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The Use of Recreation Planning Tools in U.S. Forest Service NEPA Assessments

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Abstract U.S. Forest Service managers are required to incorporate social and biophysical science information in planning and environmental analysis. The use of science is mandated by the National Environmental Policy Act, the National Forest Management Act, and U.S. Forest Service planning rules. Despite the agency's emphasis on 'science-based' decision-making, little is known about how science is actually used in recreation planning and management. This study investigated the perceptions of Forest Service interdisciplinary (ID) team leaders for 106 NEPA projects dealing with recreation and travel management between 2005 and 2008. Our survey data show how managers rate the importance of social and biophysical science compared to other potential 'success factors' in NEPA assessments. We also explore how team leaders value and use multi-disciplinary tools for recreation-related assessments. Results suggest that managers employ a variety of recreation planning tools in NEPA projects, but there appears to be no common understanding or approach for how or when these tools are incorporated. The Recreation Opportunity Spectrum (ROS) was the most frequently used planning tool, but the Visitor Experience and Resource Protection (VERP) framework was the most consistently valued tool by those who used it. We recommend further evaluation of the strengths and weaknesses of each planning tool and future development of procedures to select appropriate planning tools for use in recreation-related NEPA assessments.

Keywords Recreation planning · National Environmental Policy Act (NEPA) · US Forest Service · Travel management

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Introduction

Scientific management has long been a critical component of decision-making in U.S. federal land management agencies, where for most of the twentieth century, trained foresters and range specialists made 'expert' decisions about public lands based on scientific data and use of science-based tools and models (Dryzek 1997; Kaufman 1960). In the U.S. Forest Service ("Forest Service"), science has been identified as the basis for resolving natural resource problems and for conducting planning and decision-making activities (Hoberg 2004). The use of science for forest planning and assessment is mandated by laws, such as the National Environmental Policy Act (NEPA) and the National Forest Management Act (NFMA), as well as the agency's own planning rules. In recent years, agency decision-making has incorporated greater public involvement and faced increased scrutiny, but the emphasis on science-based decision-making has not waned. The integration of biophysical and social science in decision-

making forms a core element of ecosystem management, which has been adopted by the agency as a management paradigm (Butler and Koontz 2005; Cortner and Moote 1999). 'Science-based' decision-making has become embedded in agency culture and practice, yet little is known about how science is actually used in planning and decision-making.

NEPA, Science, and the U.S. Forest Service

The National Environmental Policy Act (NEPA) requires federal agencies to assess and disclose the likely impacts of a major project or decision with potentially significant effects on the environment. NEPA is designed to inform decision-makers, agencies, and the public about the likely environmental consequences of government actions through a set of general process requirements (Caldwell 1998; Dreyfus and Ingram 1976). NEPA stipulates the use of "a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment" (Sec. 102 [42 USC § 4332]). Thus, NEPA analysis requires an integrated understanding of scientific principles and the ability to synthesize and apply relevant knowledge into various stages of the environmental assessment process. The level of documentation required depends on the scope, scale, and potential effects of the proposed project. An environmental impact statement (EIS) is developed when projects are deemed to have significant effects or broad scope. An environmental assessment (EA) is the preferred pathway for less complex or smaller-scale projects (USFS 2010a: FSH 1909.15). Other factors determining the NEPA pathway have been identified, including threat of litigation and potential for public controversy (Stern and Mortimer 2009).

Individual federal agencies are responsible for determining how science is incorporated in NEPA. The Forest Service is responsible for managing 155 national forests and 20 grasslands (193 million acres) scattered throughout the U.S. and its territories. Agency decision-making structure is hierarchical, with "line officers" at each level of the agency responsible for making decisions within their scope of authority. Decisions begin with the Chief of the Forest Service in Washington DC, extending down to regional foresters in each of the nine geographic regions in the National Forest System, to forest supervisors, and finally to district rangers with authority for individual districts. When a decision requires NEPA documentation, interdisciplinary (ID) teams are formed with responsibility to analyze proposed actions with the potential for significant effects on the natural and social environment (USFS 2010a; FSH 1909.15). Line officers select ID team leaders and outline team expectations and direction. ID teams are composed of subject matter specialists trained in relevant disciplines who work together to measure the intensity of likely project impacts for each alternative, including direct, indirect, and cumulative impacts (Garcia 1989; USFS 2010a; FSH 1909.15). In terms of responsibility for science, ID teams are required to identify information needs and data sources, adopt appropriate analytical methods, establish science quality standards and measurement indicators, and determine levels of acceptable risk (USFS 2010a, b). Meanwhile, the ID team leader is responsible for coordinating scientific analysis and synthesizing science findings of the ID team. In making a final decision, the line officer must ensure that all alternatives and recommendations incorporate science. Regulations that require the use of 'best available science' suggest the need for both a standard for judging science quality and for a public record that documents and justifies the use of particular types of science (Francis and others 2005).

While the use of science remains relevant to policymakers implementing NEPA, greater understanding about how resource managers actually incorporate science in an environmental assessment is needed. Francis and others (2005) explored how scientific information was used in planning at different levels of government and found variation in the way 'best available science' was defined and managed, based somewhat on the size of the political jurisdiction. Butler and Koontz (2005) observed that the Forest Service has been successful in integrating biophysical information for forest planning, but the integration of social and economic information has not been achieved. Stern and others (2010) surveyed 3321 Forest Service employees about perceptions of appropriate measures of success of Forest Service NEPA processes and learned that the employment of 'best available biophysical science' ranked 6th of 18 success factors, and that 'best available social science' ranked 11th. Emphasis on science, however, varied greatly among agency personnel with different functional roles in planning. Despite the repeated emphasis among resource agencies on management informed by science, resource managers appear to have some discretion about how and when science is incorporated in agency planning and decision-making (Francis and others 2005).

Science and Planning for Travel Management

Science also was a critical component of the NFMA, which governs planning for all forests and grasslands within the National Forest System. The rules that regulate agency implementation of the NFMA, referred to as the 'planning rules,' were first developed in 1982 and have been updated

several times since 2000 (Hoberg 2004). An explicit goal of the 2005 planning rule was to strengthen the role of science in planning. This rule made clear that protection and management of the National Forest System should be based on 'sound science' and that all Forest Service decisions should be consistent with the 'best available science' (USFS 2005, § 219.11). The decision-maker must document how scientific information was considered, interpreted, and used during the decision-making process, note gaps in available information and uncertainties of scientific knowledge, and evaluate risks associated with that science (USFS 2010c).

Science also is an integral part of the Forest Service Travel Management Rule (2005). Over the past few years, conflicts between motorized and non-motorized recreation users have posed challenges for resource agencies with dual missions to both protect and restore forest habitat and provide a range of recreation opportunities (Bosworth 2003). In 1972, Richard Nixon signed Executive Order 116112, which instructed all federal agencies to better manage roads and control the use of off-highway vehicles (OHV) on federal lands. In 2005, the Travel Management Rule (36 CFR Parts, 212, 251, 261, and 295) required all national forests to designate a system of roads, trails, and areas that are open to motor vehicles of various classes at specific times of the year. The purpose of the rule was to improve recreation opportunities while reducing recreation use conflicts and environmental impacts (USFS 2005). Once a travel management assessment has been completed, the rule prohibits motor vehicle use in non-designated areas. Travel management decisions were to be made based on collaboration with multiple stakeholders, other federal, state, and local agencies, and tribes (USFS 2005). This rule sparked a surge in NEPA activities related to recreation management in the Forest Service, particularly regarding motor vehicle use and recreation access. These decisions suggest the need for rigorous analysis of both the biophysical and the social environment, where effects from motorized and non-motorized travel are experienced and present a unique opportunity for exploring the incorporation of tools and frameworks in the assessment process.

Study Objectives

This study investigated the perceptions of Forest Service interdisciplinary (ID) team leaders for 106 NEPA processes for projects dealing with recreation and travel management conducted between 2005 and 2008. A surge in NEPA projects related to travel management for recreation had resulted partly from the issuance of the Travel Management Rule (2005). Our study sought to identify factors ID team leaders attributed to a successful NEPA process for travel management projects, measure team leader perceptions of project goals, and understand how ID teams used scientific tools and frameworks in the assessment process. The emphasis of this paper is on the application of science, namely how team leaders incorporate existing recreation planning tools in NEPA projects. Specifically, we characterize three types of recreation planning tools (planning frameworks, analytic applications, and visitor data) and describe the use of particular tools in agency planning and decision-making. We then present survey data showing how managers rate the importance of social and biophysical science compared to other potential "success factors" in these particular NEPA assessments. We also explore how team leaders value and use planning tools designed to integrate social and biophysical data for recreation-related environmental assessments (EAs) and environmental impact statements (EISs). Because NEPA influences nearly every Forest Service management action and decision, understanding how NEPA assessments incorporate scientific information will shed light on an important aspect of agency decision-making.

Recreation Planning Tools

There are many data sources and planning tools that can be used for applying science in NEPA assessments. For this study, we focused on the most commonly used planning tools that were explicitly designed for managing wildland recreation in national parks, forests, and other public lands in the U.S. (c.f., Manning 2007; McCool and others 2007; More and Driver 2005; Nilsen and Tayler 1997; Stankey 1999). These tools were designed to be used in planning at various scales and many seek to integrate both social science and biophysical information. We organized recreation planning tools into three types: planning frameworks, analytic applications, and visitor data.

Planning Frameworks

McCool and others (2007, p. 25) describe a planning 'framework' as a "process that involves a sequence of steps that leads managers and planners to explicate the particular issue." We focused on frameworks used for wildland recreation planning in the U.S. that approximate the steps of the traditional rational planning process (i.e., define the problem, identify goals and objectives, develop and analyze alternatives, select the preferred alternative, implement and monitor the plan). Three planning frameworks meet these criteria: Limits of Acceptable Change (LAC), Visitor Experience and Resource Protection (VERP), and Visitor Impact Management (VIM) (McCool and others 2007; Nilsen and Tayler 1997). All of the frameworks emphasize the use of inter-disciplinary teams

and the incorporation of sound science and information (Nilsen and Tayler 1997) (Table 1).

LAC was developed by the Forest Service in the 1980s in response to requests to establish recreation carrying capacities in wilderness areas (McCool and Cole 1997; Nilsen and Tayler 1997). LAC involves identifying recreation opportunities and desired resource and social conditions for a particular area and evaluating the effects of change to those conditions. LAC is considered the most complex of the frameworks. While most applications have been in wilderness areas, the steps of the LAC process have been used to inform a wide variety of planning efforts, including the development of VERP and VIM (McCool and others 2007). VERP was developed by the National Park Service (NPS) in the mid-1990s primarily for recreation planning in national parks, though it has been applied in other settings. The framework includes an explicit step for public involvement, but puts less emphasis on planning alternatives than LAC. VIM was developed in the early 1990s for the NPS by scientists at the University of Maryland. This approach emphasizes three factors related to visitor impacts: problem conditions, causal factors, and management strategies (Nilsen and Tayler 1997). Compared to VERP and LAC, VIM focuses more heavily on impacts or problems of visitor use, rather than recreation opportunities and benefits. It is typically applied to recreation sites rather than broad-scale geographic areas like large parks or wilderness areas (McCool and others 2007).

Analytic Applications

Analytic applications are used by recreation managers to help identify issues, frame problems, and conceptualize strategies and solutions for relatively specific management problems (e.g., crowding, scenery), but they are less comprehensive and systematic than planning frameworks (Table 2). Carrying capacity was a concept first used in natural resources management referring to the limits of growth that an area can achieve due to environmental factors (Shelby and Heberlein 1986). The concept was

Table 1 Steps of recreation planning frameworks

Limits of Acceptable Change	
1.	Identify area issues and concerns
2.	Define and describe wilderness recreation opportunity classes
3.	Select indicators of biophysical and social conditions
4.	Inventory existing biophysical and social conditions
5.	Specify standards for biophysical and social conditions in each opportunity
6.	Identify alternative opportunity class allocations reflecting area-wide issues and concerns and existing biophysical and social conditions
7.	Identify management actions for each alternative
8.	Evaluate and select a preferred alternative
9.	Implement actions and monitor conditions
Visitor Experience and Resource Protection	
1.	Assemble an interdisciplinary team
2.	Develop a public involvement strategy
3.	Develop statements of park purpose, significance, and primary interpretive themes; identify planning constraints
4.	Analyze park resources and existing visitor use
5.	Describe potential range of visitor experience and resource conditions
6.	Allocate potential zones to specific locations within the park
7.	Select indicators and specify standards for each zone; develop a monitoring plan
8.	Monitor resource and social indicators
Visitor Impact Management	
1.	Conduct pre-assessment and database review
2.	Review management objectives
3.	Select key indicators
4.	Select standards for key impact indicators
5.	Compare standards and existing conditions
6.	Identify probable causes of impacts
7.	Identify management strategies
8.	Implement

Based on McCool and others (2007) and Nilsen and Tayler (1997)

applied to recreation management of parks as early as the 1930s, when officials asked how many people could coexist in a wilderness area before the wilderness quality is destroyed (Manning 1999). In the 1970s, recreation scientists began using the concept to determine levels of appropriate use of a park, wilderness, or other management area. Recreation Carrying Capacity (RCC) typically involves defining recreation opportunities, establishing indicators and standards of quality to be maintained, and monitoring these indicators for change (Nilsen and Tayler 1997). To determine an area's carrying capacity, managers rely on data collected from visitors to the particular management area on perceptions of crowding as well as observational data.

The Recreation Opportunity Spectrum (ROS) was developed in the 1970s by Forest Service scientists and managers to address growing recreation use and to integrate visitor experience information with recreation site attributes (Clark and Stankey 1979; McCool and others 2007). The development of ROS was based on empirical research on recreation visitors and their site preferences and usage. ROS was also the conceptual precursor to LAC, VERP, and VIM. The ROS process utilizes social, biological, and managerial characteristics to produce a map of opportunity zones ranging from low use-primitive to high use-urban type recreational settings (McCool and others 2007; More and Driver 2005). ROS is not a planning framework, because it does not include the systematic development and analysis of alternatives. Recent research shows that ROS has been applied primarily as a descriptive inventory assessment (Stankey 1999). All Forest Service lands have been inventoried, however, and ROS settings are also used by other federal land management agencies, such as the NPS and the Bureau of Land Management (BLM).

The Scenery Management System (SMS) was developed in the mid-1990s to integrate different 'visual resource management systems' that were being used by the Forest Service and BLM (More and Driver 2005; USFS 1996). These applications were developed by landscape architects to map the scenic quality and sensitivity of natural landscapes so that the visual preferences of the public would be included in agency planning activities and management decisions.

Benefits-based management (BBM) was developed with a similar zoning approach as ROS, but rather than focusing on recreation opportunities provided by settings, it identifies potential beneficial outcomes (social, physical, and psychological) of leisure participation (McCool and others 2007; More and Driver 2005). In other words, ROS is a tool for analyzing the *supply* of recreation opportunities; BBM is a conceptual tool to help analyze the need or *demand* side of outdoor recreation. More recently, the concept of BBM has been re-framed as outcomes-focused management (OCF), but for this study we employed the more commonly known concept of BBM (Driver 2009).

Place-based planning (PBP) starts from a totally different assumption than ROS, SMS, or BBM. Rather than planning primarily for instrumental outcomes, this approach seeks to understand symbolic and emotional meanings and attachments people have to geographic places (Williams and others 1992). Place meanings are often not substitutable (Eisenhauer and others 2000; Kruger and Williams 2007). Place-based planning approaches and BBM (outcomes-focused management) are both new, and the mechanisms for turning these applications into integrative planning frameworks have not been fully developed. Adoption of either would require a recreation planning paradigm change in the Forest Service (McCool and others 2007; Williams and others 1992). The data gathered from these applications tend to be project or site-specific and often comprise one component of broader planning efforts, rather than being used as a primary framework in broad-based planning or assessment.

Table 2 Analytic applications commonly used in the U.S. Forest Service for recreation

Recreation Carrying Capacity (RCC)	RCC is used to manage the social and physical impacts of recreation by determining the point beyond which the number or type of recreation visitors has an unacceptable impact
Recreation Opportunity Spectrum (ROS)	ROS links visitor experiences with biological, physical, and managerial attributes of a setting. ROS produces a map of six opportunity zones ranging from low use-primitive to high use-urban. ROS often is used as a descriptive inventory tool
Scenery Management System (SMS)	SMS is a visual management tool developed by landscape architects to map the scenic quality and sensitivity of natural landscapes. SMS enables aesthetic preferences of the public to be included in agency management and planning activities
Benefits Based Management (BBM)	BBM uses a zoning approach, but rather than focus on recreation settings (supply-side approach), it identifies beneficial outcomes of leisure, and focuses on the needs for setting use zones and objectives (demand-side approach)
Place-based Planning (PBP)	PBP seeks to understand meanings and values people attach to geographic places. These connections may be spiritual, psychological, social, cultural, or rooted in historic use by individuals and groups

Based on McCool and others (2007) and Nilsen and Tayler (1997)

Visitor Data

There are many types of data that could be used in travel planning NEPA processes, such as U.S. Bureau of Census data, visitor surveys, entrance and trailhead registers, public involvement records, and camping and forest product permits. Although other federal land management agencies collect visitor data, the only visitor use data that are collected consistently on all national forest units are gathered by National Visitor Use Monitoring (NVUM) surveys (USFS 2010d). NVUM collects information on activity participation and visitor behavior, preferences, and satisfaction for each national forest. The program uses standard questions and a sampling protocol developed by Forest Service scientists. All national forests collected NVUM data between 2000 and 2004, and the second round of data collection is underway. Planners use NVUM data to understand visitor characteristics and preferences for use of public lands and to estimate future recreation demand.

Study Methods

A web-based survey of interdisciplinary (ID) team leaders was the primary source of data for this study. In March 2008, an invitation to participate in this study was sent to all identifiable ID team leaders of recreation and travel projects between December 2005 and March 2008. The initial sample was drawn by searching for key words in the Forest Service's Planning, Appeals and Litigation System (PALS) database. The PALS database includes a list of current and completed NEPA projects. We used several key words to search for projects that involved recreation, roads, and travel management, including: travel management, motorized, off-highway vehicles, all-terrain vehicles, and access. Identified projects were further reviewed to eliminate redundant entries and limit the sample to those explicitly involving recreation. We included in the sample both projects where NEPA had been completed and projects where NEPA assessment was underway. We did not include projects in the proposal development phase, because these projects were not far enough along to warrant discussions about project success and the use of recreation planning tools.

The invitation to participate identified the study purpose: "to gain a broader understanding of how Forest Service personnel implement NEPA and planning processes associated with recreation, public use, and travel management projects." The survey instrument included questions about indicators of successful NEPA processes, project goals, the relevance of the Travel Management Rule to the process, the use and evaluation of recreation planning frameworks and tools, and characteristics of the ID team and team leaders. The survey was designed to take 15–20 min to complete and consisted primarily of closed-ended questions.

We selected recreation projects dealing with travel management for a number of reasons. First, these processes provide a common framework for comparison among a variety of cases. While the projects were diverse in scale and geographic region, they shared goals associated with travel management and recreation access. Second, recreation, access and roads projects typically involve diverse stakeholders with competing social, economic, and environmental interests and potentially strong conflicts in values regarding appropriate use on public lands. Thus, the need for both biophysical and socioeconomic information in the NEPA assessment process is likely.

Initially, the search resulted in 167 total projects, including 46 EIS projects and 121 EA projects. The projects included a range of spatial scales, from a specific site or trail network, to an entire district, national forest, or even multiple forests within a region. After sending a query email to persons listed in the database, we realized that many recipients actually were not ID team leaders, but played some other role in the project. Follow-up emails and phone calls allowed us to identify contact information for 142 ID team leaders: 103 for EA projects and 39 for EIS projects.

Since we were constrained in the amount of information we could elicit in a web survey, we also conducted semi-structured interviews with a small sample of eight ID team leaders who illustrated the broad spectrum of opinions about the usefulness of the recreation planning tools. Interviewees were asked to reflect on why they chose certain recreation planning tools over others, why they assigned a particular rating to a tool, and how it was incorporated into the travel management assessment. They were also asked about their experiences with selecting tools on similar NEPA processes. Data from this small, non-representative sample are used to provide tentative explanations for survey results.

Results

Of the 142 possible projects, 106 ID team leaders completed the online survey, representing a 75% response rate. Table 3 contains additional information about the types and status of the projects represented. The sample included a mixture of 39 EIS projects and 67 EA projects. Assessments in the sample were in various stages of completion. Nearly half (52) of the projects were already completed while 54 were in various stages of completion, with most (48) being 'in progress' while a few assessments were officially 'on hold' or they had been conducted, but the

Table 3 Characteristics of study sample

Sample statistics	EIS	EA	Total
Number of respondents	39	67	106
Completed	7	45	52
In progress	28	20	48
On hold	1	2	3
Cancelled	3	0	3

projects were later cancelled. All regions within the national forest system were represented in the sample. Respondents reported that the Travel Management Rule played a role in 70% of NEPA processes in this study. The rule was the primary impetus for nearly one-third of the surveyed processes.

Perceptions of the Importance of Science in NEPA

ID team leaders were asked to rate on a seven-point scale the importance of 18 potential factors in terms of the extent to which they felt factors reflected appropriate measures of success for Forest Service NEPA processes (Stern and others 2009). Next, they selected up to three of these items as the most appropriate measures of success for these processes (Table 4). All 18 items were rated above the scale mid-point. The items with the highest means deal with implementation of the NEPA process (e.g., full disclosure of impact analysis, well documented rationale for decision, and transparent decision-making process) as well as implementation of the project itself. On the list of 18, two items focused on the role of science. The item 'process employs the best available biophysical science' ranked 9th, (12% of team leaders placed this item on their list of 'top-3' measures of success'), while 'best available social science' ranked 13th (2% placed this item on their top-3 list). These data suggest that team leaders perceive the use of best available biophysical science and social science as moderately important measures of success in NEPA processes and less important than other factors related to public disclosure and procedural compliance.

The Use of Recreation Planning Tools

The 97 ID team leaders whose projects had advanced at least to the analysis phase were asked about their awareness of all nine of the recreation planning tools discussed above, whether they were used in their processes, and their opinions of the value of each recreation planning tool used. Mean value scores were calculated by attributing a score of 1 to answers of "not valuable;" a score of 2 to answers of "somewhat valuable;" and a score of 3 to answers of "very valuable."

Team leaders reported familiarity with a wide range of recreation planning tools (Fig. 1). More than 70% of ID team leaders were aware of six of the nine recreation planning tools mentioned. Nearly all (96%) ID team leaders had heard of the ROS. VIM and BBM were least well known. Overall use was highest for ROS (79%), VERP (58%), and NVUM (46%) (Table 5). The remaining planning tools were used on about one-fifth to one-third of the projects. Most teams (87%) reported using at least one planning tool, and nearly three-fourths used more than one. Planning frameworks were used on 55% of the NEPA processes compared to analytic applications being used on 76%. (Data are not shown in table.)

The number and types of planning tools used varied sharply between EIS and EA projects. Multiple (more than one) planning tools were used in 90% of EIS projects and 65% of EA projects. ROS was the most common planning tool used by ID teams in both EA and EIS projects. VERP and NVUM were more commonly found in EIS projects. Place-based planning was used by half of all EIS projects, compared to less than a quarter of EA projects.

Team leaders offered varied responses about the degree to which they valued recreation planning tools (Table 6). VERP, the second most often used planning tool, scored the highest on the value scale ($x = 2.55$). Meanwhile, ROS, which team leaders reported was used the most, rated third on the value scale ($x = 2.13$). Both of the newer tools, PBP and BBM, were rated highly on the value scale ($x = 2.22$ and 2.13, respectively), though they were used in relatively few of the processes. LAC, SMS, and RCC were rated the least valuable among ID team leaders who used them.

We examined the use and value of recreation planning tools across different project scales to see whether significant differences existed (Table 7). ID teams conducting NEPA assessments for projects at the national forest level tended to use more recreation tools than those at the smaller, ranger district level. Projects at the forest level used an average of 3.97 tools compared to 3.03 for projects at the district level (t-statistic = 1.75; $P = 0.084$). Moreover, ID teams working at the forest level were more apt to use multiple tools in the assessment process (Pearson chi square = 6.75; $P = 0.009$). NVUM was more likely to be used at the forest level (Pearson chi square = 10.7; $P = 0.001$). VIM appeared to be more highly valued at the district level than the forest level, and LAC appeared to be

Table 4 Factors leading to success in Forest Service NEPA processes

Potential measures of success in FS NEPA processes	% selecting item as one of top 3 most appropriate measures (%)	Mean importance (7-point scale)
Full disclosure of impact analyses has taken place	30	6.21
Well-documented rationale for decision is developed	32	6.15
The project gets implemented	39	6.11
The decision-making process is made transparent to all stakeholders	18	5.99
The final decision reflects the mission of the agency	33	5.91
All procedures are followed correctly	18	5.87
The final decision minimizes adverse environmental impacts	39	5.75
The final document is easy to read and understand	8	5.64
The process employs the best available biophysical science.	12	5.61
Public participants are satisfied with the PROCESS	25	5.46
Other agencies are effectively engaged	1	5.18
The process is completed in a timely manner	9	5.13
The process employs the best available social science	2	5.08
The final decision minimizes adverse socioeconomic impacts	6	5.02
All team members are satisfied with the process	2	4.68
Public participants are satisfied with the FINAL DECISION	8	4.53
Compromise has taken place between the interested parties	3	4.47

Scale was 1–7 points, with 1 indicating "did not achieve," 4 "partially achieved", and 7 "achieved completely"

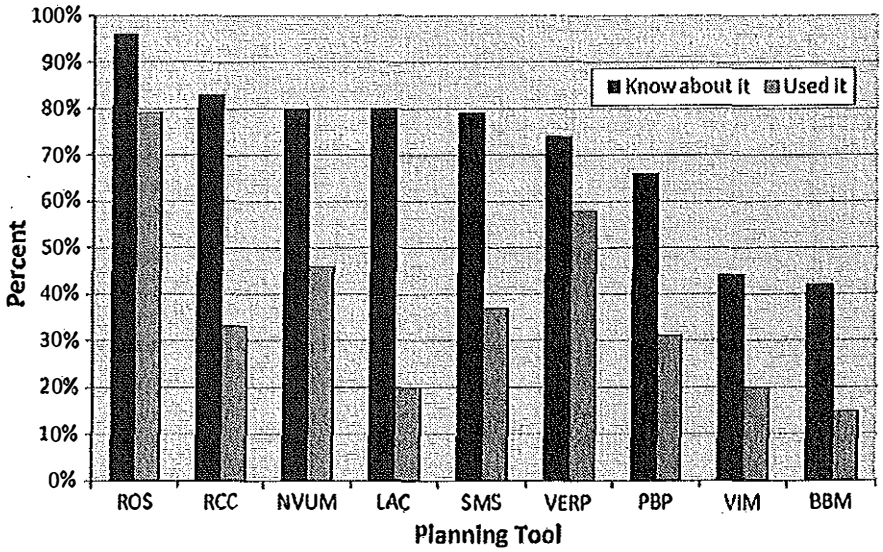

Fig. 1 Recreation planning tools knowledge and use by all EA and EIS projects ($n = 97$); *Note*: The following abbreviations are used in this figure. ROS: Recreation Opportunity Spectrum; RCC: Recreation Carrying Capacity; NVUM: National Visitor Use Monitoring; LAC: Limits of Acceptable Change; SMS: Scenery Management System; VERP: Visitor Experience and Resource Protection; PBP: Place-based Planning; VIM: Visitor Impact Management; and BBM: Benefits-Based Management

more highly used and valued at the forest level, but these were not statistically significant at the $P < 0.05$ level. Comparisons between forests and districts also revealed that while the use of analytic applications was roughly comparable (forests 78%; districts 74%), recreation planning frameworks were more likely to be employed in forest-level projects (63%) than projects at the ranger district level (49%).

Based on the eight follow-up interviews we conducted, ID team leaders indicated that they sometimes made choices of recreation planning tools based on their perceived utility to the specific project at hand. These considerations took into account public interest and controversy, whether the tools can make clear to the public the choices to be made, and whether the information provided through these tools matches the scale of the project.

Table 5 Use of recreation planning tools in EA and EIS processes ($n = 97$)

Planning tools	EA ($n = 65$)	EIS ($n = 32$)	Overall
Recreation Opportunity Spectrum	74%	91%	79%
Visitor Experience and Resource Protection	49%	75%	58%
National Visitor Use Monitoring Data	31%	78%	46%
Scenery Management System	32%	47%	37%
Recreation Carrying Capacity	27%	44%	33%
Place-based Planning	22%	50%	31%
Limits of Acceptable Change	17%	26%	20%
Visitor Impact Management	15%	28%	20%
Benefits-based Management	9%	25%	15%
Any planning tool (all combined)	84%	94%	87%
More than one planning tool used	65%	90%	74%
Average number of tools	2.70	4.65	3.35

Table 6 Opinions of recreation planning tools in EA and EIS processes

Planning tools	n	Not valuable (%)	Somewhat valuable (%)	Very valuable (%)	Mean value score (1 to 3 scale)
Visitor Experience and Resource Protection	56	2	41	57	2.55
Place-based Planning	30	11	56	33	2.22
Recreation Opportunity Spectrum	77	16	56	28	2.13
Visitor Impact Management	19	7	73	20	2.13
Benefits-based Management	14	8	75	17	2.08
National Visitor Use Monitoring	45	19	62	19	2.00
Limits of Acceptable Change	19	31	44	25	1.94
Scenery Management System	36	18	70	12	1.94
Recreation Carrying Capacity	31	29	50	21	1.93

It was also clear from the interviews, however, that other factors play a role in determining which tools are used. The ID team leaders' degree of familiarity with the available tools can strongly influence choice. The availability of up-to-date data may also come into play, as ID team leaders may want to avoid employing tools that will require additional data collection and slow the process. For example, one team leader cautioned that RCC may not always be practical, because it requires monitoring or a permit system. The ID team leader's choice of tools may also come down to the recommendations of the recreation specialist, the specialist's familiarity with the tools, or the availability of the expertise needed to use these tools. This was explicitly noted by one interviewee who explained that the dearth of landscape architects may inhibit the use of SMS.

Some team leaders also acknowledged in interviews that VERP was not often used because it is perceived as a National Park Service tool to be used for resource preservation and does not fit well in the Forest Service paradigm of multiple use. This suggests that use of planning frameworks, like VERP, VIM, and LAC, may be based on their affiliation with a particular agency. Those who employed VERP said they did not always use it formally, but found it helpful to frame questions, identify issues, and aid discussion. One ID team leader said that VERP was useful to disclose to the public how recreation demands could be balanced with resource protection. Team leaders acknowledged in interviews the value of LAC for issues or activities that were controversial or complex, particularly related to wilderness. As one respondent explained, "[LAC] provides a good framework for involving the public and letting them know the issues we had to deal with and bringing them along—but you have to have someone who knows how to use it." One team leader we interviewed used VIM to assess the baseline level of recreation use and measure the change in use associated with implementation of the alternatives.

In cases where multiple recreation planning tools were employed, it appears that team leaders sometimes feel external pressure to employ an array of tools and use existing NEPA templates to guide their environmental analysis and documentation. In other cases, interviewees claimed that the need to use multiple tools was to improve

Table 7 Percentage of teams that used any recreation planning tool and their value for national forests and districts

Planning tools	Forest		District	
	Use (%)	Mean value score (1 to 3 scale)	Use (%)	Mean value score (1 to 3 scale)
Recreation Opportunity Spectrum	100	2.29	92	2.02
Visitor Experience and Resource Protection	79	2.57	62	2.54
National Visitor Use Monitoring Data	79	2.00	42	2.00
Scenery Management System	41	2.00	46	1.90
Recreation Carrying Capacity	41	1.90	36	1.94
Place-based Planning	38	2.20	38	2.24
Limits of Acceptable Change	31	2.14	18	1.88
Visitor Impact Management	21	1.67	24	2.27
Benefits-based Management	17	2.00	16	2.00
Any recreation planning framework used (VIM, VERP, LAC)	63	[a]	49	[a]
Any analytic tool used(ROS, BBM, SMS, RCC, PBP)	78	[a]	74	[a]
One or more tools used	94	[a]	85	[a]
More than one tool used	90	[a]	65	[a]

[a] Inapplicable

defensibility of these documents so that they would stand up to appeals or litigation. One interviewee noted that SMS is often used because "for any NEPA document we [the agency] have to look at visual impacts." An ID team leader who used eight different planning tools on a single project confirmed the potential importance of NEPA protocols in the choice of tools. He also related that NEPA protocols often reflected a desire to avoid future public scrutiny:

> A lot of it is the standards that we use for analysis. When we do any type of project, those tools will probably go somewhere in the write-up, as well as others. If we don't address them, we will get comments back, like 'why didn't you address this or that?'

Discussion

Results indicate that ID team leaders for recreation and travel management projects view the use of biophysical and social science as moderately important factors in NEPA processes in general, but that factors related decision documentation and transparency are at least as important, if not more important. Given the complex operating environment of the Forest Service and the sometimes contentious nature of public lands management, it is perhaps not surprising that team leaders identified several procedural factors with success in NEPA processes (Stern and others 2009). Based on these results, we expected that planning frameworks would be even more important than analytic applications or NVUM data, because planning frameworks include specific process elements consistent with NEPA, such as public involvement, incorporating science, and developing evaluative management alternatives. However, this was not the case. Of the planning frameworks investigated, VERP was the only one highly ranked by team leaders and LAC and VIM were ranked relatively low.

The Importance of Science in NEPA

Biophysical science was ranked as more important than social science as a measure of success in NEPA assessments for travel management. This finding also appears consistent with Butler and Koontz's (2005) study on ecosystem management objectives, which showed that the integration of biophysical scientific information sources has been perceived to be more common than social and economic information. Our results also are consistent with a larger study ($n = 3321$) that featured the identical 18 measures of success for a variety of Forest Service NEPA projects (not limited to recreation and travel management) (Stern and others 2010). Interestingly, respondents in this larger study ranked the use of both biophysical science and social science higher relative to other success factors than in our study of recreation and travel management projects. This discrepancy between biophysical science and social science is especially perplexing in our study, given that we focused on recreation, which has a strong human dimensions element. Further research is needed to understand the apparent gap between the use of biophysical science and social science, and to explore why the employment of both

types of science was ranked lower for recreation and travel-management projects than for all other NEPA projects.

Recreation Planning Tools

Team leaders demonstrated awareness of and familiarity with a variety of recreation planning tools and incorporated many tools either individually or in combination in the NEPA assessments for the recreation and travel-management projects we studied. What is less clear in these results is whether team leaders identified these planning frameworks, analytic applications, and NVUM data as being science-based. Follow-up interviews with team leaders indicated that there was some variation in whether the incorporation of recreation planning tools was considered to be the 'use of science.' This question about what actually constitutes science and how one determines the 'best available science' is being explored in a follow-up study. Thus, we exert caution in making assumptions that team leaders equate the use of these tools with the use of science.

Our conversations with team leaders suggested no consistent criteria for tool selection. Rather than consistently basing their use on their scientific contribution to substantive knowledge associated with impacts analysis, tools were often chosen based on their ability to clearly communicate issues to the public. Furthermore, our interviews suggested that tools may be selected because they are easy to use or because team members are aware of them or have used them before. As noted in other studies, the emphasis on procedure and the selection of planning tools may be related to the judicial system and its treatment of the NEPA process, requiring strict adherence to detail to avoid legal action (Stern and others 2009). The use of certain planning tools may be associated with a greater sense of confidence that a NEPA decision will withstand legal challenge.

Questions to team leaders about their awareness, use, and value of recreation planning tools revealed that they were widely incorporated in recreation planning assessments. Nearly every NEPA project we examined used at least one of the nine recreation planning tools listed in the survey. ID teams also combined multiple recreation planning tools within the same assessment, particularly for large-scale EIS projects and more commonly at the national forest level. These data suggest that scientific information and science-based decision tools are being used in NEPA assessments for recreation and travel management. Still, we know little about what complexity or clarity these tools add to the NEPA process, the timing of their use, or how they may be used exclusively or in tandem. Results show variation in the appreciation of planning tools for different projects.

Planning frameworks are designed to aid problem z-framing, interdisciplinary planning, and public involvement. They can be used to guide the team's interdisciplinary assessment process in combination with other sources of scientific information (McCool and others 2007). Yet, we do not know for fact that they are being incorporated in this way. VERP was more consistently valued by team leaders, although its level of use varied. Because LAC contains a prescriptive, step-by-step approach that emphasizes social assessment, the tool may be more attentive to socioeconomic impacts of decision alternatives than others. The multi-step process that goes along with LAC may make this framework less attractive for use in small-scale projects and EAs. Its use was more frequent in EIS projects as well as projects conducted at the forest level. In contrast, VIM was more likely to be employed on district level projects, which suggests it is more relevant at the smaller scale. Interviewees suggested that VIM is easy to implement, which also helps to explain its value to team leaders. Moreover, selection of planning frameworks may be based on perceptions of application to a particular government agency. Tools developed for use by NPS may not be immediately considered by ID teams engaged in Forest Service NEPA assessments.

ROS was the single most highly used recreation planning tool among those identified in the study, though perceptions of its value to the project were less pronounced. This may reflect the fact that ROS is often used as a descriptive inventory application and not a broader planning framework (Stankey 1999). Participants in follow-up interviews offered a more detailed explanation for the high use of ROS. They noted that ROS is typically included in long-term planning, and that most recreation projects and plans cite ROS to demonstrate compliance with forest plans. Thus, some interviewees and likely some survey respondents reported "using" ROS when in actuality it was mainly just referenced in the NEPA documents. Interviewees also attributed its expansive use to its utility in visualizing decision alternatives and in communicating decisions to the public about how the proposed action could affect recreation use and opportunity. Findings suggest that an upgrade may help ROS evolve from an inventory application to a planning framework to enhance its utility.

Other analytic applications were used rather sporadically. SMS, for example, was used on fewer than 40% of projects, and RCC and PBP were used in about one-third of the projects. SMS focuses on aesthetic perceptions, and RCC is used to determine site capacity in areas where crowding is perceived or biophysical resources are threatened by human use. The emphasis of RCC on establishing visitor use limits may be helpful in situations where negotiation of management actions is the focus. Team leaders in follow-up interviews noted that RCC was useful for conveying to the public how recreation use would

change due to a proposed action. PBP is relatively new and it focuses on the attachment to specific sites, as opposed to the values attached to recreation opportunities or experiences. The high values assigned to PBP suggest that this application has potential for use in travel management and other planning processes. Team leaders suggested that PBP is especially responsive to residents and user groups who form attachments to places affected by the travel management designation. BBM was not widely used by ID teams in this study, even though the Forest Service has made a commitment to enhance connections between the public and their national forests with the goal of improving health benefits (Kimbell and others 2009).

NVUM data, which were developed for use in forest planning and other management decisions, were used in half the projects, but were perceived as being of modest value relative to other tools. Team leaders believed that the scale of NVUM data was a barrier to optimal use. Because NVUM data are collected at the forest level, it is not always appropriate to extrapolate data for use at the district or watershed scale. Indeed, NVUM was much more commonly used in planning for forest level projects than those at the district level (Table 7). Understanding recreation demand at the site or watershed level would require a separate data collection effort or tools to scale down from the forest-level data provided by NVUM.

The tremendous variation we see in the use of recreation planning frameworks, analytical applications and visitor data for transportation and recreation projects studied, suggests that no consistent criteria for selecting appropriate recreation planning tools appears to exist for NEPA assessments. ID teams for recreation and travel management projects appear to make decisions about the use of science based on a variety of factors, including potential for legal action, scale of the project (forest or district), level of documentation (EA or EIS), and subjective perceptions of team leaders and team members about recreation planning tools. This finding points to the potential need to develop criteria for selecting and using recreation planning tools to address integrated resource problems.

Study Limitations

This study has some limitations which are important to acknowledge. First, the study emphasizes perceptions of team leaders about the role of science and recreation planning tools in the NEPA process, rather than direct observations. These perceptions can be viewed as a proxy for what actually happened in the process. Perceptions of respondents are affected by memory and are influenced by personal values and beliefs. Moreover, while ID team leaders are critical players in the NEPA assessment, they are but one of many players involved, and perceptions may vary. Second, we asked respondents to talk about the use of science for NEPA, but respondents may vary in their perception of what it means to use science or apply a tool. This suggests that the employment of the term 'best available science' may be problematic, and more research may be needed to understand how science is being applied in NEPA assessments. Third, the small sample size limits the strength of statistical analyses. Clearer trends may have been identified in a larger sample. Fourth, this study focused on recreation and travel management projects, and findings should be viewed as most pertinent to these types of projects. It is not clear if results may be generalized to NEPA assessments in other resource areas. Finally, our study explored the use of recreation planning tools in projects formally assessed by NEPA. Other recreation and travel-management projects may have been proposed, but later dropped for a variety of reasons (e.g., public controversy, lack of funding, or threat of appeal). We have no way of knowing how recreation planning tools would have been used in these projects or whether our sample reflects the full spectrum of possible recreation projects where these nine planning tools may be employed. Thus, our findings can only be applied to recreation-related projects that were deemed suitable for NEPA assessment.

Conclusions

NEPA and other planning legislation require the use of 'best available science' in Forest Service environmental documents. Moreover, the principles of ecosystem management adopted by the agency advise the integration of both biophysical science and socioeconomic information in planning and decision-making (Cortner and Moote 1999). Our study suggests that the actual use and integration of science is considered alongside many other factors in the development of NEPA documents. Given the omnipresent threat of appeals and litigation, perhaps it is not surprising that agency personnel associate NEPA success more strongly with disclosure and procedural compliance than they do with the use of science. We must be cautious in interpreting our results with respect to the importance of science as a true reflection of our respondents' broader views about science. But, an emphasis on procedural compliance would be compatible with recreation planning frameworks that incorporate these elements into their step-by-step process (e.g., VIM, VERP, LAC), and we did not find evidence of widespread use of these frameworks in our study. Given that our study focused on recreation-related NEPA projects, we expected ID team leaders would value the use of social science at least as much as biophysical science on these projects, but this was not the case.

We observed wide diversity in the use of recreation planning tools in NEPA assessments and in team leader evaluations of their effectiveness. It seems that in some cases, the use of recreation tools may be more dependent more upon convenience, familiarity, or availability of adequate resources or expertise, rather than a concerted effort to identify the best tool to meet specific planning needs. Team leaders also noted the need to 'bullet-proof' documents against appeals or litigation as reasons for selecting multiple tools. A more detailed process for tool selection may provide not only planning steps, but information about how and when different recreation planning tools can be used in planning and NEPA documentation.

This study represents an initial empirical attempt to understand the use of recreation planning tools in Forest Service NEPA assessments. Further evaluation of the strengths and weaknesses of each planning tool in particular contexts would help to provide a more nuanced understanding of how these tools intersect with the NEPA planning process. More research is needed on the actual implementation of planning tools based on factors like project scale, critical issues, timing, and types of stakeholders. Additional work is also needed to help understand how planning tools might address the changing role of recreation in American society (Kimbell and others 2009; Selin and others 2009). For example, ROS was developed 40 years ago, and this research suggests an update is needed to help ROS evolve from an inventory tool to a planning framework. Also, PBP and BBM are newer tools and their use is relatively low, but they may have the best potential to address agency initiatives to reverse the apparent decline in participation of American people in outdoor recreation (Pergams and Zaradic 2008), because of their focus on forest benefits and visitor demand. Additional investigation could lead to better informed tools for decision-making in recreation planning and management.

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