Environ Manage (2007) 39:534-544
DOI 10.1007/s00267-006-0031-2

Implementing Participatory Decision Making in Forest Planning

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Received: 18 January 2006 / Accepted: 20 October 2006
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Abstract Forest policy decisions are often a source of debate, conflict, and tension in many countries. The debate over forest land-use decisions often hinges on disagreements about societal values related to forest resource use. Disagreements on social value positions are fought out repeatedly at local, regional, national, and international levels at an enormous social cost. Forest policy problems have some inherent characteristics that make them more difficult to deal with. On the one hand, forest policy decisions involve uncertainty, long time scales, and complex natural systems and processes. On the other hand, such decisions encompass social, political, and cultural systems that are evolving in response to forces such as globalization. Until recently, forest policy was heavily influenced by the scientific community and various economic models of optimal resource use. However, growing environmental awareness and acceptance of participatory democracy models in policy formulation have forced the public authorities to introduce new participatory mechanisms to manage forest resources. Most often, the efforts to include the public in policy formulation can be described using the lower rungs of Arnstein's public participation typology. This paper presents an approach that incorporates stakeholder preferences into forest land-use policy using the Analytic Hierarchy Process (AHP). An illustrative case of regional forest-policy formulation in Australia is used to demonstrate the approach. It is contended that applying the AHP in the policy process could considerably enhance the transparency of participatory process and public acceptance of policy decisions.

Keywords Public policy · Analytic hierarchy process · Australia · Forest land-use decisions · Public participation · Stakeholders

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Introduction

Over the last decade, Sustainable Forest Management (SFM) has emerged as a dominant forest management paradigm (Kant and Lee 2004). Unlike the conventional commodity-based resource management paradigm, the SFM focuses on sustainable commodity production, conservation, amenity values, and long-term sustainability of forests where larger spatial scales and longer time periods are accommodated (Clark 2004). Formulating sustainable forest policy involves balancing complex economic, sociopolitical and environmental objectives, and accounting for the multiple objectives of forest stakeholders and their conflicting interests. More importantly, SFM represents a shift from "management by exclusion" to "management by inclusion" (Kant and Lee 2004). Collaborative decision-making processes have been proposed to achieve a more inclusive resource management (Wondolleck and Yaffee 2000).

The movement towards SFM has been a rough journey that has incited numerous forest-related conflicts in many countries including Australia. Among the sources of conflict are complex institutional arrangements, uncertainty of available information, a multitude of stakeholders, and vulnerable forest ecosystems.

Under the Australian constitution, the responsibility for forest management is vested with the State and Territory governments; however, the Commonwealth government influences forest policy indirectly through federal legislation. The emergence of the National Forest Policy Statement (NFPS) (Commonwealth of Australia 1992), along with other intergovernmental agreements, has strengthened Australia's policy commitment to ecologically sustainable development. The NFPS engendered region-specific agreements (Regional Forest Agreements [RFAs]) between the Commonwealth and State governments. Initiated in 1992, the RFA program is regarded as an attempt to reconcile conflicting societal values while ensuring sustainable and multipurpose forestry in Australia. The RFA program is based on the principles of ecologically sustainable development, and public participation was identified as an integral part of the RFA process. However, there is disagreement over how public preferences on forest attributes should be incorporated into the forest policy-making process.

The aim of this paper is to illustrate how the Analytic Hierarchy Process (AHP), a multicriteria evaluation tool, could be used to incorporate stakeholder input in participatory forest policy-making processes. The present study envisions a role for decision support tools such as the AHP in forest planning exercises. The next section discusses some theoretical aspects of public participation and the AHP. After this, a brief account of the RFA program and its public involvement processes is provided. This is followed by a case study illustrating the use of the AHP in participatory forest policy making. A discussion and some concluding comments are presented in the final section.

Theoretical Underpinnings of Public Participation

In recent times, there has been an increasing emphasis on direct citizen participation in policy formulation, at least at a rhetorical level, in numerous national and international policy documents (Tacconi 2000). There are many different meanings of the term ''participation,'' and a certain level of ambiguity exists when putting ''participation'' into practice (Buchy and Hoverman 2000). Arnstein (1969) presented a ''ladder of participation''—a typology, which illustrates a continuum of public involvement, ranging from a more token approach to a more genuinely participatory approach. At the lowest level of the ladder, there exists therapy and manipulation—nonparticipatory mechanisms—whereas at the top of the ladder citizen control and partnership exist where citizens make the final decision. Creighton (1986) described the relationship between the level of participation and the type of technique (Table 1). According to Creighton's classification, the techniques at the top of the scale (techniques 1, 2, and 3) have a high impact on the decision, whereas those at the bottom of the scale (techniques 7, 8, and 9) have no impact.

There are many justifications for citizen participation in decision-making processes. The commonly cited justifications for direct citizen involvement include democratic, substantive, and pragmatic rationales (Korfmacher 2001). The democratic rationale emphasizes that citizens are the ''quasi-owners'' of the resource; hence, they have the right to participate in the decision-making process. The substantive rationale holds the view that citizens have unique knowledge about the resource in question, and therefore their contributions should inform the decision-making process. The pragmatic justification points out the strengthened commitment to decisions by direct citizen involvement, which increases the chances of smooth policy implementation. Considering the frequency and magnitude of forest conflicts, perhaps pragmatic justification offers the most compelling reason for direct citizen involvement. The inherent characteristics of environmental issues such as complexity, uncertainty, and large temporal and spatial scales and irreversibility offer further justifications for direct public participation in decision making (van den Hove 2000).

Although agreement on the importance of participation is well recognized, there is less agreement about how to include the public in decision-making processes (Korfmacher 2001). Participatory decision support involving local communities has been proposed as a means of involving the public in decision making

Table 1 Arnstein's typology of participation and associated techniques

Level of participation		Technique
High	Forming/agreeing *to* decisions	(1) Joint decision-making (2) Conciliation/mediation (3) Assisted negotiation
	Having an influence *on* decisions	(4) Collaborative problem solving (5) Facilitation/interactive workshops (6) Task Force/advisory groups
	Being heard *before* decision	(7) Conferences (8) Public hearings
Low	Knowledge *about* decisions	(9) Public information

Source: Creighton (1986)

(Antunes and others 2006; Sheppard 2005). Recently, several Multi-Criteria Analysis (MCA) techniques have been trialed in participatory decision making, negotiation, and mediation processes (Antunes and others 2006; Bojórquez-Tapia and others 2005; Striegnitz 2006). MCA provides an analytical environment where multiple objectives and perspectives can be accommodated and analyzed collectively (Mendoza and Prabhu 2005). MCA decision support techniques could unravel the value positions and related tradeoffs of various stakeholders in quantitative terms. This is critical to establishing consensus, and finding mutually agreed-upon policy options. In particular, the sensitivity analysis offered by MCA techniques is fundamental to attaining consensus and achieving technically defensible policy options (Bojórquez-Tapia and others 2005). Therefore, combining decision support tools with participatory processes could lead to genuine citizen participation in policy decisions.

The Analytic Hierarchy Process (AHP)

The AHP is a robust, ratio-scaled MCA method for analyzing complex decisions with multiple attributes (Saaty 1977). The AHP has been applied to elicit public preferences in a vast range of natural resource policy areas, including forest management (Schmoldt and others 2001; Mardle and others 2004). It has been used in conjunction with Geographic Information Systems in land suitability analysis (Schmoldt and others 2001), participatory forest assessment (Mendoza and Prabhu 2000), consensus building in environmental impact assessments (Bojórquez-Tapia and others 2005), and environmental planning (Mardle and others 2004).

Although not grounded on any specific theoretical paradigm, such as neo-Paretian welfare theory, the AHP can aggregate separate performance indicators into one (Bouma and others 2000). When applying the AHP, a hierarchical decision schema is constructed by decomposing the decision problem into its decision elements or attributes. Alternatively, if nonlinearity and feedback is detected, the decision hierarchy can be constructed as a network of interacting elements (referred to as Analytic Network Process). The preferences for the attributes are compared in a pairwise manner, and numerical techniques are used to derive quantitative values from these comparisons (Kurtilla and others 2000). For example, how important is the conservation of old-growth forests compared to forest-based recreation? The decision maker has the option of expressing his or her intensity of preference on a 9-point scale. If two attributes are of equal importance, a value of 1 is given in the comparison, whereas a 9 indicates the absolute importance of one criterion over the other (Saaty 1977). The 9-point scoring system of the AHP is presented in Table 2.

Table 2 Nine-point scoring system of Analytic Hierarchy Process

Preference score	Explanation
1	Two attributes are equally preferred
3	Weakly preferred
5	Strongly preferred
7	Very strongly preferred
9	Extreme preference
2, 4, 6, and 8	Intermediate values between two adjacent judgments

Source: Saaty (1977)

Pairwise comparison data can be analyzed using either regression methods or the eigenvalue technique. In the eigenvalue technique, reciprocal matrices of pairwise comparisons are constructed. Using these pairwise comparisons, the relative weights of attributes can be estimated. The right eigenvector of the largest eigenvalue of matrix A (Eq. 1) estimates the relative importance of attributes.

$$A = (a_{ij}) = \begin{bmatrix} 1 & b_1/b_2 & \cdot & \cdot & \cdot & b_1/b_n \\ b_2/b_1 & 1 & \cdot & \cdot & \cdot & b_2/b_n \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ b_n/b_1 & b_n/b_2 & \cdot & \cdot & \cdot & 1 \end{bmatrix} \quad (1)$$

where b_i is the importance or desirability of decision element *i*.

In the AHP approach, the eigenvector is scaled to add up to 1 to obtain the weights. Based on properties of reciprocal matrices, the consistency of pairwise judgments can be calculated. Saaty (1977) has shown that the largest eigenvalue, $\gamma_{\max}$, of a reciprocal matrix A is always greater than or equal to n (number of rows or columns). If the pairwise comparisons do not include any inconsistencies, then $\gamma_{\max} = n$. The more consistent the comparisons, the closer the value of computed $\gamma_{\max}$ to n. A Consistency Ratio (CR) measures the consistency of the pairwise comparisons and as a rule of thumb, a CR value of 10% or less is considered acceptable (Saaty 1977). There is proof that the geometric mean is consistent and upholds the necessary axiomatic conditions to aggregate individual pairwise comparisons (Duke and Aull-Hyde 2002).

The success of the AHP as a preference elicitation technique can be largely attributed to its ability to integrate both qualitative and quantitative attributes. The pairwise comparisons force the decision maker to explicitly consider the tradeoffs among attributes. The lengthy enumeration process associated with the 9-point preference elicitation scale, potential rank reversal problems, and the highly ''technical'' nature of the method are regarded as the main limitations of the AHP.

The Australian Regional Forest Agreement (RFA) Program

Historically, Australia's forests have been managed for commodity production. However, a deepening of ecological consciousness, an increasing demand for recreation services, and aesthetic values have engendered a recurring conflict over forest land-use management. The underlying intention of the RFA program was to diffuse the conflict and highly emotive debate over the use and management of forest estate. Australia's publicly held forests cover more than 124.4 million hectares or 15% of total land area (Healy 2002). RFAs involve the formulation of agreements between the Commonwealth and State governments for the future management of specific forest regions (RFA regions), taking into account economic opportunities, conservation and heritage values, and the social impacts of various strategies. The RFA establishes the framework for the management of the forest in each forest region for a period of 20 years, providing certainty for forest industry, conservation, and local communities. It has three main objectives: (1) to protect environmental values in a Comprehensive, Adequate, and Representative Reserve System based on nationally agreed criteria; (2) to manage all native forest in an ecologically sustainable way; and (3) to develop an efficient and internationally competitive timber industry and certainty for communities (Commonwealth of Australia 1999).

The RFA process comprised three main stages, each of which involved close consultation with stakeholder and community organizations at the state and regional levels. The first stage involved the State and Commonwealth governments signing Scoping Agreements. The Scoping Agreement was concerned with the logistical and administrative arrangements between governments for data and project development related to RFA. The second stage was characterized by resource assessments called Comprehensive Regional Assessments (CRAs), which form the basis of a particular RFA. During the third stage, the integration of technical information and stakeholder views, RFA negotiations, and finally, the signing of the RFA occurred. This is the stage in which participatory decision-making tools can be employed to clarify and quantify public preferences for specific forest attributes outlined in the proposed forest management plans. There are 11 RFA regions throughout Australia and all, except the Queensland RFA, have been signed between 1997 and 2001. The RFA program stands out as ''the most ambitious, comprehensive and expensive environmental and resource planning exercise ever undertaken in Australia'' (Dargavel and others 2000, p. 98). Given the complexity and controversy involved in forestry issues, the RFA process is internationally remarkable, at least in stated intent and scope (Mobbs 2003).

Participatory Mechanisms of the RFA

A strong emphasis was placed on obtaining active involvement from a range of stakeholder groups in the RFA process. The public involvement in the RFA process was characterized by three main consultation phases: (1) stakeholder briefings at the commencement of the RFA process; (2) public comment opportunities on assessment work (CRA reports); and (3) public comment opportunities on proposed RFA options and draft RFA reports.

As part of the CRA, a social assessment was carried out. The key objectives of the social assessment were to identify forest stakeholders and to assess likely impacts of the proposed policy changes. Several public consultation meetings and workshops were held during the social assessment. Many researchers commented that the participatory process of the RFA did not allow a rigorous comparison of economic, environmental, and other forest values during its integration stage (Dargavel and others 2000; Mobbs 2003; Slee 2001). The integration phase is the most critical and yet the most neglected phase of the RFA process (Dargavel and others 2000). During the integration phase, the information from CRAs, forest agencies, and stakeholders are reconciled. The process has not greatly influenced the final outcomes, and has not convinced those with an interest in forest conservation that their views are taken seriously (Kirkpatrick 1998). The public consultations carried out under the RFA were viewed as an exercise in information and opinion input provision, rather than a decision-making exercise (Kirkpatrick 1998). The effectiveness of the participatory effort greatly depends on the technique used. It is evident that under the guise of participatory rhetoric, the top-down approach dominated in the RFA process (Mobbs 2003).

North East Victoria Case Study

The North East Victoria RFA region was selected for this study (Fig. 1). It is a large region with differing land use and forest types and a wide range of stakeholders. The region covers approximately 2.3 million hectares, about 10% of Victoria's total land area. The region is known for its mountain landscapes, diverse flora and fauna, native timber resources, tourism and recreational opportunities, and high quality water in its rivers and streams. The most contentious issue in forest management in the region is logging in native forests. The North East region's $20.6 million native forest industry accounts for about 8% of total State sawlog production and 1.3% of total State residual log production (Commonwealth of Australia 1999). The North East RFA region had a vibrant native timber industry, but over the past decades, timber production has declined significantly. Furthermore, the regions' industries use timber directly; thus, the decline in the timber industry has been a concern of the wider community. A significant disparity of preferences existed between the timber industry and the conservation groups. This was reflected in numerous protests and barricades held by lobby groups to disrupt the logging activities. These protests have contributed to the debate in the North East region and highlighted the public dissatisfaction and lack of integration of stakeholder values in the final RFA outcomes. The parties involved in the hardwood timber industry have been greatly affected by the increased reservation levels. The next section discusses the formulation of a model based on the AHP to elicit stakeholder preferences for forest attributes and forest land-use plans.

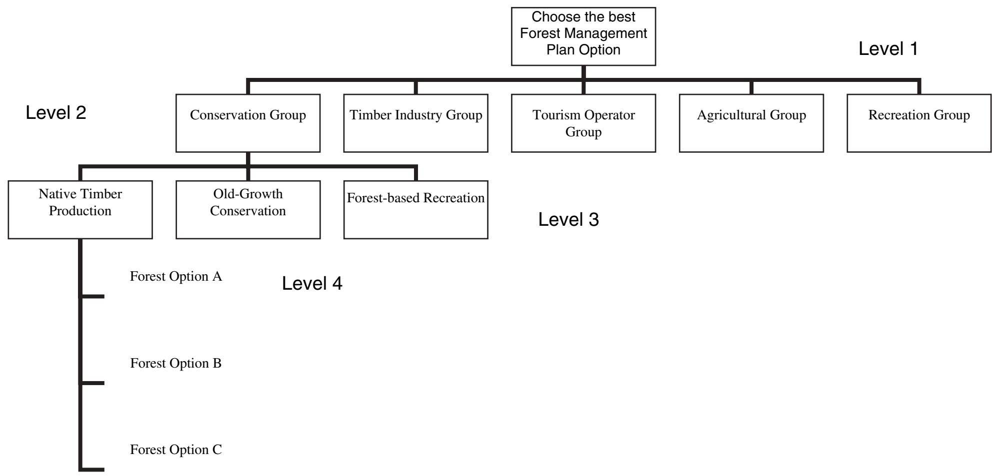
Formulating a stakeholder decision model based on the AHP involves (1) structuring the decision problem; (2) identifying management options; (3) identifying attributes; (4) identifying stakeholders; (5) conducting pairwise comparisons of attributes; (6) developing the attribute weighting scheme; and (7) calculating global priorities (ratings) for the decision alternatives based on local priorities. In a hierarchical decision model, the priorities obtained for decision elements of the lowest tier are referred to as global priorities, whereas priorities obtained for decision elements above the lowest tier are referred to as local priorities.

Fig. 1 Map of Northeast Victoria

In the present study, a decision problem is formulated as shown in Figure 2. The decision problem was cast as one involving the choice of the best forest management plan for the North East Victoria region. In formulating this decision model, appropriate background research was carried out and discussions were held with several forest stakeholders, including officials of the Department of Sustainability and Environment (DSE). The DSE officials assisted with the technical aspects of the decision problem. The structuring of the decision hierarchy and the selection of attributes were guided by the properties of completeness, operationality, decomposability, nonredundancy, and minimality (see Keeney and Raiffa 1976 for details).

The model contains four levels. At level 1, the most general objective of forest management and planning is considered as choosing the best forest management plan. Level 2 consists of stakeholder groups. Identifying stakeholder groups for a forest management region is a difficult task, raising issues concerning representation. The process of selection has to be open and transparent so that at least people are aware of the selection process (Buchy and Hoverman 2000). Grimble and Chan (1995) suggest that stakeholders be initially identified through reputation, focus groups, or demographic analysis. Harrison and Qureshi (2000) contend that the selection process should not adopt a ''one-shot'' approach, but rather an iterative approach, where discussions with pre-identified stakeholders reveal other, previously unknown stakeholders. Five stakeholder groups were identified using the social assessment process of the RFA, namely, the timber industry group, environmental group, farmer group, tourism operator group, and the recreation user group. A total of 106 stakeholders were selected using a snowball sampling technique, which involved identifying one or a few qualified respondents from each stakeholder category, and then soliciting the respondent's help in identifying other people with similar characteristics (Hair and others 2000). Snowball sampling is typically used in research

Fig. 2 Analytical Hierarchy Process group decision model



situations in which the defined target population is unique and the compilation of a complete list of sampling units is a nearly impossible task.

Level 3 consists of decision objectives or attributes. Native timber production, forest-based recreation, and old-growth conservation, which includes biodiversity values, were identified as the most important attributes. Although other forest values were identified, including Aboriginal values, and educational values, these were not included in the present study because of practical reasons. The idea was to examine the key tradeoffs among the decision attributes. Level 4 consists of alternative forest management options.

Alternative Forest Plans

The forest management options were constructed using the current North East RFA management plan figures as the base case or status quo (Option B). Option B is a rough approximation of the then-proposed RFA for North East Victoria. It has a native timber harvest level of 64,000 m^3, 1.2 million recreation visitor days and 60% conservation of old-growth forest. Two hypothetical forest management plans (Conservative: Option A and Pro-industry: Option C) were constructed using the base case (see Ananda 2004 for details). Table 3 presents these forest management options and attribute levels of each option. The decision problem was to choose the best forest management plan for the region using the abovementioned attributes.

Elicitation of Pairwise Comparisons

The AHP preference elicitation process requires stakeholders to answer several pairwise comparison questions. A survey instrument was developed using the AHP decision model presented in Figure 2. The preference elicitation survey was conducted as a face-to-face interview and the respondents were briefed about the AHP and how to make pairwise comparisons before carrying out the actual preference elicitation. Once the respondents were comfortable with the context, the analyst asked them to make pairwise comparisons and rank the intensity of their preferences. When making pairwise comparisons related to decision attributes, the respondents were advised to explicitly consider the study area in question, North East Victoria. For example, one might believe that the native timber industry (hardwood) in the region should be given more priority or importance than the old-growth conservation in the present context, even if the respondent believes that the old-growth forest per se is more important. This makes it easy for the respondent to make his or her value judgment clearly and accurately. The pairwise comparison questions were presented as follows:

Timber Production is 1 2 3 4 5 6 7 8 9
more important than Old-Growth Conservation OR
Old-Growth Conservation is 1 2 3 4 5 6 7 8 9
more important than Timber Production.

The respondent was first asked to choose the attribute that should be given more importance (or priority), and then to circle the appropriate strength of preference (either on first or second statement) after referring to either the verbal or numerical preference scale. Then the attribute levels of the three forest options were compared in a pairwise manner with respect to one attribute at a time. For example, the

Table 3 Attribute levels for forest land-use options

Forest plan	Old-growth forest conservation (%)	Native timber extraction cm^3/y	Recreation intensity Recreation visitor days/y (millions)
A (Conservative)	80	54,000	0.8
B (Status quo)	60	64,000	1.2
C (Pro-industry)	40	74,000	1.6

pairwise comparison of option 1 (OPT 1) and option 2 (OPT 2) with respect to timber production is as follows:

OPT 1 is 1 2 3 4 5 6 7 8 9 more important than OPT 2 OR
OPT 2 is 1 2 3 4 5 6 7 8 9 more important than OPT 1.

Each respondent provided 22 pairwise comparisons: 3 comparisons among decision attributes, 9 comparisons related to forest management options (with respect to each decision attribute), and 10 comparisons among five stakeholder groups (to obtain self-assessed weights). A total of 2332 pairwise comparisons were obtained from the respondent interviews. It should be noted that the pairwise preference elicitations were conducted individually, although the method can be applied in group settings using specialized group facilitation software as well. The results are discussed in the next section.

Results

Pairwise comparison data were analyzed using the Expert Choice™ (Expert Choice Incorporated) software with priority vectors calculated using the eigenvalue method. The pairwise comparisons made by the respondents were fairly consistent. The overall mean consistency ratio of the comparisons was 12.1% (standard deviation 7.1%), which is acceptable for surveys administered to the general public.

Table 4 presents the priority weights computed for the three attributes using the pairwise comparison data for the total sample and for individual stakeholder groups (an alternative way of examining stakeholder positions would be to use a game theory or voting model). Table 4 indicates that the old-growth conservation is the most important attribute with a mean weight of 0.487 (standard deviation 0.237) for the overall sample. The weights for native timber production and recreation attributes were 0.302 (standard deviation 0.241) and 0.203 (standard deviation 0.124), respectively.

The priority weights by stakeholder groups showed a similar trend. Old-growth conservation had the greatest weight for all stakeholder groups, except for the timber industry, which considered native timber production as the most important decision attribute with a weight of 0.596. The environmental group assigned the highest weight (0.667) to the old-growth conservation attribute, followed by the tourism operators group (0.529) and the recreation group (0.524). All stakeholder groups, except the timber industry group, considered timber production as the second most important objective. None of the stakeholder groups ranked forest recreation as a priority. The priority weight results are consistent with similar studies conducted elsewhere (Rosenberger 1998; Duke and Aull-Hyde 2002).

Individual pairwise comparisons were aggregated using geometric means to obtain group preferences for attributes and forest options. Various weighting schemes can be used to derive aggregate level or group preferences. In the present study, aggregation using self-assessed weights was used. The respondents themselves assessed the relative importance of each of the five stakeholder groups in forest decision making (10 pairwise comparisons), and these pairwise comparisons were synthesized to obtain the self-assessed weights.

The self-assessed weights were 0.219, 0.236, 0.229, 0.166, and 0.150 for the timber industry, environmental, farmer, and recreation and tourism operator groups, respectively. The environmental group received the highest priority, followed by farmers and the timber industry. There were only small differences among the weights assigned to the environmental, timber, and farmer groups. The aggregate preferences by stakeholder groups using the self-assessed weights are presented graphically in Figure 3. On the horizontal axis, self-assessed weightings for stakeholder groups are shown, whereas on the right vertical axis, the overall global priority score for options are shown. The priority scores for options B, A, and C were 0.414, 0.372, and 0.214, respectively. According to the AHP results, option B received the highest priority.

Table 4 Attribute weights by stakeholder groups

Stakeholder group	Relative weights of decision attribute		
	Native timber production	Forest-based recreation	Old-growth conservation
Overall sample	0.302 (0.124)[a]	0.203 (0.124)	0.487 (0.237)
Timber industry	0.596 (0.228)	0.194 (0.108)	0.294 (0.187)
Environmental	0.136 (0.119)	0.171 (0.009)	0.667 (0.165)
Farmer	0.374 (0.229)	0.178 (0.139)	0.445 (0.230)
Recreation	0.190 (0.175)	0.284 (0.128)	0.524 (0.217)
Tourism operators	0.265 (0.233)	0.204 (0.128)	0.530 (0.213)

[a]Standard deviations are in parentheses

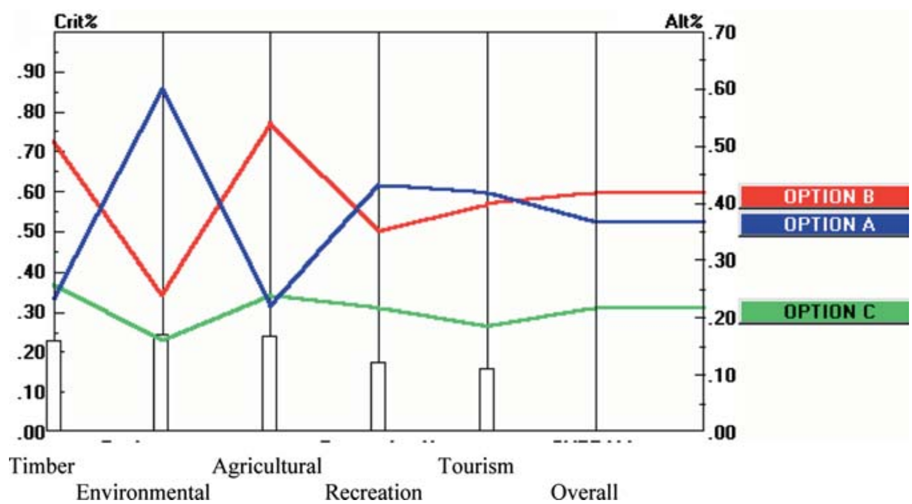


Fig. 3 Aggregate preferences of forest stakeholders

Sensitivity Analysis

Sensitivity analysis on the effects of changes in local priorities provides useful insights into the stakeholder preferences. It shows how robust the choice of an option is to changes in weighting factors. Sensitivity analysis can be performed for both stakeholder weights and attribute weights. It is noted that the weight assigned to the native timber production attribute by the recreation user group is rather insensitive to the final choice of option. However, the choice of options is somewhat sensitive to the weights assigned to the recreation and old-growth conservation attribute. Sensitivity analysis was also conducted on self-assessed stakeholder weights. Except for the weight assigned to the environmental group, self-assessed stakeholder weights were rather insensitive to the final outcome. The weight assigned to the environmental group showed some sensitivity towards the final choice option as shown in Figure 4. It depicts that if the weight assigned to the environment group changes to greater than 0.33 (indicated by dotted vertical line), then the final outcome would change from option B to option A.

Discussion and Conclusions

Moving from a commodity-based management approach to a participatory approach has engendered new challenges for forest policy evaluation. Moreover, conventional forest management models based on the neoclassical framework are subject to limitations (Kant 2003). The forest value elicitation resembles more of a social choice than the monetary values derived from a cost–benefit analysis (Kant and Lee 2004). Hence, the policy decisions should be guided by non–market-oriented stated preference techniques, rather than the techniques based on monetization (Kant and Lee 2004). In this context, conventional economic analysis is deemed inadequate to guide forest policy. This study has shown how a decision analytic tool such as the AHP can aid participatory forest policy planning.

The role of decision theoretic approaches in participatory forest policy formulation can be envisioned in several ways. First, they offer a robust framework for stakeholders to express their preferences towards policy choices in a meaningful way without giving in to an emotive debate. Second, the AHP model-

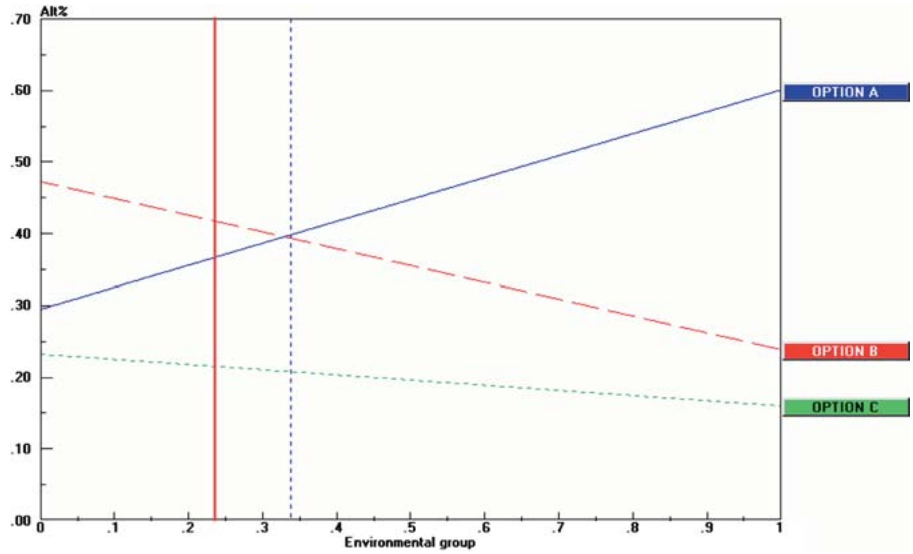


Fig. 4 Sensitivity of self-assessed weights for the environmental group

building process improves the understanding of the choice problem. Third, the process may facilitate relevant stakeholders to find common ground for mediation and negotiation. By explicitly expressing and quantifying preferences in terms of weights, the value positions of each stakeholder group are made known to all, thereby providing a platform for negotiations. Fourth, quantifying preferences explicitly also makes the process transparent. The lack of trust among stakeholders is one of the main impediments to collaborative decision making in natural resource management (Wondolleck and Yaffee 2000). Having a transparent process precludes the forest agency staff, and other lobby groups, from hijacking the decision-making process. Moreover, such deliberations could lead to new forest options that were previously not obvious.

Public consultation is regarded as an integral element of the participatory approach. However, the participation literature contends that public consultation and public comment processes fall short of genuine participatory decision making. According to Arnstein's (1969) classification, such a form of public involvement depicts tokenism. To this end, conventional public consultation can be best described as an opportunity of "being heard" before the decision is made. The quality of public participation hinges on the extent to which stakeholder preferences are incorporated into the decision-making process. The AHP does this by using a decision hierarchy and eliciting priority weights for criteria, which in turn are used to rank policy options. Unlike the conventional public comment or consultation process, the AHP can utilize stakeholder input in a more efficient and transparent manner. For instance, the results of this study indicate that explicit weight elicitation and sensitivity analysis may assist stakeholders in identifying their respective value positions (numerically and graphically). Moreover, the method unravels the magnitude of compromise required to reach the top rungs of Arnstein's participation typology (e.g., techniques 1–3 of Table 1).

At first glance, decision analytic techniques could be viewed as an isolated, hands-off approach that does little to foster citizen participation in decision making. This may be true if such methods are used in isolation. With increasing reliance on discourse models of decision making (Timney and Kelly 2000), techniques such as the AHP could both integrate disparate value dimensions and enhance the quality of deliberation among stakeholders. Although the AHP helps to structure complex decision problems and provides a framework to rigorously evaluate various value dimensions of the problem, it is not a substitute for the conventional participatory modalities, including negotiation and conflict resolution processes. Rather, the AHP should be seen as a complementary decision support tool that can be aligned with the conventional public consultation process.

One limitation of the method is the difficulty in interpreting the nine-point preference scale of the AHP. Its ability to capture the stakeholder preferences and the users' ability to grasp the meaning of the scale accurately are uncertain. However, such inconsistencies can be traced using the consistency ratio of the AHP. Another aspect of using the AHP is its sensitivity to model building and criteria selection. The quality of the outcome hinges on the manner in which the method is implemented and the quality of information used. Forest policy formulation involves an enormous amount of information, both value-based (societal input) and technical (scientific input). In this study, the model building process was not entirely participatory. Ideally, the structuring of the decision problem and formulation of forest land use options should be carried out in a group setting where all stakeholders are present. Although significant stakeholder input was sought in developing the decision model at an individual level, it is uncertain whether the same results would be achieved through an interactive group deliberation. Ideally, all relevant attributes should be considered and included in the decision model; however, for this study only three core attributes were included. It was found that by increasing the number of attributes, it made the decision problem unworkable and the attribute evaluation beyond the cognitive limits of the respondents. In addition, the selection of stakeholder groups raised other issues. The direct involvement of citizens in policy decisions raises important questions about the representativeness of the involvement. It is not clear at what point stakeholder groups should be excluded from the participatory decision making.

Forest policy decisions, or any other public decision, are not made in a political vacuum. In fact, the very existence of political institutions is justified by the role politicians play in policy decision making. However, bureaucratic rules and various types of authority and power among governments and stakeholders can constrain participatory and deliberative efforts. By the same token, one cannot discount the negative implications envisaged by public choice theory. It is unlikely that society would benefit if politicians and lobby groups were allowed to fulfill their self-interests. Without a participatory democracy, forest decisions are made by policymakers in consultation with bureaucrats and technocrats. Institutionalization of decision analytic techniques in participatory processes must be backed up by strong political support. Without political will, the forest agencies are less likely to adopt methods such as the AHP as part of their public deliberations.

There is a need for a systematic, participatory decision support that combines the attributes of collaborative learning and multicriteria evaluation. Future research should focus on setting out clear criteria for the selection of stakeholder groups, designing user-friendly preference elicitation protocols, and comparing policy evaluation studies with and without decision aids. The improvements to these areas could potentially enhance the scope of the AHP in participatory policy formulation. Given the strengths and limitations of the method, the plausible conclusion is that the AHP is best suited for localized and regional scale policy evaluation rather than policy evaluation at a watershed or national level.

Acknowledgments An earlier version of this paper has been presented at the Centre of Excellence, Kobe University and Japan Economic Policy Association (JEPA) Joint International Conference, December 17–18, 2005, Kobe, Japan. The author wishes to thank Dr. Virginia Dale, Editor-in-Chief, Environmental Management for her guidance and patience, Dr. M. Timney and two anonymous reviewers for their helpful comments on earlier versions of this paper. Thanks are also due to Debra McKenzie for her assistance in finalizing the manuscript.

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