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## FEATURES

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# DECISION-MAKING AND ECOSYSTEM-BASED MANAGEMENT: APPLYING THE VROOM-YETTON MODEL TO PUBLIC PARTICIPATION STRATEGY

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*Previous literature has been critical of public participation practices, finding unimpressive application of public participation principles and low levels of public satisfaction. Ecosystem-based management generally involves mixed land ownerships, which adds considerable complexity to the planning process. This complexity increases both the importance of public participation and the difficulty of selecting appropriate public involvement mechanisms. To help solve the problem of choosing among public involvement mechanisms, the Vroom-Yetton model for selecting decision process options is reviewed and applied to ecosystem-based management. The model recommends a public decision process unless developing new alternatives is not possible, in which case segmented public consultation is recommended.*

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### Introduction

Ecosystem-based management has become the explicit management direction of major federal land management agencies such as the United States Depart-

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ment of Agriculture (USDA) Forest Service and the United States Department of the Interior (USDI) Bureau of Land Management. Whereas much of the agencies' attention to date has been on the biophysical science of ecosystem-based management, an equally important question involves the kind of public participation strategy to use. For ecosystem-based management to reach its potential, it must be both effective science and effective public policy. The public involvement strategies that accompany ecosystem-based management will be a crucial link between the technical and social components of the process.

Relatively little has been written about public participation and ecosystem management to date. Notable exceptions are Sample (1990, 1993), which will be discussed in more depth, and Stankey and Clark (1992). The latter includes a problem analysis of new perspectives, a Forest Service initiative that was a precursor to ecosystem-based management. It concluded, among other things, that there are few effective mechanisms to "translate public involvement into public participation in decision-making" and a "lack of nonthreatening environments in which debate and discussion of critical issues facing resource managers, citizens, and others can occur" (p. iii).

Our examination of ecosystem-based management and public participation proceeds through four steps. First, we provide a selective synthesis of the literature on public participation in public lands management, which shows that the generally critical tone in Stankey and Clark (1992) is broadly shared and that theoretical progress has been slow. Next, we review the social and political context within which the ecosystem-based management paradigm must be implemented. The multiple sources of biophysical complexity (intermingled ownerships, endangered species, etc.) and sociopolitical complexity (deeply held and divergent values, legal constraints, etc.) indicate that ecosystem-based management will put both our scientific and governance abilities to the test. Third, we examine the Vroom-Yetton model of decision-making and present a version of it adapted to a public participation context. This version provides a framework for designing public participation strategies based on the attributes of the underlying decision at hand. Finally, we apply the Vroom-Yetton model to the general notions of ecosystem-based management to predict which public participation strategies are most likely to contribute positively to the development and implementation of ecosystem-based management.

### **Public Lands Public Participation Literature**

Public involvement emerged as a broad legal mandate for federal land managers in the 1960s and 1970s. Although not requiring public involvement, the Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C.A. §§ 528-531, required the Forest Service to consider the relative values of the national forest resources in a way that would result in utilization that best met the needs of the American people. This was a tacit recognition that natural resource

decisions involved, among other things, public value judgments. The National Environmental Policy Act (NEPA) of 1969, 42 U.S.C.A. § 4321 et seq., required analysis and disclosure to the public of the environmental effects of every major federal decision significantly affecting the environment. Later, the guidelines issued by the Council on Environmental Quality and, in 1978, the regulations promulgated under NEPA, mandated public notice, meetings, and other procedures throughout the NEPA process (40 C.F.R. § 1500 et seq.). Thus, through NEPA, its regulations, and court interpretations, by the end of the 1970s public involvement was a central part of the analysis of the effects of all significant federal natural resource decisions.

With respect to the National Forests, the National Forest Management Act (NFMA) of 1976, 16 U.S.C.A. § 1600 et seq., went beyond public involvement in the analysis of consequences. NFMA required the Forest Service to involve the public in planning and decision-making. A similar requirement was included in the Federal Land Policy and Management Act of 1976, 16 U.S.C.A. § 1701 et seq., with respect to Bureau of Land Management administered lands.

Much of the general literature on public participation urges public land managers to embrace and apply public participation (e.g., Bolle 1971; Behan 1988; Delli Priscoli 1989). More specifically, the public participation literature consists of several categories:

- theoretical perspectives (e.g., Arnstein 1969; Goldenberg and Frideres 1986; McCoy et al. undated);
- strategic objectives (e.g., Hendee et al. 1973; Wondolleck 1988; Blahna and Yonts-Shepard 1989);
- inventories/explanations of techniques (e.g., Bonnicksen 1985; USFS handbook);
- evaluations of agency implementation (e.g., Mohai 1987; Blahna and Yonts-Shepard 1989; Magill 1991; Office of Technology Assessment 1992).

The bulk of this literature is broadly critical of either agency behavior or of the quality of current thinking regarding public involvement. The empirical research has found generally unimpressive application of public participation principles and low levels of public satisfaction. Further, reviewing this literature shows that there has been surprisingly little progress over the last 20 years. Focusing on application and prior to public involvement being required at current levels, Hendee et al. (1973) developed a set of 17 recommendations regarding effective public participation. A considerable segment of the recent literature either documents public dissatisfaction in situations where the foregoing objectives were not achieved (often without referring explicitly to Hendee et al.) or repeats those recommendations as if they were new ideas (again, without citing Hendee et al.). A recent "state of the art" paper (McCoy

**TABLE 1.** Comparing Hendee et al. (1973) and McCoy et al. (circa 1994)

Hendee et al. (1973) Recommendations	McCoy et al. (circa 1994) Key Principles
Clarify objectives	Clearly state goals and objectives
Decentralize responsibility for public involvement	
Develop a comprehensive plan	Plan for effective dialogue
Allow adequate time	
Broaden public input; Use a variety of collection techniques	Understand the multiplicity of publics and public involvement techniques; Diversify the public involvement framework
Provide a full range of alternatives	
Encourage primary input	
Strengthen analysis with systematic methods	Analyze, evaluate, and monitor public involvement efforts
Analyze all input	
Separate analysis from evaluation	
Recognize line officers' responsibility for evaluation	
Develop consistent procedures	
Provide full disclosure at all levels	Be open, honest, and responsive
Give feedback to the public	Establish a framework for continuing dialogue
Seek expertise needed	Use a third-party intervener when necessary
Provide comprehensive training	
	Build cooperation constructively and deliberately over time
	Emphasize education and social learning

et al., undated) prepared for the Interior Columbia River Basin Ecosystem Management Project lists 10 key principles for public involvement. Comparing the findings of McCoy et al. with Hendee et al. (Table 1) reveals little if anything new, thus illustrating how little real development in the public involvement field has taken place.

A thorough review of agency practice revealed that the principles and methods developed in the early 1970s, supported by additional literature over the ensuing years, have often failed to be realized in application, if the Forest Service is representative (Blahna and Yonts-Shepard 1989). The difficulty in implementation may stem in part from the largely atheoretical nature of the field. Wengert (1976) noted a lack of theory to support public participation choices and criticized both the amount and quality of research that had been done, focusing on a lack of systematic organization. Goldenberg and Frideres (1986) and Office of Technology Assessment (1992) provide similar criticisms in subsequent decades. Further, whereas the conceptual validity of public participation is generally accepted (i.e., stakeholders should participate in the management planning and decision-making for public lands), the implementation has proven to be both complicated and controversial.

### **Attributes of Ecosystem-Based Management on Mixed Ownerships<sup>1</sup>**

This section discusses the nature of ecosystem-based management decisions in order to understand what role public involvement might have in those decisions. A necessary first step is understanding the kinds of lands likely to be involved in ecosystem-based management.

#### *Understanding the Mixed Ownerships*

One fundamental barrier to ecosystem-based approaches in the United States is the pattern of land ownership. Despite reform efforts, such as recommendations by the Public Land Law Review Commission of the 1960s, the current land ownership pattern remains a crazy quilt that is the cumulative result of expansionist policies, national defense interests, political expedience, and historical relative resource abundance, among other factors (Clawson 1983). If ecosystem-based management provides a rationale for land management decisions, it must recognize that any resulting degree of rationality will be constrained by a land ownership pattern that does not reflect similarly systematic origins.

When categorizing the nation into public land states and private land states, the former lay generally west of the 100th meridian.<sup>2</sup> The high concentration of public land (federal land, more precisely) in the western states comes from the treaty processes that initially brought these lands into the public domain and the subsequent divestiture programs that either granted the lands to states, railroads, or homesteaders. Even though the concentration of federal land is much lower east of the 100th meridian, there is still a considerable amount of state and county land and a growing interest in finding ways to apply ecosystem concepts to private land management that are compatible with private interests and property rights.

With this typology of land ownership in the United States as a context, the remainder of this study focuses on lands that are referred to as mixed ownerships, those areas that contain both privately and publicly owned land. This focus on the mixed ownerships arises because (1) purely public situations may in large measure be too unique to be of general interest and (2) fundamental policy questions about public management (and hence public involvement activities) of private land have not yet been settled and are unlikely to be settled in the near-term. Thus, both the challenges and opportunities of ecosystem-based management present themselves to the mixed ownerships.

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<sup>1</sup> This section extends ideas originally presented at a conference at Utah State University and published in a proceedings (Wagner 1995).

<sup>2</sup> Wallace Stegner, in his 1954 book, *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West*, and Charles Wilkinson in his 1992 book, *Crossing the Next Meridian: Land, Water, and the Future of the West*, provide excellent analyses of the factors that distinguish this portion of the country.

### *Understanding Land Management Politics*

Several attributes of land management create complex challenges for successful policy formation and implementation, regardless of whether one addresses mixed ownerships or not. Several sources of this complexity are:

- deeply held values;
- markedly different worldviews;
- multiple parties and issues;
- production interrelations;
- legal constraints; and
- entrenched conflict industry.

Taken together, these attributes make land management decision-making a formidable undertaking.

The deeply held values and markedly different worldviews mean that public lands disputes share structural attributes with cultural conflict. For many people, the values and activities that define their core identities may be derived from the public lands. As one travels throughout the western states, one hears phrases like "I am a rancher," or "I am an elk hunter," not "I am in the beef industry," or "I like hunting elk." If public lands are at stake, the very places and activities around which people build their self-identities are on the table (Brandenburg and Carroll 1995; Kemmis 1990). When one combines this intense link to the public lands with the range of views about how those lands should be managed, it is easy to see why disputes over them can move quickly past heated into white-hot.

By the same token, mixed ownerships also include private lands, and there are equally deeply held values both about them and about the associated rights that arise from owning them. Private property ownership is one of the fundamental cornerstones of American history and culture, and attempts to constrain or redefine private property rights cut deeply into the American social psyche. If ecosystem-based management processes across mixed ownerships attempt to force private landowners into practices that they do not see as in their best interests, it is hard to imagine how those policies could be implemented without direct enforcement pressure. If such an ecological police state is to be avoided, a more sophisticated and politically inclusive process is called for, with the flexibility to recognize legitimate differences between the functions of public and private lands.<sup>3</sup>

The multiple parties and multiple issues mean that land management disputes are often structurally difficult to address. A rule of thumb in dispute

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<sup>3</sup> Although this phrasing may seem alarmist, private property rights debates run as deep as any we face. The Wise Use movement and associated home rule ordinances in the rural west have become widely popular. Failure to recognize the gravity of these groups, and the social forces that give rise to them, reduces one's ability to craft policy responses that are robust in the face of them.

resolution is that a dispute with more than 15 participants is not amenable to direct negotiations (Harter 1984); it is common to find several times that number in a mixed ownerships situation. Moreover, some may live a considerable distance away from the specific land in question if federal lands are involved. As one example, the number of recreationists with a direct interest in issues on national forests has exploded in recent years (Shelby and Heberlein 1986). How to involve these distant stakeholders and what weight to give their views are confounding questions. It is similarly common to have participants enter and exit throughout the process and for there to be significant differences between the views of organizations that superficially share similar ideological positions. There are moderate environmental groups and more extreme ones, just as there moderate and extreme commodity interests. It is not likely that you could invite one environmentalist and one commodity representative to a negotiation and have the range of interests adequately represented.

Various natural resource production interrelationships mean that obtaining products from lands (whether these are wood products, recreation-visitor-days, wildlife populations, water yields, or other products) often can only be achieved at the cost of lower production of other products. Thus, it is never possible to maximize all production values, and relative priorities must be set for each management unit. Further, production decisions within one owner's boundaries may affect production capabilities on a neighboring owner's land and may influence the neighbor's utility further if amenities are also impacted.

The legal constraints and entrenched conflict industry mean that any public land decision process must meet precise procedural requirements and that there are well-organized groups of advocates who will pounce on procedural errors to overturn decisions that they do not regard as meeting their needs. As such, decision-makers' range of process opportunities is substantially limited; they do not have carte blanche to assess a situation and craft a situation-specific process that meets the unique issues at hand. They must comply with a daunting array of judicial mandates, policy directives, and legal precedents. In addition, the policy gladiators employed by the various interest groups are rewarded for the quality of their battles, not their compromises; they are only too willing to exploit procedural errors and adopt extreme rhetorical positions.

### *Special Challenges of Ecosystem-Based Management*

As if the general demands of land management are not enough, adding ecosystem-based management contributes even more. Notable among these are:

- complexity and uncertainty increases;
- systems view is more important; and
- mixed ownership solutions are more important.

One of the goals of ecosystem-based management is to consider more issues, acres, and years in one's decisions. This certainly raises the technical complexity, but it creates additional policy challenges as well. Because ecosystem-based management is based on emerging disciplines such as conservation biology, there are few guarantees that management will achieve the precise outcomes that models might predict. Probabilistic assessments are perhaps the best one can reasonably produce.

This fundamental uncertainty allows interest groups to establish unrealistically stringent burdens of proof as preconditions before they will support management choices, thus effectively preventing implementation. In the spotted owl conflict, both of the major combatants have used this tactic. Environmentalists have argued for no more harvesting on the federal lands because there are no guarantees that the owl will survive if harvesting persists. Industry proponents have likewise argued that there is no proof that protecting critical owl habitat guarantees species survival and that there is no proof that the owl will not adapt and survive if harvesting continues. Both sides are right — there are no guarantees with ecosystem-based management.

A systems view is also increasingly important under ecosystem-based management.<sup>4</sup> The ability to understand the linkages between the various physical and biological components of an ecosystem are obviously central to success of this emerging management philosophy. It is equally important, however, to understand the links among biophysical conditions, social structures, land ownership patterns, existing technology, and policy processes.

The ability to address mixed ownerships will determine the future of ecosystem-based management to a considerable extent. The nineteenth century policies that granted land to railroads and homesteaders in the west created a pattern of checkerboard lands (alternating 1-mile squares) in the former case and a pattern of private lands in the low elevations and public land above them in the latter case. In both situations, no single owner controls a block of land that encompasses any significant ecosystem-scale processes, and any policy that intends to reflect ecosystem functions must cross ownership boundaries. In addition, there is considerable legal ambiguity in the authority that any federal land management agency has either to consider the activity of other land owners in its own planning or to regulate the behavior of nearby landowners.

In short, the social and political considerations of ecosystem-based management on mixed ownerships are as complex as are the biological considerations. Ecosystem-based management can only proceed if it is effective policy and quality science. One element of effective policy will be the quality of the

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<sup>4</sup> In some circles, systems thinking is likened to vague, overly generalized thinking. The converse can also be true. Systems thinking is increasingly seen as a key activity in large, complex situations (Senge 1990; Flood and Jackson 1991). Techniques of particular relevance to ecosystem-based management are soft systems (Checkland 1981; Wilson and Morren 1990) and interactive planning (Ackoff 1974, 1978).



public involvement that accompanies the decision process, particularly if that involvement is able to invest a considerable measure of social legitimacy in the outcome. To the extent that it will not be possible to provide everything to everyone under ecosystem-based management, a meaningful voice in the process will likely be an important factor in the ability to craft policies that the affected groups view as legitimate (Lind and Tyler 1988). However, as mentioned earlier, extensive studies and literature have indicated the inadequacy of current public involvement practices. Many of these criticisms were summarized succinctly by the Office of Technology Assessment (1992) as (1) use of incorrect models of public involvement, (2) the lack of information on how to involve the public, (3) professional resistance to public ideas, and (4) inflexible conditions for managers. It is to public involvement that our attention now turns.

### **Selecting a Potential Public Participation Strategy**

Although federal land managers are required to involve the public throughout the planning process, broad discretion is left to the managers on how to conduct involvement programs. Given how many different kinds of decisions there are and how many different individuals and groups are potentially involved, to presume that there is any single "magic bullet" approach is perhaps naive. But if one rejects the magic bullet notion, then one faces the task of choosing among a set of decision processes, with the relative superiority of some processes contingent on the attributes of the situation at hand. Such a contingency analysis compels one to assess the situation, define the key attributes that might lead to differential success of different decision processes, and then select the indicated process from the set of available choices.

Fortunately, the Vroom-Yetton model (1973) structures that task to a considerable extent. It is a contingency approach to decision-making grounded in studying how leaders make decisions in different ways, given different situations, in order to be effective. The Vroom-Yetton model received a fairly early critique (Field 1979), as well as subsequent tests and refinement (Vroom 1976; Vroom and Jago 1978; Field 1982; Schweiger and Leana 1986). Field, who earlier criticized the model, concluded later (1982) that "evidence has accumulated that managers should be aware of the [Vroom and Yetton] normative model and its potential use in decision-making" (p. 532).

The link between Vroom-Yetton and public involvement has been developed by Thomas (1990, 1993). This research studied a set of 42 public decision processes to determine their (1) core attributes, (2) decision processes, and (3) decision effectiveness (measured as effective, mixed/uncertain, or ineffective). By comparing the situational attributes of each case with the Vroom-Yetton model's recommended decision process, consistency between the cases and the model was established. This consistency could then be correlated to decision effectiveness. Thomas's conclusion was that were "strong relationships be-

tween this deviation from recommended involvement and all three measures of decision effectiveness; the greater the departure from the recommended involvement, the less effective the decision" (Thomas 1993, p. 454). Moreover, the deviations from the Vroom-Yetton model were decisions with too little public involvement rather than with too much involvement (Thomas 1990, p. 439).

Specific application of Vroom-Yetton to natural resource decision-making has been discussed by Sample (1990, 1993). Both studies present the model and explain why it might be a valuable addition to agency public involvement planning. Neither attempts to characterize natural resource decisions to determine which Vroom-Yetton recommendations might be associated with effective decision-making. That extension is the major goal of this article.

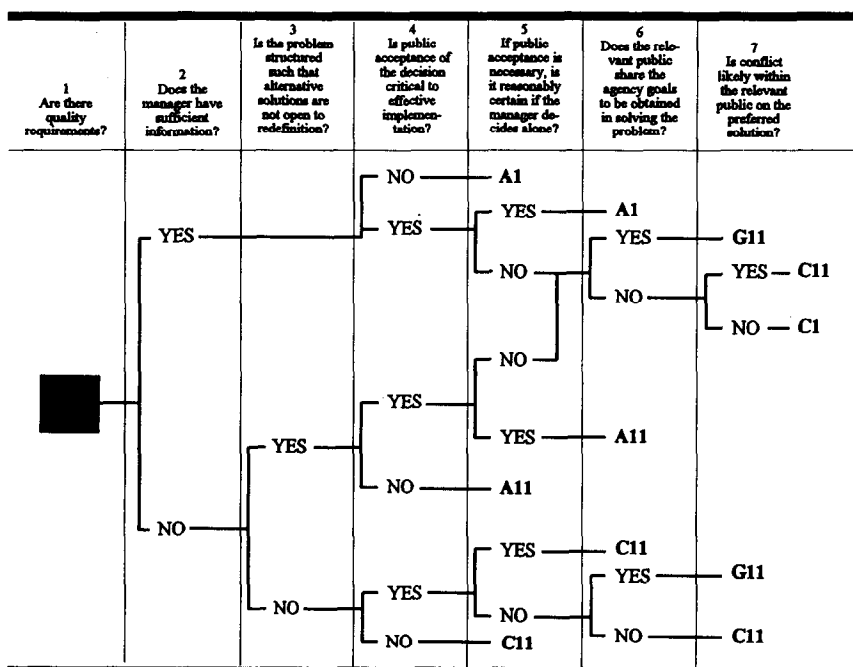
### *Brief Overview of the Vroom-Yetton Model*

The contingency analysis in the Vroom-Yetton model involves seven questions that are asked sequentially. Phrased in terms of public involvement and agency decisions:

1. Are there quality requirements such that one solution is likely to be more rational than another? (These requirements refer to professional standards, legislated mandates, engineering considerations, etc.)
2. Does the agency have sufficient information prior to the beginning of the decision-making process to make a high-quality decision?
3. Is the problem structured such that alternative solutions are not likely to be acceptable? (This is a question of decision space; are there a number of potentially acceptable alternatives, or is the choice substantially predetermined?)
4. Is public acceptance of the decision critical to effective implementation?
5. If public acceptance is necessary, is that acceptance reasonably certain if the agency decides without public involvement?
6. Does the relevant public share the agency goals to be obtained in solving the problem?
7. Is conflict within the public likely to result from the preferred solution? (Thomas 1990).

Each of these questions involves a yes/no response; the set of questions therefore operates as a dichotomous key to produce recommended public involvement approaches for different situations (see Figure 1). The Vroom-Yetton decision process options, as modified by Thomas (1990) for compatibility with public involvement, are:

1. Autonomous managerial decision (A1): The agency makes the decision alone, without public involvement.
2. Modified autonomous managerial decision (A11): The agency seeks input from the public but makes the decision alone in a manner that may or may not reflect the input.



**FIGURE 1.** Dichotomous key to public involvement approaches.

Key to decision process options: A1: autonomous managerial decision; A11: modified autonomous managerial decision; C1: segmented public consultation; C11: unitary public consultation; G11: public decision. Source: adapted from Thomas (1990).

3. Segmented public consultation (C1): The agency shares the problems separately with segments of the public, getting ideas and suggestions, then makes a decision that reflects group influence.
4. Unitary public consultation (C11): The agency shares the problem with the public as a single assembled group, getting ideas and suggestions, then makes a decision that reflects group influence.
5. Public decision (G11): The agency shares the problems with the assembled public, and together the manager and the public attempt to reach agreement on a solution.

Because there are more than five decision process options on the Vroom-Yetton decision tree, most of the options are recommended for more than one type of situation.

Whereas the Vroom-Yetton approach indicates a public involvement approach, it does not provide recommendations of specific public involvement methods, such as public meetings or workshops. Thus, it is up to the public participation practitioner to select methods that fit within the approach se-

lected through the decision tree, including matching specific methods to legal requirements and management resource availability.

### *Applying Vroom-Yetton to Ecosystem-Based Management*

Application of the Vroom-Yetton model begins by asking the seven core questions. For the specific case of ecosystem-based management on mixed ownerships, the questions might broadly be answered as follows:

1. Are there quality requirements such that one solution is likely to be more rational than another?

Yes. There are scientific considerations, physical constraints, financial feasibility, and legal requirements to consider. Many solutions are likely to fall outside of these constraints. Thus, it is possible, and indeed necessary, to be able to define some outcomes in ecosystem-based management as preferable to others (Salwasser 1994).

2. Does the manager have sufficient information to make a high-quality decision?

No. The process of ecosystem-based management requires considerable learning in both the short-term and long-term (Lee 1993). The interest in adaptive management bears witness to that need. Furthermore, there is typically insufficient information about public values and interests before a land management decision process begins — hence the need for social assessment scoping activities.

The sufficiency of information is even more suspect as more private lands are involved. Biological data on those lands has not generally been gathered by agencies, and information on private management goals/plans is generally closely held.

3. Is the problem structured such that alternative solutions are not likely to be acceptable?

Yes and no, depending on the situation. This question refers to the latitude one has to develop new alternatives, and that ability is situationally defined. There is sufficient ambiguity in the concept of ecosystem-based management, and enough ways in which it might be defined and implemented, to imply that in general there is considerable room for redefinition.

In other settings, the decision space may be quite limited and conveying impressions to the contrary raises expectations that cannot be fulfilled. For example, the hierarchical structure of federal land management agencies means that some on-the-ground decisions may be largely preordained by decisions made at higher levels in the agency. By the same token, critical habitat designation is required by the Endangered Species Act once a species is listed; holding a public forum to discuss designation may imply the existence of decision latitude that in fact may not exist.

Given this contextual variability, it is useful to consider the Vroom-Yetton recommendations that result from either outcome of this question.

4. Is public acceptance of the decision critical to effective implementation?

Yes. The history of the past 30 years of public land management policy shows clearly that public acceptance is crucial to effective implementation (Wondolleck 1988). The number of groups interested in land management policy, and their ability to either appeal, litigate, legislate, publicize, or monkeywrench—depending on which tactic meets their needs best at the time—means that implementation can grind to a standstill if those groups do not view the process as acceptable.

5. If public acceptance is necessary, is that acceptance reasonably certain if the agency decides alone?

No. The range of views regarding the preferred future for the public lands is too broad to make acceptance likely (Wondolleck 1988). In fact, the converse is more likely the case. Because it is generally impossible to meet everyone's goals from a limited resource base, it is more likely that dissatisfaction is reasonably certain if an agency makes a unilateral decision.

This is doubly true where private lands are involved; if an agency made a unilateral decision on how private lands in an ecosystem-level planning unit were to be managed, public acceptance appears virtually impossible.

6. Does the relevant public share the agency goals to be obtained in solving the problem?

No. Given the diverse views regarding resource issues, it is important to disaggregate the relevant public into specific groups (Shindler et al. 1993). Although there may be portions of the public that share the agency goal, there will also be groups that do not.

7. Is conflict within the public likely to result from the preferred solution?

Yes. Land management has become highly politicized in recent years, as controversies such as the Northern spotted owl/federal forestry conflict have played out. The groups interested in land management have become polarized, and the rhetoric has taken a zero-sum game/"take no prisoners" tone.

## Discussion

Tracing these answers through the Vroom-Yetton contingency tree provides recommended public involvement/decision-making strategies. Given the uncertainty about alternative redefinition (question #3), two separate routes must be examined. In the most general case for ecosystem-based management—where there is opportunity for redefining alternatives—a public decision process is recommended. It is the preferred choice because public accept-

ability is crucial to effective implementation, but the public does not generally share the agency's goals. The social factors, combined with the complexity of ecosystem-based management (quality requirement, incomplete knowledge, and flexibility in alternative definitions), mean that processes less interactive than public decision-making are problematic. The agency and public must work together on shared definitions of the situation at hand, on joint fact-finding projects, and on defining the different roles for public and private land in order to agree on a course of action. Any other decision process is either not likely to achieve the technical standards that ecosystem-based management implies or would not achieve the degree of social acceptability needed for effective implementation. Litigation following the FEMAT process has focused on the failure of that process to include properly public decision-making (Walker and Daniels 1996). Although it may be argued that opponents of the substantive results of Forest Ecosystem Management Assessment Team (FEMAT) are using legal procedural requirements to block implementation, it is also possible that public decision-making would have resulted in greater social acceptability.

If developing new alternatives is not possible, the contingency tree suggests segmented public consultation. This consultative approach is called for because of the interaction of two factors: fragmented public opinion and lack of decision space. Because the public does not uniformly share agency goals and because the decision may exacerbate intergroup tensions, bringing the groups together in a consultative or decision-making process involves social/political risks. Furthermore, the alternatives cannot be restructured significantly, implying that there is little effective decision latitude; the choice may have already been largely prescribed. In this particular situation, bringing diverse and polarized groups together may only add tension, given that the problem structure offers few ways in which their input might be integrated into the decision.

Much of the Vroom-Yetton approach is predicated on a model of a unitary decision-maker, which is a *prima facie* contradiction with ecosystem-based management on mixed lands: no single decision-maker controls the entire system. A more plausible scenario is that an issue network (Heclo 1978; Browne 1986) might emerge to focus on issues of common interest, with the public land manager being but one player in that network. Even so, that manager must choose carefully among the various collaborative opportunities that emerge and must simultaneously fulfill the existing legal requirements for public involvement. Failure to do so raises the risk of violating various open-government laws such as the Federal Advisory Committee Act of 1973. Because there are legislated authorities that reside with public land managers, they are ultimately accountable for their public involvement decisions, and the unitary decision-making emphasis of the Vroom-Yetton model is compatible with this role.

## Conclusion

There is tremendous interest in participatory decision-making in both the private and public sectors (Senge 1990; USDA Forest Service 1995). Even so, there is more than one way to define participatory, and a high degree of participation is more appropriate in some situations than in others. The thoughtful matching of decision process to situation becomes paramount.

The Vroom-Yetton model assists in the selection of decision-making strategies. If this study's representation of ecosystem-based management is correct—that it must consider mixed ownerships, meet quality standards in terms of its management, and be acceptable to a diverse and polarized public—then the appropriate public involvement strategy is a public process that stresses joint problem structuring and solving. The exception to that broad recommendation is for those situations where the alternatives have largely been predetermined; segmented public consultation is probably more compatible with the situation.

This study accomplishes two tasks. First, it develops a general conclusion that public decision processes are more compatible with the general structural attributes of ecosystem-based management than are other forums. Second, it illustrates how the Vroom-Yetton model can be applied to ecosystem-based management situations. Whereas the former is the study's explicit focus, the latter may be an equally important outcome. There will be sufficient variation in the specific technical and sociopolitical details of ecosystem-based management projects to make any generalized recommendation regarding public involvement suspect. It is probably more useful for agency managers to reason through the Vroom-Yetton logic for themselves, so that they might think carefully about the public involvement challenges and choices before them.

Even so, this effort leaves one significant issue largely undiscussed: the challenge of implementing a public involvement strategy. Whereas the Vroom-Yetton model offers some general guidance regarding the type of process one might use, it offers little in terms of tactical insight into how to conduct specific activities that convert that strategic vision into tangible progress. Fortunately, a number of techniques have emerged in recent years that address the tactical challenge of resource planning: strategic perspective analysis (Dale and Lane 1994), collaborative learning (Daniels and Walker 1994), and participatory design workshops (Deimer and Alvarez 1995) among them. These are largely consistent with the learning-based emphasis that characterizes much of the contemporary business/organizational development literature (e.g., Senge 1990; Schwartz 1991) and their emphasis on learning teams, systems thinking, and scenario planning. Managers have a set of tools available to them, but applying them in an informed manner must be founded on a careful analysis of the underlying decision situation. The Vroom-Yetton logic can contribute to that process, but it must be viewed as initiating a deliberative process, not ending it.

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