Chapter 7

Efficient Group Decision Making in Workshop Settings

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Abstract: Public land managers must treat multiple values coincidentally in time and space, which requires the participation of multiple resource specialists and consideration of diverse clientele interests in the decision process. This implies decision making that includes multiple participants, both internally and externally. Decades of social science research on decision making by groups have provided insights into the impediments to effective group processes. Nevertheless, there has been little progress in producing more rigorous and accountable decision processes in land management. The authors' experiences with temporary, formal groups (workshops) have led them to develop a process for group decision making that combines (1) a strawman document to initiate and pattern group discussion, (2) brainstorming to generate ideas, and (3) the analytic hierarchy process to produce judgements, manage conflict, and develop implementation plans. An application of this group process to program development in tire research in a workshop setting indicates that it is efficient and cost effective, and provides a large amount of useful quantitative information about group preferences.

1. INTRODUCTION

Natural resource management has become increasingly complex during the past two decades due to the multiplicity of management objectives that must be considered to address public interest, legislative requirements, and

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environmental compliance. "Ecosystem management" is the paradigm most commonly cited as the appropriate template for resource management by public agencies. Indeed, this concept has provided a vehicle for a transition on United States federal lands from commodity-dominated and output-based management to the inclusion of multiple resource values.

Few choices in natural resource or environmental management are made unilaterally. Decision makers rely on others either directly through consultation and collaboration or indirectly through established protocols and chains of command. There is a tacit belief that groups function in a superior way to individuals when important issues are at stake, which has led to a proliferation of workshops focused on a wide range of issues in natural resources. While there are many important benefits from group interaction and a team approach to problem solving, there are also well-documented drawbacks associated with group processes (McGrath 1984). In light of the growing complexity of decisions in natural resource management, group decision making is becoming increasingly common, and we anticipate that its shortcomings will become more noticeable in the future.

Many decisions that must be made depend on subjective information and values. Judgmental (value laden) decisions that do not result in group unanimity produce less decision satisfaction for group members (Kaplan and Miller 1987), as opposed to informational (intellective) decisions that have a demonstrably "correct" answer. This implies that as strategic and tactical land management decisions are influenced by a wide variety of stakeholders' agendas (not entirely intellective influences), it will become more difficult for a majority to reach a state of satisfied acceptance. Therefore, it is increasingly important that differences in preferences be understood and that mechanisms and procedures for describing and handling them be developed and applied.

Many natural resource problems involve selecting among a fixed set of alternatives or treatments or scenarios—a 1-of-*N* decision situation. On the surface, this seems like a straightforward task, but it is not that simple. There are many criteria, influences, and stakeholders that help to frame a decision. This often reduces the likelihood of making a good decision to little better than 1/*N*, or random odds.

Furthermore, decision making typically involves a BOGSAT process ("Bunch Of Guys/Gals Sitting Around a Table", Peterson *et al.* 1994). BOGSAT appears, on the surface, as a very cost-effective decision mechanism, because relatively little time or effort is expended. These perceived cost savings can become irrelevant, however, if shortcomings of the process lead to downstream costs such as time-consuming and expensive litigation and land *mis*management. By expending more organised and systematic effort up-front, it may be possible to reduce total costs in terms of time, money, and credibility.

Because we expect that dependence on group decision making (GDM) in natural resource management will increase, we have sought to develop a group decision process that minimises negative dynamics and process losses, while attaining beneficial group effects. Based on a review of the pertinent social science literature and our own empirical observations during group decision-making situations, we have developed a group process that contains three basic components: (1) a strawman document that acts as a template and starting point for group discussion, (2) a mechanism for idea generation that enables a group to quickly and easily produce issues to be included in the decision process (e.g., criteria, objectives, alternatives, etc.), and (3) the analytic hierarchy process (AHP) as the decision structuring and analysis component. In the next section, we provide some background and previous research results on GDM, followed by a description of our GDM approach for workshops and other formal meetings.

2. GROUP DECISION MAKING

2.1 Group Attributes and Tasks

In some instances, decision-making groups contain relatively fixed membership and persist for long periods of time, meeting periodically to make strategic, policy, or tactical decisions (e.g., the resource management staff of a national forest—a persistent, formal group). Other groups are assembled for a short period of time for specific tasks (e.g., technical workshops—temporary, formal groups, q.v. Peterson *et al.* 1992, Rogelberg *et al.* 1992, Peterson *et al.* 1993, Schmoldt *et al.* 1999). Such task-oriented, temporary groups can be distinguished by differentiation of members' skills, little synchrony within or across members' organisations, and variable duration (Sundstrom *et al.* 1990). While these two types of groups (and specific groups, as well) may differ in decision rules, group dynamics, membership, meeting procedures, and organisational support, all types of groups have common problems (see Group Liabilities, below).

It is often assumed that decisions produced by a group are superior to decisions by an individual. In reality, groups generally perform better than their *average* individual member does but worse than the group's *best* individual (Hall and Watson 1970, Hill 1982, Yetton and Bottger 1982, Bottger and Yetton 1987, Rogelberg at al. 1992). Ideally, we should strive to avoid group deficiencies and yet capitalise on inherent group benefits. All types of groups can benefit from group-decision methods that facilitate dialog, mitigate adverse interactions, provide a smooth and efficient process, and produce good collective decisions.

McGrath (1984) summarised much of the existing literature on group interaction and performance, and categorised group tasks into four components: (1) generate (identify alternatives), (2) choose (make value-laden judgements), (3) negotiate (manage conflict), and (4) execute (coordinate detailed implementations). Most resource management decisions and actions incorporate aspects of each of these dimensions, which makes analysis and implementation difficult.

A group-decision context provides several benefits. First, two individuals bring more knowledge to the table than one person does; each additional person brings an added amount. Second, the addition of other people to the decision process also produces an interaction effect, whereby multiple approaches to a problem can eliminate the limited scope that often hinders individual thinking. Third, if more than one person is affected by a decision, it is desirable to have those affected parties involved in the decision process. Participation increases decision acceptance and the ability and willingness of group members to champion the decision when faced with affected parties outside of the group. Because these assets are intrinsic to most groups, most research has sought to identify which factors *hinder* GDM, and to find methods that eliminate them.

2.2 Group Liabilities

"Process losses" (Steiner 1972) associated with human interaction impede group communication. On the other hand, when group interaction favours the exchange of relevant decision-making information, favourable decision outcomes occur (Vinokur *et al.* 1985). Shyness, poor communication skills, and individual dominance all contribute to process losses in groups (Johnson and Johnson 1987). Social pressures to conform can stifle effective discussion (Maier 1967) and lead to group avoidance of viable alternatives (groupthink). Social loafing—relying on others to perform the group's work—is also common (Williams *et al.* 1981). Additional problems include personality conflicts (Maier 1967), promotion of personal agendas, and uncooperative individuals.

Agreement within a group (consensus) is important because it: (1) ensures individual ownership in, and commitment to, the group solution, (2) promotes individual satisfaction with the group outcome, (3) provides a unified (even if only majority) group decision that is viewed as more reliable and supportable by outside agents, and (4) produces a group accomplishment and avoids the perception of a lack of consensus. Majority and unanimity are the two basic decision rules used to obtain consensus (conformity in the case of majority rule). On the other hand, expectations to conform and produce a consensus judgement can often dilute individual, specialised contributions. The failure by groups to adequately consider and accept individual opinion (when correct) often drives suboptimal group performance (Maier and Solem 1952, Janis 1971, Lamm and Trommsdorff 1973). Consequently, groups often choose a middle-ground position that compromises a better alternative for the sake of agreement (cohesion; Callaway and Esser 1984, Leanna 1985) or to merely avoid a less desirable alternative.

The authors' experiences with technical workshops (as temporary formal groups) suggest that such meetings often are dominated by unfocused and rambling discussion, which mixes judgmental and intellective issues (Schmoldt and Peterson 1991, Peterson *et al.* 1992, Peterson *et al.* 1993, Schmoldt *et al.* 1999). Ideas presented in such a freeform dialog have merit, but those ideas may not always be synchronised with a logical flow of topics. While general discussions of this nature can produce beneficial results due to juxtaposed ideas, there is also a cost due to inefficiencies of time and effort and the potential loss of ideas introduced in the wrong context. Lacking any sort of meeting structure, groups often go through an unfocused and inefficient period developing discussion protocols and group expectations. Many individuals also attempt to promote personal agendas during this initial period of disorganisation, which can bias subsequent group interaction.

2.3 Strategic Research Planning

Developing a long-term research program involves strategic planning. Formal studies of strategic decision-making practices have found that logical and sequential steps are rarely used, sophisticated methods for problem formulation are lacking, and alternatives are not critically examined (Milliken and Vollrath 1991). The four components of strategic decision making or planning (McGrath 1984) were mentioned previously, and include: generating, choosing, negotiating, and executing. The GDM approach described below is a highly structured process that relies heavily on the AHP for its structure (refining and organising), and utilises brainstorming as an idea-generation mechanism. Negotiation (or agreement) is supported within the process but is not required due to the capability of the AHP to calculate an average of disparate judgements. When options (or alternatives) are prioritised with respect to both importance and feasibility, an implementation plan emerges naturally (e.g., select alternatives with high importance and high feasibility). However, we have also supplemented the process with a "strawman document" that acts as an archetypal template to provide initial content for group discussions. Such a document provides the group with a starting point for deliberations, and removes much of the time-consuming, procedural gymnastics that groups experience while trying to develop an operational protocol for discussion.

We illustrate the application of an AHP-based GDM process in a strategic context by formulating a research program for assessing the effects of large-scale fire disturbances (Schmoldt *et al.* 1999). We developed an AHP-based process for workshop settings based on the success of the AHP in similar group settings (Basak and Saaty 1993, Bryson 1996, Choi *et al.* 1994, Dyer and Forman 1992, Madu and Kuei 1995, Peterson *et al.* 1994, Reynolds and Holsten 1994) and its ease of application compared to multi-attribute utility theory (Bard 1992). The GDM process described here is potentially applicable to many types of workshops, meetings, and other temporary (or persistent), formal group tasks.

3. AHP-BASED GROUP DECISION MAKING

During the past decade, there has been a proliferation of workshops associated with planning and decision making in federal agencies. However, the personal experiences of many workshop participants are that such meetings are often unfocused and unproductive, wasting both time and money, and producing results with little substance. Although the AHP has most often been applied in small-group settings, it is also effective in facilitating the conduct of large workshops that include decision making as a component of their objectives (Schmoldt *et al.* 1999).

Workshops will succeed only if (1) the workshop host has clearly stated the objectives (Silsbee and Peterson 1991, 1993), (2) the workshop process is highly structured, and (3) there are specific products resulting from the workshop. As with any discussion group, size matters, because a group with too many participants leaves little opportunity for any single individual to contribute. Introductory information and plenary sessions should be relatively brief and directly relevant to the objectives of the workshop. One or more facilitators, who are willing to assertively guide the workshop process and keep discussion focused, are a key to successful workshop outcomes.

3.1 Workgroup-Focused Deliberations

While a workshop may have many participants, most of the actual work is best conducted in smaller *workgroups*. Each workgroup can be assigned a discrete part of the overall decision problem—for example, in Figure 1, each workgroup was assigned a single "primary topic". Our GDM process is designed to operate in this intimate, participant-friendly environment of small workgroups. In the context of GDM, each participant has more opportunity and greater willingness to contribute (less introverted behaviour and less social loafing), and social inhibitions are less pronounced. Members of each workgroup can also be given considerable freedom to move about and participate in other workgroups as appropriate (for informational purposes only). This encourages wide-ranging contributions by participants (also hindering introverted behaviour) and facilitates between-group interaction (discourages social loafing). Use of disjoint workgroups is particularly effective when primary topics are relatively focused and discrete. However, care must be exercised when making workgroup assignments, because it is possible to unwittingly skew workgroup membership in a negative or political way.

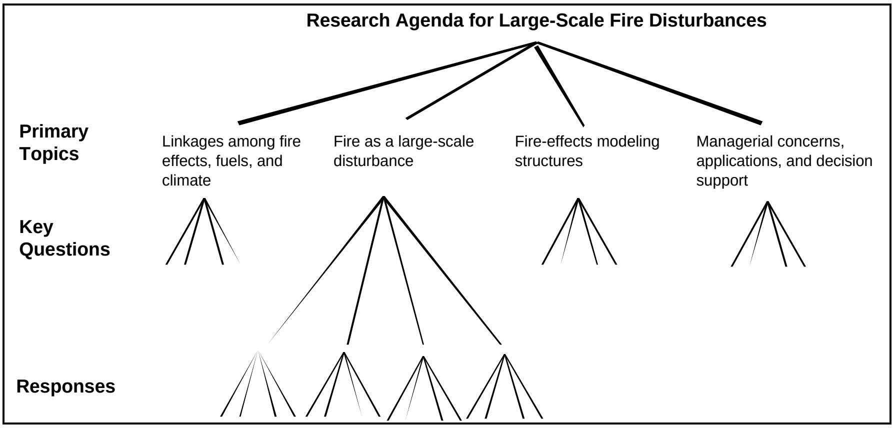

Figure 1. The hierarchical organization of primary topics, key questions, and response to key questions is illustrated. The *response* layer is displayed for only one key question; it would be duplicated for the others. Terminology for each level is generic and designed to accommodate many types of decision problems.

3.2 Strawman Document

It is normally helpful to present workshop participants with a "strawman" document as a framework for discussion and potential revisions (Schmoldt and Peterson 1991). In the case of an inventory and monitoring (I&M) program, the strawman can be a summary of key scientific/managerial questions and responses, sample project statements, or a programmatic plan developed by someone else. The strawman may eventually be completely revised in the course of the workshop, but its presence is extremely helpful in reducing unfocused discussion and as a starting point for initial deliberations.

3.3 Hierarchical Organisation of Topics

In keeping with the overall structure of the AHP, a hierarchical organisation of workgroup discussion topics is used. We can organise this hierarchy using the generic concepts of *primary topics*, *key questions*, and *responses* (Figure 1). These generic terms for hierarchy sub-levels are used because they are intuitively understandable and reflect a problem-solving approach to a technical workshop assignment. Their generic nature also means that the same hierarchical structure and terminology could be used for other technical workshops, or supplanted with more workshop-specific terminology. An initial hierarchy is presented in the strawman document, although workgroups can modify this structure as they develop their own topics. Subsequent levels of each sub-hierarchy contain key questions and responses to key questions.

The hierarchy presented in Figure 1 is not a traditional AHP hierarchy, but rather, more like a taxonomy. In a typical AHP exercise, items at each level are compared pairwise with respect to *each* element in the level above, and priority values are propagated down the hierarchy to alternatives (in this case, responses to key questions) at the lowest level. This produces a *fully-connected* hierarchy, where all items on each level are connected to all items on adjacent levels. For the fire workshop described below, the hierarchy is singly connected, therefore, each response receives only a contribution of importance (or feasibility) from one key question in the preceding level.

Because each workgroup discusses a single primary topic, workgroup sub-hierarchies can eventually be combined to form a global hierarchy for the workshop—each primary topic would be an element on level one of the global hierarchy. Comparisons could then be made among the primary topics according to importance and feasibility. Program managers could perform this step, if importance and feasibility have strategic relevance. However, this level of comparison is beyond the scope of the workgroup context, each of which focuses on a single primary topic.

3.4 GDM Process

With the use of small workgroups, an AHP-based hierarchical structure of discussion topics, and an archetypal template (strawman document) as operational tools, the general process for each workgroup is to: (1) identify key questions in the primary topic area assigned, (2) rank those key questions with respect to importance (and feasibility, where appropriate), (3) articulate responses to each of those key questions, and (4) rank the responses to each key question with respect to importance and with respect to the feasibility of scientific knowledge, models, and data. Because steps 3-4 for *responses* duplicate steps 1-2 for *key questions*, the next two sections refer to them both as "issues" and they are not duplicated here for both types of issues.

3.4.1 Idea generation

One of the most familiar GDM techniques, brainstorming, has been around for a long time. It simply provides for face-to-face discussion between individuals with the intent of generating ideas. In a round-robin fashion, group members offer ideas, which are recorded for later discussion. Ideas that seem to have a nominal amount of group agreement are eventually retained (McGrath 1984). Brainstorming is valuable for making lists of things and generating ideas. However, individuals working alone can generate more ideas than when working in groups, which suggests that group dynamics can have a negative impact on brainstorming (Lamm and Trommsdorff 1973).

Because brainstorming aims to generate lots of ideas, workgroup members offer up issues while someone records them. Brainstorming can use the strawman document as a template for generating ideas or can be done independently of the strawman. In any case, the objective is to generate many issues as quickly as possible. No evaluation of issues is made at this point; rather, judgement is deferred until subsequent discussion. When the production of additional issues begins to dwindle, further enumeration is suspended and discussion commences.

Issues identified by brainstorming can be further refined during discussion. Workgroups can augment each issue to include a clear statement of its meaning and a thorough explanation of its rationale and its position within the primary topic. Recorders then edit these descriptions as necessary and can print out copies for all workgroup members to reference in subsequent deliberations.

3.4.2 Issue ranking

The AHP is used to prioritise and rank the individual issues within each list generated by each workgroup. As described above, this is conducted by all workgroup members (who make pairwise comparisons of the issues), with final scores calculated for the group as a whole. Geometric averaging should be used for these ratio-scale judgements. Individual rankings should generally be compiled privately by each person to avoid the possibility of biases. It is recommended that rankings be developed for both importance and feasibility (or practicality), in cases where these different criteria have different implications for program development or decision making. By having AHP software available at the workshop, all the raw data for pairwise comparisons can be entered and final rankings can be quickly calculated and reported to workshop participants. An I&M example of this brainstorm/discuss/rank procedure appears in Figure 2.

3.4.3 Analysis of priority vectors

Ranking of list items derived from ratio-scale judgements is a critical part of the AHP (Saaty 1980). Within a workgroup, all corresponding judgements are geometrically averaged to produce a single, group judgement for each comparison. This produces a group priority vector. There are two critical questions regarding final priority vectors. One, is there general agreement among workgroup members with respect to their rankings in the priority vectors? Two, are different values within a priority vector really different?

Each workshop attendee can be viewed as a sample from the population of experts on the workshop topic. Because not all experts agree exactly, each priority vector provided by a workgroup member may differ from other workgroup members. One way to be more confident in these uncertain results is to perform statistical tests. Individual judgements can be treated as samples from a population of experts that are independent and identically distributed. The approach that we use is to conservatively apply distribution-free tests that are analogous to tests based on the normal distribution of vector elements (Smith *et al.* 1995). Because distribution-free tests use rank information only (no magnitudes), they may fail to detect significant differences in some cases.

Three common distribution-free tests that are useful in this context are Friedman's two-way ANOVA, the Kruskal-Wallis one-way ANOVA, and Wilcoxon's signed-ranks test. The Friedman two-way ANOVA test analyses the rankings by different workgroup members on each set of items compared. The null hypothesis is that there is no systematic variation in the rankings across items by workgroup members. The Kruskal-Wallis one-way ANOVA test indicates whether there are differences between the elements of a priority vector taking into account all workgroup member judgements. The null hypothesis is that there are no differences. While this test can indicate when differences exist, it does not specify which vector elements are different. To highlight specific differences, the Wilcoxon signed-ranks test is used. A pairwise table of probability values is created which is equivalent to an ANOVA post-hoc test for mean differences. The combination of these three tests allows us to analyse group, and individual, rankings.

Brainstorm

Anadromous fish
Water quality
Phytoplankton
Benthic invertebrates
Aquatic vascular plants
Resident fish
Amphibians
Zooplankton
Ducks and geese

Discuss

1 Need to divide water bodies into lakes/ponds, streams, and reservoirs; different relevant I&M components for each category
2 Water quality is easiest thing to measure
3 Fish populations are difficult to measure
4 Vascular plants should be considered by the terrestrial vegetation workgroup
5 Birds should be considered by the terrestrial fauna workgroup

Rank

	Lakes and ponds		Streams		Reservoirs	
Monitoring component	AHP priority	Ranking	AHP priority	Ranking	AHP priority	Ranking
Anadromous fish	*	—	0.240	2	*	—
Resident fish	0.212	2	0.205	3	0.460	2
Water quality	0.233	1	0.247	1	0.540	1
Amphibians	0.171	3	0.148	5	*	—
Phytoplankton	0.106	6	*	—	*	—
Zooplankton	0.112	5	*	—	*	—
Benthic invertebrates	0.165	4	0.160	4	*	—

* Resource not monitored in this location

Figure 2. An example of the brainstorm/discuss/rank process for monitoring aquatic biota. Information is typically recorded on a flipchart and/or laptop computer during a workshop (adapted from a workshop for the North Cascades National Park Service Complex).

Although statistical analysis of AHP results provides insight into the decision-making process, a detailed analysis may not be needed for all workshops. If statistical analysis is desired, it should be incorporated in the design of the AHP approach, and someone with statistical expertise should participate in workshop planning and compilation of results.

4. SETTING RESEARCH PRIORITIES: AN EXAMPLE

4.1 Background and Workshop Conduct

The role of fire as a disturbance phenomenon in forest, shrubland, and grassland ecosystems of western North America has long been recognised. Nevertheless, there are many difficulties associated with scientific assessment and management of large-scale fire phenomena. This problem was brought sharply into focus in 1988 during and following the large fires in the Yellowstone National Park region. Given the complexity and importance of large-fire phenomena, there is a need to improve our current scientific assessment and management of natural resources in North America with respect to fire disturbance. In April 1996, a group of scientists and resource managers gathered at the Fire-Disturbance Workshop at the University of Washington to discuss these issues. The workshop objectives were to: (1) identify the current state-of-knowledge with respect to fire effects at large spatial scales, (2) develop priorities for scientific assessment of large-scale fire disturbance and its effects, and (3) develop priorities for assisting scientifically-based decision making with respect to fire disturbance in resource management.

Workshop discussion centred around four *primary topics*: (1) linkages among fire effects, fuels, and climate, (2) fire as a large-scale disturbance, (3) fire-effects modelling structures, and (4) managerial concerns, applications, and decision support (Figure 1). Because these topics are relatively independent, small workgroups were used rather than one large plenary session. Each of the 25 workshop attendees was assigned to one of the four workgroups, based on their established expertise. Both scientists and managers were in attendance—in about a 3-to-1 ratio, respectively.

Following a two-hour introduction to the workshop structure/process (including the use of brainstorming, the AHP, the strawman document, and subsequent analyses of priority vectors), workgroups met for one full day and for two hours on the morning of the third day to discuss and synthesise their results. Total time spent in workgroups was 10 hours. After a morning break on the third day, a plenary session was again convened with a member from each workgroup making a summary presentation to the entire group.

A spreadsheet macro was written to generate matrices and perform AHP calculations during the workshop. The recorder needed only to label matrix-row headings and enter each workgroup member's judgements. The software calculated the priority vectors and consistency ratios. Because all judgements are entered into a spreadsheet, it is then possible to modify selected cells (e.g., judgements) and observe how the priorities and consistency change. Statistical analyses of priority vectors were conducted following the workshop.

4.2 Workshop Results

Experts within a workgroup differed significantly in their ratings for 33 of 48 priority vectors, as determined by Friedman tests that failed to detect a systematic pattern. The workgroups dealing with "linkages between fire effects, fuels, and climate" and "fire as a large-scale disturbance" generally had lower internal agreement on rankings than the other two workgroups. We attribute this effect to the uncertainty and difficulty associated with those two topics (science questions), as well as the more applied nature of the latter two topics (modelling and decision support). In particular, this non-agreement strongly corroborates the feeling that our current knowledge about "linkages among fire effects, fuels, and climate" (primary topic #1) is poorly understood and should be an important focus for future research and expanded modelling efforts (Schmoldt *et al.* 1999). Extensive non-agreement also implies that we avoided the groupthink pitfall, wherein group unanimity bolsters the group against outside criticism. The "managerial decision support" group, consisting mostly of managers, experienced the best agreement (of the four groups) in their rankings. This was particularly noticeable in their importance rankings, although feasibility rankings for future research generated less agreement.

Given the strong non-agreement within workgroups, we suggest limiting the number of workgroup-member judgements used to develop programs and priorities (Schmoldt and Peterson 2000). It is not absolutely necessary to rely on everyone's judgement; certain workgroup members' judgements might be discarded owing to their contributions in other ways (e.g., generating discussion or providing valuable insights). Those same insightful individuals may not necessarily provide good judgements or agree with others.

Because the importance and feasibility of issues interact to determine the foci of research programs, we can plot priority values with respect to those two dimensions. In Figure 3, we consider key research questions only for the "managerial concerns and decision support" group. Intuitively, one would prioritise those key questions that have both high importance and high feasibility, that is high, short-term research priority. In this example, one would choose "communication between model builders and users" based on its relatively high score for both importance and feasibility. Of course, this assumes that equal weight is assigned to both dimensions. Arbitrary lines are drawn in Figure 3 based on an obvious separation between the points in both the importance and feasibility dimensions. As in multi-attribute utility theory, different weights and different mathematical models can be used to calculate the final score.

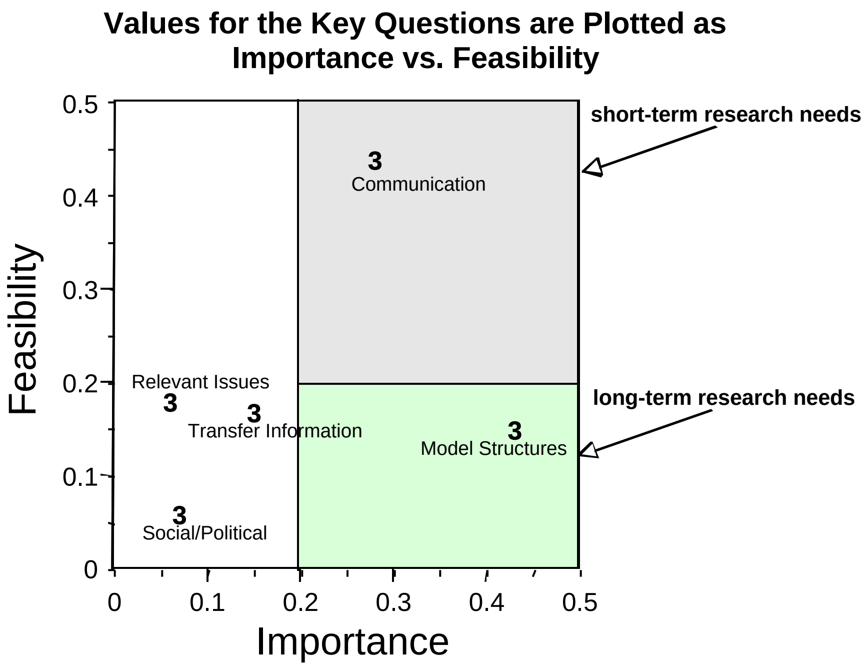

Figure 3. Rating scores for key questions can be plotted according to both importance and feasibility. Those key questions with a high score on both dimensions can be considered good candidates for a research program.

A similar dimensional analysis can be conducted for the responses within each key question. The responses within the highest ranked key question can be examined solely, or global priorities for all responses can be calculated based on the local priorities of key questions and responses.

5. CONCLUSIONS

While our experiences cover several technical workshop efforts, the one described above is the only one to have benefited from a detailed, specific, and rigorous process for GDM. Based on results from all workshops we have facilitated, we can highlight the following ingredients as most critical to workshop success (Peterson and Schmoldt 1999):

- Clearly describe workshop objectives and distribute them and other relevant materials to participants *before* the workshop.
- Limit attendance to no more than 50 people for effective group dynamics; a maximum of six people per workgroup will greatly facilitate decision making. A combination of scientists and resource managers works best, and substantial participation by personnel from the host agency ensures local ownership of workshop output. Resource managers generally are more amenable to using the AHP and less argumentative than scientists.
- Allow movement of individuals between workgroups to promote sharing of expertise and to help develop linkages between related topics.
- Develop a clearly defined product from the workshop output (Davis 1989, Schmoldt and Peterson 2000). This product might be an action/implementation plan or a comprehensive policy statement or a scientific paper. Post-meeting follow-up will ensure that attendees know that something tangible resulted from their hard work, and they will be more likely to participate in future, similar efforts.

A highly structured workshop can elicit a large amount of expert knowledge in a short amount of time. We have found that two days is sufficient to produce the basis of an action plan or similar strategic document. Economic efficiency is an important benefit of this GDM process, because each extra day can cost the host organisation several thousand dollars for salaries, travel, and facilities, in addition to potential frustration for participants. Less structured, and consequently more protracted, meetings produce rapidly diminishing returns for attendees' time. Our experience with using the AHP in group settings (Peterson *et al.* 1994, Schmoldt and Peterson 2000) is that acceptance of the AHP approach quickly follows initial hesitancy and a brief learning period. Implementing AHP decision making interactively in a group setting, for example by projecting a computer display that shows decisions and scores instantly, helps to engage participants and facilitate rapid decisions. Most participants find that this rapid feedback improves their understanding of the decision-making process and speeds up the process by keeping discussions focused.

Some participants even remark that applying AHP interactively in a group setting is fun.

This GDM method contains all the key components of strategic decision making identified by social scientists (McGrath 1984): generating (ideas are produced in brainstorming sessions), choosing (matrices contain value judgements), negotiating (conflict is handled/mitigated by judgement aggregation, but individual judgements are still retained), and executing (several alternatives are given for implementation plan generation, which emerge naturally from the hierarchy and priority vectors). Despite the apparent breadth of this approach, it is relatively straightforward to implement in workshop settings. For smaller, persistent groups (e.g., resource management staffs on a national forest or park), this GDM process may not need to be followed in complete detail, owing to such a group's regularity and familiarity. The important point is that this process offers many advantages—efficiency, comprehensiveness, rigor, and accountability—that the de facto standard (BOGSAT) cannot equal. Both the responsible organisation and its clientele benefit from decision making based on a quantitative and analytical foundation.

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Managing Forest Ecosystems

Volume 3

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Aims & Scope:

Well-managed forests and woodlands are a renewable resource, producing essential raw material with minimum waste and energy use. Rich in habitat and species diversity, forests may contribute to increased ecosystem stability. They can absorb the effects of unwanted deposition and other disturbances and protect neighbouring ecosystems by maintaining stable nutrient and energy cycles and by preventing soil degradation and erosion. They provide much-needed recreation and their continued existence contributes to stabilizing rural communities.

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