widest range of possibilities for social impact that might result from program activities. This range of possibilities should then be weighed against the other criteria used in determining the alternative program goals. The agency should in fact develop a master list of such possibilities for use by both program planners and field personnel, for use at every level.

### Distributional Effects on Clients

This category deals with the influence of program outputs on identifiable social groups. The two questions to ask are: (1) Who benefits and who pays? (2) What are the sociocultural changes?

The first question can be answered in terms of the *scope* (numbers of people and things affected), *intensity* (degree to which future options are foregone), and *duration* (length of time of impact) of effects on social groups. A partial list of variables describing these abstractions includes type of occupation, education, income, age, sex.

Sociocultural changes include the effects of a program on social structure, subcultures, and population. Effects on social structure are comprised of changes in social stratification and kinship ties. Subcultural effects concern tradition, customs, language, and lifestyle. Effects on population have to do with demographic data such as migration, mobility, and age/sex ratios.

### National Materials and Energy Accounting

The products (*e.g.*, wood) from Forest Service programs greatly influence the use of materials and energy (*e.g.*, petroleum and coal) in the United States. Thus, changes in the agency's wood-production programs and in materials and energy policies not only affect each other, but also have profound effects on society. Wood is related to materials and energy policies in several ways. Wood may be used as fuel, a renewable substitute for fossil-fuel energy reserves. Wood may be used in construction in place of asphalt or steel or aluminum, which requires comparison of the effects of alternative programs on non-renewable resources. New programs may call for conserving capital stocks and re-using wood products. Timber stocks may be maintained as a reserve against future national emergencies.

### International Trade Policy

The United States trades on the international market. We import and export timber and fiber, and we import great quantities of petroleum. Changes in world-wide potential and need for resources can affect us and our natural resources greatly.

An International Trade Policy account is therefore necessary, for economic measures such as National Income do not adequately reflect the environmental and social consequences of foreign trade.

### New Approach

A different approach to assessing social impact has the added feature of involving the public much more directly in decision-making. Traditional methods of assessing social impact leave much to be desired. In seeking to quantify essentially qualitative things — feelings, wishes, opinions — the analysts may project their own value judgments. Furthermore, too often the assessor relies on economic and demographic data or on sampling techniques that emphasize randomness and representativeness; in either event he probably fails to get what he was searching for — the deeply felt community and individual needs, desires, and direction.

The Foundation for Urban and Neighborhood Development (FUND),[5] a Denver consulting firm, has developed a technique that differs two ways from traditional methods: (1) FUND separates the social and cultural elements from the economic, because the economic elements do not contribute information relative to the qualitative problems; (2) FUND has developed a process, as opposed to an assessment, which both diagnoses and seeks to involve all relevant parties in strategies for coping with or avoiding the negative effects of a proposed project. This nonsequential, interactive method is intended to be a learning experience for all participants: private citizens, agency personnel, industrial representatives.

To determine the dimensions of social impact, FUND consultants enter a community as "strangers," engaging people in what they term the "discovery process": they have people describe (1) individual and cultural lifestyles and values and how they are exercised in informal social networks; (2) the movement and interaction of people within the natural environment; (3) individual perceptions of and relationships to social institutions and systems; (4) how individuals and groups perceive work, get training for jobs, and relate as employees and employers.

The object is to identify the mechanisms by which an individual will adapt to and absorb changes that will result from a proposed project, so that specific recommendations may be developed. Each impact requires criteria for measuring performance in mitigating the impact and a time-table for its resolution.

FUND's approach proposes that the community rather than the bureaucracy should find the solutions. Caution should be exercised, however, in assuming that the individual should "adapt to and absorb" the changes. In some instances, resistance to a project might be more appropriate, and efforts to help find means of coping would likely cause resentment and conflict. An alternative, probably superior, would be to make the

[5] Trade names and commercial products or enterprises are mentioned solely for information. No endorsement by the U.S. Department of Agriculture is implied.

plans adaptable to community needs, in which case the social and cultural information collected and evaluated should be made available to the affected people.

## PUBLIC INVOLVEMENT

Most environmental policy acts provide for some citizen participation in forming policies. In recent years this participation has increased, with individuals or groups sometimes asking the courts to require performance by the agency.

There are many ways of getting the public involved, all of which the Forest Service is familiar with. But the most effective methods — workshops that permit education and close exchange of viewpoints — reach a primarily local audience. An effective means of reaching a wider range of respondents is needed, two of which are herewith suggested.

### Charette Workshop

For about 4 months, the Forest Service conducted numerous meetings with groups, individuals, and organizations, soliciting support and public participation. During the last 5 weeks, information was broadcast through the news media, who were invited to cover the Charette meeting scheduled as an around-the-clock workshop to be held on a weekend at the Sam Houston National Forest in Texas.

At the meeting, participants were given packets of data and assigned to teams. Special "consultants" visited the teams to provide additional information as required. On Sunday afternoon, all the teams submitted their alternative proposals. During the next 9 days, Forest Service personnel evaluated these alternatives, rejecting the few that were unworkable, rewriting others for clarification. All the retained proposals became an integral part of a final *Environmental Statement and Unit Plan*.

### Codinvolve System

A Forest Service research team developed this "applied content analysis system" when other systems proved unsatisfactory. It is grounded upon a set of principles and criteria that will provide an accurate, understandable summary of public response. The system can be adapted to any field level (using edge-punch, card-sorting techniques where computer assistance is not available) — and is designed for easy computer operation.

Analysis of public input provides the decision-maker with a display and summary of the opinions for, against, or about the issues in question, and the reasons behind them define the values of the different segments of the public. To make the Codinvolve system function as envisioned, the Forest Service researchers formulated a list of 10 specific criteria for analyzing public input. The method should

1. Summarize the extent, content, and nature of public input in relation to the decision-makers' questions;
2. Be objective;
3. Be visible and traceable;
4. Be reliable, in that the opinions expressed are recorded the same way by different analysts;
5. Provide for uniform application among different administrative units;
6. Be flexible, to accommodate different conditions;
7. Have the capacity to handle large quantities of input, to store and retrieve input, and to assimilate continuing input;
8. Summarize the balance of opinions expressed and describe variations in each opinion;
9. Provide other descriptive and qualitative information about the content and nature of input; and
10. Facilitate environmental analysis leading to preparation of final environmental impact statements by identifying all significant information and arguments for and against the proposed actions.

Since Codinvolve was developed in 1972, it has been used in a number of studies to analyze thousands of inputs from the public. The system has proved to be an excellent tool for providing the land manager (*i.e.*, decision-maker) with objective, undiluted data in a manageable form when the above principles and criteria guide the conduct of the analysis.

## ECONOMIC ISSUES AND METHODS

The *Assessment* and *Program* stimulated many comments about economic issues, some of which have been mentioned elsewhere. Some critics complain that the entire effort is based on economic concerns and values. Others find that the Forest Service had inadequate data, or that it misused the data, or that appropriate methods do not exist. The following examples, chosen almost at random, barely suggest the range and diversity of the commentary on this subject.

### Supply-Assessment Methodology

To serve as the basis for a program, an assessment must provide capital-budget schedules showing feasible production- and cost-alternatives for each resource-system output. These data can then be combined in various mixes to determine the most economical combination for the program, and when a program is chosen, the required budget is known. If place-specific, locally-feasible alternatives were collected at the national level, the program could be allocated back down to the site of origin with reasonable certainty that the budgets would earn the desired responses.

To generate an investment schedule (capital-budget schedule), the assessment must...

1. Identify specific areas;
2. Determine what is being currently produced;
3. Estimate what could be produced under different feasible treatments;
4. Estimate the costs of those treatments; and
5. Rank the prospective increments in supply by the cost per unit of providing it.

Underlying this supply framework is the basic production function for a particular output. For most of the resource outputs, land is the basic factor of production. The amount of output is the quantity of land allocated to producing that output multiplied by the average productivity per unit of area. Output (or yield) is the growth or annual carrying capacity, whether used (consumed) or not:

1. *Current-Production Assessment* — To find a given yield from a specified area, it is necessary to know (a) the number of acres and its productivity class and management intensity; and (b) the average annual production per acre on land in that productivity class and with that management intensity. Multiply these two factors to get an estimate of the current yield.

2. *Stock Assessment* — The land already carries, in some areas, a stock (standing crop) of timber, fish, and wildlife. The current yield of one of these resources is related not only to the productivity of the land, but to the amount and composition of the standing crop, which therefore must be assessed. The method is the same as for finding current production, but the second factor changes: (a) The number of acres and its productivity class and management intensity; (b) average standing crop per acre on land in that productivity class and with that management intensity. Again, multiplying these two factors provides the desired estimate.

3. *Potential-Production Assessment* — A similar but more complex method permits assessment of the possibilities for changing production. In brief, production may be changed in two ways: (a) by changing the number of acres devoted to that output; (b) by changing the management treatment. Of these two, the second is far more complicated to calculate. The problem with the first is a matter of identifying specific areas in order to simplify budgeting allocations.

### Assessment Methodology

There is no market mechanism for establishing the necessary demand functions for such services as wildlife and recreation. The RPA analysts either improvised *ad hoc* procedures that provided illogical relationships (timber), or estimated likely consumption at zero price (recreation). The RPA programmers merely expressed demand (for wildlife and recreation) as an arbitrarily fixed price, regardless of the level of consumption.

A better method would be to fashion synthetic demand relationships from case-study information that indicates that the demand for recreation and wildlife activities is income- and price-elastic (an increase in income causes an increase in demand; an increase in price causes a decrease in demand). These "synthetic" relationships would have to be developed by expert judgment, which means that they would still be only estimates. Nevertheless, they would be better than no estimates at all, and they would have the virtue of being internally consistent.

### Production Function

A better model (than the Forest Service used) would allow better use of the data (than the Forest Service managed), which is inadequate and will probably remain so unless new research is implemented. This model, like the improved assessment methodology, above, would require a panel of experts to render judgment on case data. Here, the object is to synthesize production functions (a mathematical relationship that shows how various inputs are related to changes of output). The test will be whether they contain plausible relationships and appear consistent with general empiric information.

### Cost-Effectiveness

Tests of the internal cost-effectiveness of pairs of goals within each resource system show such wide differences in marginal benefit-cost ratios as to suggest that the proposed program represents a socially optimal program. There is also the uneasy feeling that the programs, including the recommended one, are arbitrary and completely judgmental.

The programmers need, among other things, to standardize the bases on which their cost-benefit analyses are made. For example, benefits to Timber include consumer surplus, while benefits to Wildlife and Recreation assume that the intrinsic social value is equal to an arbitrarily established price that remains the same no matter what goal is selected.

### Supply and Demand

The Forest Service should consider the National Forests as economic entities in which supply and demand are regulated by anticipatory pricing, thereby relieving the pressure on policies which rely heavily on projections of basic variables. It should also make clear the assumptions underlying projections, so that all the decision makers may be aware of the associated limitations.

## AGGREGATION AND DISAGGREGATION

This subject, too, attracted much commentary. Of all the suggested models, the following is the most complex. It is offered as representative because it provides the greatest detail, and because it has the features emphasized in all the models: that local managers participate in assessment and planning, that aggregation progress from the lowest possible level to the national level, and that disaggregation proceed from the national to the lowest possible level.

The assessment and program are separate but interacting activities, each with its unique locational, data, and timing requirements; and each requiring a methodology that permits disaggregation from the national to at least the regional level, and aggregation from the local to the national level.

Three basic questions are relevant to an assessment and programming that begins with a relatively small geographic unit and aggregates information vertically to higher levels:
1. How should assessments be displayed and aggregated?
2. How should assessment data be used to guide program design:
3. How should programs be designed and aggregated?

The answers to these questions imply and are based on precepts embodied in the following process.

### Stage 1: Assessment

The Assessment should begin at the local aggregation unit and be specific to an ownership class (*e.g.,* National Forest, industrial forest). Initially, each planning-unit staff should develop a marginal cost-supply relationship (a "what-if" model, not necessarily a market-supply curve) for each type of good or service to be produced. These would be forwarded to the regional level.

At the regional level, supply relationships would be aggregated and combined with a regional demand model to derive a tentative set of output targets for the region and perhaps for each sub-unit, keeping in mind the regional- and national-welfare interests. This process would also yield a set of relative prices for the various outputs as well as a first approximation to the portion of the total output to be supplied from the National Forest land, thus completing the first stage of an interactive process.

### Stage 2: Program

In the second stage, analysis centers on program design. Each local planning-unit staff would develop programs for a series of alternative budget levels administratively specified at the regional level. These alternative budgets would represent incremental additions to or subtractions from a current base-level budget. Each program would be described as program inputs and an *output mix*. *Relative prices* from the regional assessment analysis would guide decisions regarding this mix, although they would not be binding, and thus could be adjusted to reject a local situation. In fact, these relative prices may be negotiated in the planning process; that is, the final set may most likely appear as the result of the iterated process.

Local alternative programs would be aggregated at the regional level, thus yielding a regional output mix for each alternative budget. A set of relative prices would emerge at this point, to be checked against the assessment stage set for consistency. After making adjustments to achieve internal balance, programs would go forward to the next higher administrative level.

A number of conclusions should be pointed out:

1. Neither the aggregation framework nor the process model are practical for total adoption by 1980, but they do provide a recommended framework for assessment and programming for the period beyond.
2. To some, it may seem that the assessment model recommended here places undue emphasis on economic efficiency and prices at the lower geographical and administrative levels. This state of affairs is unavoidable. Any program-design work as mandated by the RPA will require this level of emphasis on economics, and it is better to have this element explicit rather than implicit, as was the case in the 1975 effort.
3. The recommended process presumes that the cycle of assessment precedes the cycle of programming with sufficient lead time, probably 2 to 3 years.
4. Future assessment, program-development, and implementation efforts will require personnel with substantial skill in data analysis and model development at the lowest and middle levels.
5. Guidelines regarding standards for data analysis and program design must be developed for uniform application at every level.
6. The conceptual recommendation stated herein for the dual efforts of assessment and programing in part extend beyond the state of the arts and in most cases lack systematic empirical verification. These existing constraints, however, underscore the need for a continuing research program to parallel and support the adoption of these recommendations for future RPA assessment and programming.

## INTERAGENCY COORDINATION

The Forest Service has to have the cooperation of various entities outside its own agency, yet it has no power to command that cooperation. It therefore must invite others (*e.g.*, U.S. Department of Interior) to participate on its planning committees. It can establish advisory committees at the various levels and invite outside participation appropriate to each level, and it must work out cooperative agreements with the other Federal agencies responsible for forest and range lands. The object of these efforts is to secure needed data and improved programming techniques, and to help create a consolidated information system.

Similar cooperative ventures should be established with state forestry divisions, university forestry departments, and forest industries. Persuasion and tact might gain voluntary cooperation, but grants for seminars and research should be considered if funds are available; and private industries might be prompted by offering them technical assistance, forest protection, and other inducements.

States with considerable areas of state forests should be encouraged to formulate complementary RPA programs of their own, especially in their land-use planning. Critics of the Jackson and Udall national land-use planning bills have unjustly but effectively aroused much public antagonism to such bills on the grounds that they represent Federal intervention. The present approach should circumvent that antagonism by sharing the data it gathers with the National Resources Council, which in turn uses it to project resource policies of value to the various state and local planning agencies.

Essentially, this approach avoids the planning-from-above that many critics fear. It offers, instead, a method by which local planning provides the basic data for national resource assessments and a national means of dealing realistically with local problems.

## FOREST SERVICE REORGANIZATION

In order to meet the requirements of the National Environmental Policy Act and RPA, the Forest Service must undertake integrated interdisciplinary planning and incorporate extra-market values and meaningful public participation. Hiring a few non-foresters for staff positions is not an adequate organizational response, because forestry professionals continue to dominate the top policy-making positions.

Instead, the Forest Service must completely refurbish its organization. The planning process should be aligned with the budgeting process in order to increase coordination and reduce conflict over goals, jurisdiction, financing, and accountability. Policies that need articulating are criteria for evaluating social and cultural effects at each level; a decision-making process for the gathering of data, the development of alternatives, and the participation of the public; and a methodology for coordination, both laterally and vertically.

To achieve these ends, multi-disciplinary (social science) personnel must be made available at all levels, because regular USFS personnel have not the appropriate conceptual and analytical skills. These professional social scientists, using a variation of the FUND process (described above) whereby they are the "strangers" and the Forest Service is the "community," will train other personnel in social-impact-assessment methods, in group-process skills (including conflict management), and in dealing with social and cultural problems in routine work.

A more complex organizational change is necessitated by the intrusion of the non-foresters, whose presence and work have differentiated the organization, have made it less capable of coordination, both internally and externally. Internally, better communications, education, and training will of themselves help to effect coordination, especially if planning teams include representatives from other levels. Externally, consultants can mediate among the diverse elements trying to make planning and program decisions. Flexibility at the local level may work to direct meaningful social change and preclude conflict. If they can be made credible to the public, staff members might themselves be taught to mediate.

## ECOSYSTEM PLANNING

*Ecosystem* may be defined as "the interactions of the living and non-living parts of the environment." Within the environment, an ecosystem functions by maintaining a flow of energy and a cycling of materials. The materials cycle continuously between the living and non-living elements. The flow of energy, on the other hand, is noncircular, comes mostly from the sun (some comes from fossil fuel and nuclear processes), and ultimately dissipates as heat.

Because ecosystems are the basic production systems for a society, and because the national economy is a system for processing matter and energy to serve human needs as efficiently as possible, it makes some sense to develop budgeting systems in which the units of measurement are quantities of energy and materials. Decisions about the mix of inputs and outputs in a given ecosystem may be described according to how they modify the flow of energy and the cycling of materials. These decisions can then be evaluated by economic or other social values.

The renewability of a resource really depends on the magnitude of the energy flux (the quantity of energy) and the time required for renewal. Renewability can thus be expressed only in terms of the rate of resource formation with respect to human values, technology, and planning horizons. In other words, any resource is theoretically renewable. Once we determine, by analysis, how much energy is required over how long a time, then we can, by evaluation, determine whether we want to make that expenditure of energy and time.

The Forest Service's product-oriented approach to planning has three basic flaws:

1. It is too simplistic; it underestimates the multiplicity of values, goods, and services provided by forest and range lands (the *Assessment* and *Program* failed to mention at least 60 specific renewable resources);
2. Its static classification of natural resources assumes that the current definition of natural resources will obtain in the future; and
3. It provides no framework for analyzing the social and ecological interactions among the resource systems.

Future assessments ought to examine the fundamental ecosystem processes involving the flow of energy and the cycling of materials in order to provide a more comprehensive basis for long-range planning. If it has not already become so, the traditional multiple-use approach will soon become obsolete, when the multiplicity of new demands becomes apparent.

A second report applies energy-accounting methods to California chaparral in order to demonstrate how accounting for all the energy in plants and fuel reserves provides the needed scientific basis for a socio-environmental methodology that avoids politics by separating analysis from evaluation.

## INFORMATION AND ANALYTIC SYSTEMS

Demands for renewable resources have increased more rapidly than have the manpower and budget required to meet those demands. Now, RPA mandates even broader responsibilities for the Forest Service, which means that new systems techniques — some already developed and proven — must be pressed into service: inventory and overlay systems for classification and assessment, resource-allocation models and benefit-cost analysis for the program, simulation models for analysis of basic inventory data, and the rigorous land-classification model that does everything but chop the trees.

## INVENTORY

One of the RPA requirements is for the assessment to contain an inventory of present and potential renewable resources, which implies a classification system. In such a system, a manager needs to have a clear understanding of his purpose in order to determine what types of data are required: What resources and how much detail? Generally, the greater the detail, the better.

Traditionally, the Forest Service has inventoried resources by the slow and costly "single factor" surveys (*e.g.*, topograpic, geologic, vegetative) rather than by a faster and less costly method such as physiographic terrain analysis, which uses air photo and other remote-sensing methods. If the Forest Service continues to use this method, an overlay-mapping system is essential for determining the relationships between resources in order to get at the potential supply. Designing the resource inventory around an automated geographical data-base, for example, would permit computer testing of interactions between resources and would yield an informative report on potential production.

## OVERLAY MAPPING

Two overlay-mapping systems for representing resource information in a computer, *grid cell* and *polygon*, have seen limited use within the Forest Service.

In the grid-cell system, a base map is overlaid by a cellular map, each cell of which is then coded according to a predetermined classification scheme. Though a cell may feasibly represent any area, the smaller the size of the cell, the greater the detail. Many different grid-cell programs are available, all easily but tediously coded for computer manipulation and all useful tools for examining the characteristics of geographical areas. The map may not conform to what the manager is accustomed to reading, but it can be made easier to read by coloring or shading or by contrasting coding symbols.

The polygon system was designed to make up for deficiencies in the grid-cell system. It is more realistic and more esthetic; it avoids the tedious coding each grid cell requires; and most importantly, it permits aggregation of data. As with the grid-cell system, many different polygon programs are available. Although the polygon system is technically more complex than the grid cell, it gives ultimately superior results.

## ALLOCATION MODELS

Resource-allocation models range from simple linear to complex non-linear. Many have been developed by or for the Forest Service. These models — which consist of mathematical routines that, given a decision criterion or criteria, match resource capabilities and potential with use demand — are well adapted to the agency's needs. Four representative models are described next.

### Timber RAM (Resource Allocation Method)

The Timber RAM uses linear programming to achieve any one of five possible objectives: maximize gross revenue 1, maximize gross revenue 2, maximize net revenue, maximize the volume harvested, or minimize cost. The resource area should be stratified into timber classes, the alternative silviculture treatments designated, and the objective defined. Each silvicultural alternative requires information on growth, net revenue, volume, and costs. In addition, constraints on accessibility, harvest needs, allowable cut, and budget availability may be entered. Although it is limited to considering a single resource and a single objective, it has great potential for use in local planning for scheduling timber harvests over a long period of time, which it does efficiently and economically.

### Resource Capability System

Based on linear-programming concepts, the Resource Capability model is used for multi-resource planning, and includes a procedural-planning framework and a systems-analysis approach to forest and local planning. It schedules multi-resource strategies over time, allocates acreage to specific management activities, and identifies levels of output for each product in response to this allocation. Parametric analysis permits the user to see the effects of changes. Already in use in several regions, this system has future possibilities at both the forest and local levels.

### Goal Programming

This multiple linear program allows multiple objectives in different units of measure. It attempts to meet the needs of the goal with the highest priority before considering others. As it considers progressively lower goals, it does so without detracting from the higher goals. The program has been used at the regional, forest, and unit levels and *can* be used at any level. It can be used at all levels of RPA assessment and programming, and can serve to improve communication between levels. If the alternative programs set forth by the Forest Service were assigned priorities, this system would provide ideal analysis.

### Economic Harvest Optimization (ECHO)

This dynamic program model incorporates a binary-search technique. ECHO joins a biological-yield model with an economic model and charts the optimal rate of timber harvest in a condition of excess inventory. Although it is economically efficient, used by the Forest Service it would doubtless lead to a mis-allocation of resources, because it can reveal only the most profitable course, which is not always the best.

## BENEFIT-COST ANALYSIS

A project is economically feasible when the benefits accruing with the project are equal to or greater than the cost of the project plus the benefits that would accrue without the project. Although neither the tangible benefits and costs nor their monetary value can always be easily determined, such a procedure forces the decision-maker to consider objectively the merits of a proposed project. Thus it is valuable even when economic efficiency is not the main criterion.

## SIMULATION MODELS

Simulation models identify the important characteristics of a system and lead to a better understanding of its components and of the relations between components. Until the last 2 or 3 years, these models were limited by being site- and problem-specific. Recently, however, the models have become more generalized and thus more practical, although they have dealt primarily with only two resources (timber and water) in a multiple-resource system. Following is a timber model which will, at some future time, accommodate other resources and products.

Economic efficiency is, as specified in RPA, important to any planning process. Equally true, society should get any given level of timber production at the least cost in resources.

This framework will directly address the call for more disaggregation in Assessment and Program analysis because one of its economic dimensions is space. It will also address obliquely the need to consider explicitly the interactions between the multiple products of the forest and rangelands. Once this framework is drawn, other resources and products can enter the analysis either in complement to or in competition with the timber system.

Of the many characteristics relative to timber production, only three — space, form, and time — will figure here as dimensions of the timber economy. Others are land quality and operability — functions of soil, climate, and topography — which determine not only the biological potential of land to grow wood but also the total resource cost of managing and harvesting the wood grown. Still others are ownership, tract size, timber size and type, accumulated inventory of timber, and alternative land uses.

An even more important characteristic, but one that is often ignored in planning, is nearness to market. Transportation can amount to as much as a third or more of the selling price. Because it is more efficient to haul processed lumber than roundwood, the manufacturing plants usually locate as near the timber source as possible.

All of these characteristics vary over space. The variation is small *within* a homogeneous timber region, but large *between* timber regions. In national planning, therefore, it is necessary to aggregate the commercial forest lands into a system of geographic timber — supply regions, each of which is homogeneous as to the spatial characteristics that determine the efficiency of growing, harvesting, and processing timber.

Transportation costs provide the economic link between those regions and the regions of another set that center on major urban areas and describe geographic wood-consumption patterns. Each region of each set has an economic center-of-gravity, which means that all possible trading routes and all transportation costs can be calculated for items that move inter-regionally.

Some timber regions are nearer their market than others are, so that transportation costs are lower. Others may have lower harvesting or processing costs. In the long run, the supply regions with the lowest costs for delivered products will have the highest stumpage value, which value is a direct measure of the efficiency with which each region supplies society with timber products.

As an economic dimension, *form* refers to the alternative products that a resource or raw material can produce. From timber comes, for example, pulp, lumber, plywood. The precise use to which it will be put depends partly, of course, on what will allow the buyer the greatest profit, but it also depends to a high degree on timber size and species. Thus, the species and size distribution of the timber within a supply region has great analytical significance.

The lack of an adequate processing plant could for a short time prevent the best allocation in the form dimension, but entrepreneurs would quickly correct such a deficiency by relocation or expansion.

Forest growth and renewal occur only over a long period of time, but harvesting and processing, spurred by consumer demand, build up rapidly to deplete the timber faster than it grows. Necessarily, the most intense production will develop in the best locations; and as the inventory begins to fail, mills will be abandoned for lack of timber or relocated on better sites.

Program planners must consider the economics of long-range regional advantage in the wood industry, for the industry will likely refuse to go where there is not maximum cost-effectiveness.

The Model-Timber is the basic unit of analysis: (a) the national market for wood products is divided into 23 demand regions; (b) consumption is divided among 11 primary wood products, and requirements over time are specified in the demand regions; (c) aggregate commercial forest land and timber resources are broken down into 17 supply regions; (d) timber is cross-referenced by owner and species/size distribution.

A linear programming (LP) model — representing the company that cuts, processes, and transports the wood — describes the production possibilities and costs of translating each supply region's timber into delivered products. Processing capacity and timber availability constrain production. Timber is allocated, on the basis of efficiency (minimum total cost), through processing plants within the supply regions and out to consumption regions to satisfy demand requirements. For each successive time period, the timber is grown, then cut to meet consumer requirements.

The details presented here are representative, not complete. The point is that organizing the vast array of data for the timber system alone demands the use of such an interdependent framework. And once the framework exists, more variations are possible. Adding new constraints, activities, and coefficients should offer an even broader range of strategies and programs; and modifications would permit interactions with other systems. The capacity of this kind of framework is the capacity of the computer.

This framework represents planning from the top, for in the future, definite national production-levels must no doubt be established as policy in order to meet basic living standards. The logic of a framework will, when regional allocations are communicated to the local level (as they must be), help ensure that local planners maintain their priorities under local pressure.

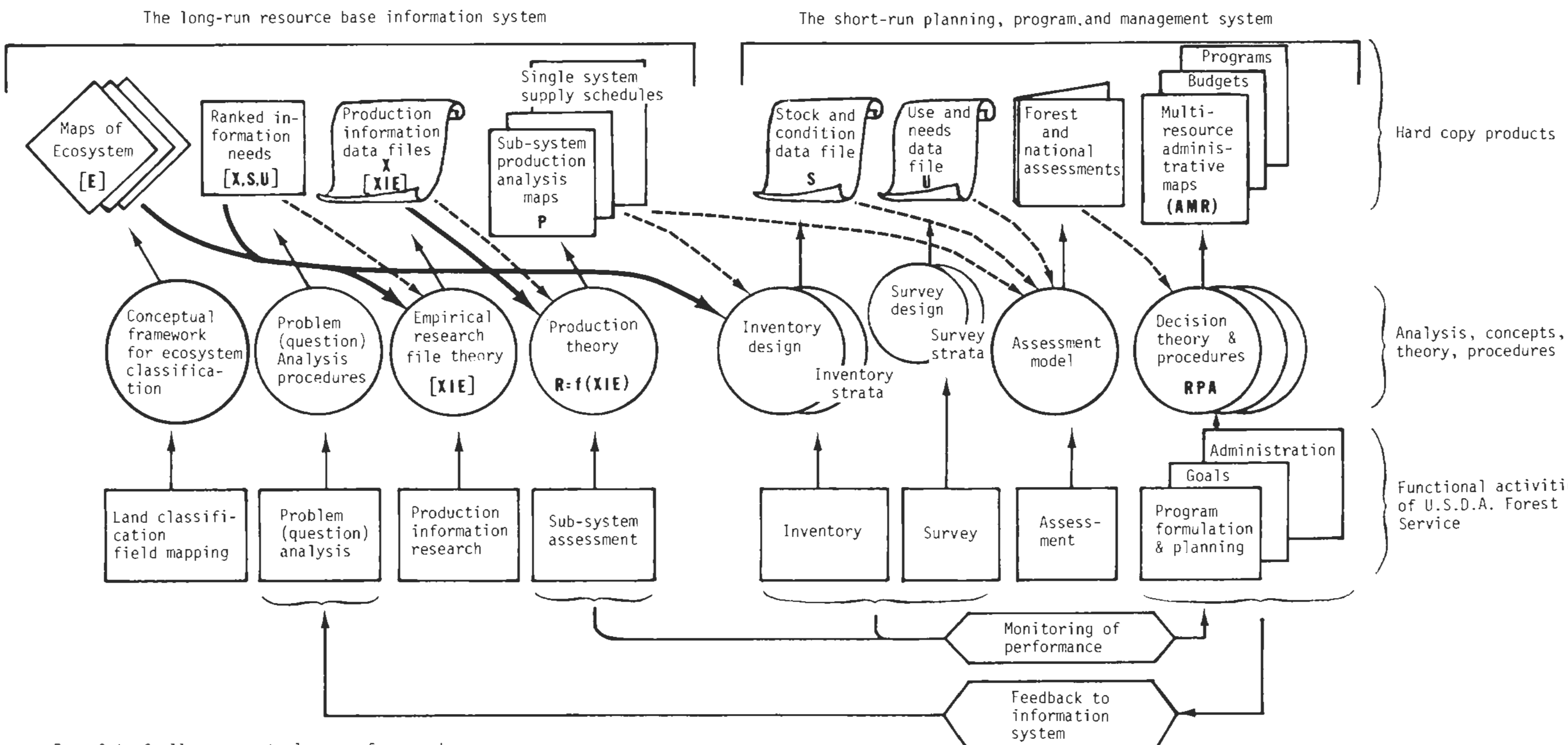
## LAND-CLASSIFICATION MODEL

Traditionally, classifying and mapping land and aquatic resources has been used only to define for particular cases, not for stable attributes of ecosystems in general. It has provided a meaningful tool for specific information at particular locations for a limited time period, but the information gathered has not been generally useful or applicable to other locations.

The needed system will succeed or fail as it provides a useful, cost-effective vehicle to store and retrieve a wide range of relevant management information. It will have three basic parts: an identified set of information needs, a classification system, and a delivery system that relates the information to the classification system and delivers it in usable form to the manager.

How effective the system is — that is, does it work? — can only be determined by empirically testing the two critical assumptions, which it shares with all classification systems: that the system contains the needed information (and, of course, that the manager can ask the right questions); and that the types and precision levels of information needed by the manager can be related to (predicted by) the set of discrete classes for ecosystems.

This system must fit the needs at every level, from local to national, but because the local land manager has the most precise, place-specific, frequent, and varied needs, the system should be




E - Set of all component classes of ecosystems
X - Set of all production information
S - Set of all stock or current condition information
U - Set of all use, consumption and demand information
R - Set of mapped delineations for production analysis of sub-systems
AMR - The operational multi-resource management map showing land allocations to sub-system production and allocation of management treatments

**Figure 3**–Structure shows how a land-and-water classification system is related to the Forest and Rangeland Renewable Resources Planning Act and to a management system.

designed to treat him as the primary client.

Such a system will require much time and money for completion. It must therefore have a stable "building-block" structure, which means that each part of the system is permanent (that no new part will have to supersede an old), that it must be useful when partially completed, and that the most important parts should be built first.

The system should have the following characteristics:

1. *Component Classification* — A component-classification system allows great flexibility and a more universal applicability than any other. An integrated system, for example, pre-determines the way components are combined and makes value judgments, selecting only the situations it was designed for. A component system does not restrict the user to any particular component or set of components; he may choose what works best for him in his area, or try different components for better solutions, because the number of possible combinations and permutations resembles the continuum of the real world.

2. *Hierarchical Classification* — A hierarchical classification has different levels of different degrees of resolution or generalization. Each higher level is more generalized than those below. Each higher level is an aggregation of those and only those classes immediately beneath it; therefore, all classes are mutually exclusive. If you know one class at any level, you automatically know all others above it.

3. *Objective* — The boundaries should be permanently fixed so that generalizations can be made about the entire class; otherwise, marginal units might get into the wrong class as a result of interpretation or whim. Objectivity will eliminate interpretation and ensure that all users will make the same choice.

The system is described as it would be used by the local manager, who will conduct the primary inventory and assessment work to transform local ecosystem and economic and political reality into feasible system-production alternatives. That the local system can be aggregated to and disaggregated from the state, regional, and national levels makes it implicitly usable at the national level. The system would also handle the assessment of non-Forest Service lands.

The system may be represented graghically as three horizontal rows of eight components each (*fig. 3*). The top row is composed of "hard copy" products (maps, information files, etc.). The middle row represents a set of theories or analytical procedures. The bottom row is the functional activities. Bottom-to-top linkages show that a function works to produce hard copy, while left-to-right linkages show how each succeeding function draws on the previous hard copy to provide its own output.

The following list names the components this land-and-water classification system will need, with an abbreviated indication of their functions:

1. Land Classification — The function is mapping, and the product is a map or a tabular summary of area distribution.

2. Production Information Research — This function collects and compiles the production information and stores it in an information file.

3. Sub-System Assessment — This analyzes the resource base.

4. Inventory — Under a narrow definition, this collects information about the current stock, status, and condition of resources, *i.e.*, the information set.

5. Survey — This determines the rates, location, etc., related to resource-system output.

6. Assessment — This is a function of the scope and purpose spelled out by RPA; aggregates to the national from the forest level.

7. Program-Planning and Decision-Making — This sets goals, plans land use, involves public, and such.

8. Monitoring and Feedback — Mainly, this monitors the incremental information obtained from survey and inventory and evaluated at the program level.

At present the accounting of current and potential production is based on land delineations that are defined on current-use ownership, administration, and current conditions. Establishing this new system would shift that accounting to the permanent and potentially much more useful delineation defined on a land-and-water ecosystem base.

Costs would be high, both in money and in time, and the new system would greatly affect survey, inventory, and research. And yet the gains would be much greater. The first components to get are land classification, question analysis, production information research, and the sub-system assessment activity, along with their hard-copy results and information storage and retrieval technology.

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## APPENDIX C–REPORT ON WORKSHOP D
## OBJECTIVES AND REQUIREMENTS OF THE ACT

It was our opinion that the goals of Congress in passing this legislation were to obtain:

1. Better picture of overall program alternatives and their consequences;
2. Greater control of policies and budget making vis-à-vis the President and the Office of Management and Budget (OMB);
3. Basis for matching the Forest Service proposals

with those of other agencies; and

4. To minimize the number of special action issues and hassles they would have to resolve.

Similarly, we believe goals of the Forest Service in supporting the legislation and in implementing its requirements are to obtain:

1. Better picture of overall program alternatives and their consequences.

2. Greater control of policies and budget-making vis-à-vis the President and OMB;

3. A larger budget;

4. Insulate programs from sporadic attacks, and budgets from short-run fluctuations; and

5. To gain more visibility and support in Congress.

To achieve these purposes we suggest the Forest Service should develop a much more explicit analytical framework than the "analytical framework" of the current RPA. An explicit framework would permit sensitivity analyses which would reflect changes in *variables of immediate interest* to Congress and which are subject to policy changes. This framework would not only be able to handle the long-term requirements of the Act, but also provide qualitative and quantitative response information related to *short-term* contingencies.

We assume almost all phases of the assessment and program would be strengthened in the 1979-80 plan; and even further improved in 1989-90. Specifically, we would urge attention be given to the following phases of the assessment:

par (1) "An analysis of present and anticipated uses, demand for, and supply . . ." Conduct the analysis using a formal supply and demand model in a traditional economic framework. This model should contain a foreign trade as well as domestic sector.

par (2) "an inventory . . ." A formal benefit cost analysis is recommended for the evaluation of opportunities to improve yields of tangible and intangible goods and services from renewable resources.

par (3) "a description of Forest Service programs " . . . and an analysis of the relationship between these programs and responsibilities "to public and private activities" requires strengthening. Particularly, this should require formal joint planning at the secretarial level to determine national goals and output targets for each of the output systems (Recreation, Wildlife, Range, Timber, and Land and Water), subdivided into agency targets, and then submitted to Congress for modification and approval. This is essential to assure that Forest Service programming will be based on national and agency targets that are compatible with those of other federal agencies with major responsibilities for a Range, Recreation, etc. This may require additional legislation.

par (4) "a discussion of important policy considerations . . ." This is currently the weakest section of the assessment and therefore requires particular attention. Specifically, we recommend these analyses:

1 Various interpretations of the even flow timber harvesting policies, and its effects on price and output fluctuations in the public, private and international context.

2. Federal timber export and import policies.

3. Effect of public programs aimed at production of timber and other system outputs from private lands.

4. Improvements in social impact analysis of various system output configurations.

5. Effect of annual budget deviations from program requests.

6. Effect on lumber price fluctuations of National Forest sales of federal logs rather than stumpage.

7. Effects of various rationing devices for recreation, such as user fees, reservations, high concessionaire prices, etc.

8. Effects of various incentives to improve program implementations, such as budget reductions for districts which fail to fully implement programs; premiums for those which achieve program targets; and bidding by districts on forests for right to produce specific system outputs.

9. Opportunities to affect and/or alter demand for various forest outputs as an alternative method for "balancing" supply and demand relationships.

In addition, we recommend legislative modification of the assessment schedule, moving it forward 5 years to be able to take advantage of new census data, rather than using data 10 years old. We recommend proceeding with the 1980 assessment and then adjusting the schedule.

In developing future Forest Service program plans, in accordance with Section 3 of PL93-378, we recommend strengthening all phases, particularly . . .

par (2) for Program outputs, improve the estimates of costs and related benefits.

par (3) develop a much more comprehensive and useful discussion of priorities and array of Program opportunities.

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