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Values Suitability Analysis: A Methodology for Identifying and Integrating Public Perceptions of Ecosystem Values in Forest Planning

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ABSTRACT *National forest planning cannot resolve all resource management issues but improved planning methods can more fully engage the public and lead to better public participation in decision making. This paper presents a planning methodology known as 'values suitability analysis' (VSA) that combines the features of expanded public participation with a rational, analytic framework for incorporating human values into forest plan decision making. The VSA methodology provides a means to evaluate and compare how 'logically consistent' potential management prescriptions (set of activities) are with publicly held forest values. Based on a spatial inventory of ecosystem values, the VSA methodology constructs a numerical rating, or set of ratings, for each management prescription and ecosystem value interaction. These ratings are used to determine (1) which management prescription is most compatible with the dominant ecosystem value within a given management area, as well as (2) the marginal difference in overall compatibility between alternative management prescriptions. The VSA methodology can be used to generate forest plan alternatives or serve as a benchmark to evaluate different forest plan alternatives. The adoption of VSA may be hampered by lack of trust and other institutional issues.*

Introduction

National forest planning and management within the USDA Forest Service (USA) over the past 20 years been marked by progress in several important and sequential ways. First, there has been a change from decision making largely devoid of public involvement to one purposely including public involvement (Wilkinson & Anderson, 1987). Second, the consideration of an ecosystem basis for planning and management is steadily gaining as an underlying principle (USDA, 1994a). Third, an attention to a systems analysis-based approach in planning is evident (Allen & Gould, 1986). Fourth, there has been a new appreciation of the human dimensions of ecosystems (USDA, 1994b). Finally,

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there has been a slow adoption of shared leadership and collaborative learning approaches involved in planning (USDA, 1999).

Nevertheless, the planning and management changes just described are as yet incomplete, in part due to a marked lack of practical 'tools' with which forest planners can translate and integrate the theoretical aspects of human use, interests, and values into the development or revision of their forest plans. It is believed that a systems analysis-based approach is still missing for identifying and integrating the social values of ecosystems into the overall forest planning framework.

This paper presents a methodology, 'values suitability analysis' (VSA), which it is proposed has the capability to *operationalize* human dimension elements for use in forest planning. Values suitability analysis should not be viewed as a replacement to traditional, biophysically oriented forest planning but rather as the addition of an equal partner in decision support. Values suitability analysis is best viewed as a subset of generalized suitability analysis (see Steiner, 2000) with a specific focus on landscape values. VSA was developed by Chugach National Forest staff beginning in 1998 with the co-operation of Alaska Pacific University. Although the VSA methodology has not been tested beyond a single forest, it is believed the methodology can be applied to forest and regional planning efforts in different geographical settings and social contexts.

This paper presents the conceptual framework for VSA. The purpose here is to focus on VSA concepts and principles rather than the complexities of its application. Following a brief historical context for VSA, the goals and assumptions of the VSA methodology are examined and the 10-step VSA process is described. The discussion reflects on some of the potential problems and opportunities associated with the methodology that may serve to limit or expand its future application in forest planning.

VSA Context—Ecosystem Management

Leopold (1949), in his landmark book, *A Sand County Almanac*, laid out the modern conceptual foundation for what is now generally referred to as 'ecosystem management' within the USDA Forest Service, as well as for key legislation such as the 1969 National Environmental Policy Act and the 1976 National Forest Management Act. With this concept, that the whole is more than the sum of its many parts, increased sophistication in analyzing the interactions of an ecosystem was needed to model and assess alternative management options. Large, computer-based programs, such as FORPLAN and IMPLAN, were developed and improved throughout the late 1970s and 1980s in response and served as the agency's principal forest plan analytic tool (OTA, 1992, p. 15). By the late 1980s and early 1990s, informal challenges to the practices of multiple-use management planning began to appear regularly (see for example Shands, 1988; Behan, 1990; Rolston & Coufal, 1991).

By the time ecosystem management was formally endorsed by the Forest Service in 1994 (USDA, 1994a), attention was beginning to focus on the idea that humans, and their social values, must be considered as an integral part of the ecosystem management paradigm. Conceptual support and justification for inclusion of the 'human dimension' was provided through academic and managerial discourse. Nevertheless, the President's Council on Environmental Quality found that environmental impact statements in general had not appropriately integrated environmental, social and economic concerns during the first 25 years of NEPA (CEQ, 1997, p. 11).

Within the last decade, the Forest Service has been reviewing the effectiveness of its land and resource planning processes. In 1989, the Forest Service initiated a comprehensive review of its land and resource management planning process that resulted in a summary report entitled, 'Synthesis of the Critique of Land Management Planning,' (USDA, 1990) along with 10 other more detailed reports. In 1997, the Secretary of Agriculture convened a 13-member Committee of Scientists to review the Forest Service planning process and to offer recommendations. The final Committee report (USDA, 1999) called for improved planning decision making by relying on concepts and principles of sustainable natural resource stewardship, by applying the best available scientific knowledge to management choices, and by effectively collaborating with a broad array of citizens.

The Committee's report resulted in the development of new planning regulations (see 36 Code of Federal Regulations 219) for the Forest Service in 2000. These new planning regulations repeatedly reference public values and the importance of managing national forests and grasslands consistent with public values. The regulations also specify the need to plan at the appropriate spatial scale and identify local community issues.

One of the recurring themes in the critique of national forest planning is the need for the Forest Service to more effectively engage the public in national forest management issues. When planners with the Chugach National Forest in Alaska began the revision of its 1984 forest plan in 1997, they wanted to expand the public involvement process to include collection of original data and the use of new analysis methods. A co-operative research agreement with Alaska Pacific University provided a research environment in which creative planning methodologies could be explored. The public involvement strategy adopted by the forest planning team added an additional dimension, 'community interest surveys', to the traditional mix of scoping, public meetings, written comments and in-person dialogues.

The community interest survey is a mail-based survey and mapping instrument that targets households in communities that would be most affected by the forest plan and offers a number of benefits not available through traditional scoping methods. The survey provides additional information not generally available to a forest planning team including community uses and values and their spatial location within the forest. This information can be used to cross-check the reliability of forest plan scoping comments, add statistical inference to forest issue analysis, and provide a rational and defensible means of allocating forest prescriptions. The information obtained through the survey provides the empirical foundation for the values suitability analysis that is the subject of this paper.

Values Suitability Analysis Goals and Assumptions

The VSA methodology described herein consists of 10 steps and appears suitable for use in all national forests, although this has yet to be tested outside the Chugach experience. This methodology may be characterized as one where empirical observations about what and where humans value from the forest are used to prescribe forest management activities that are either compatible or incompatible with the human values associated with the landscape. It utilizes the opinions and knowledge of both the public and forest land managers in combination to produce documentable and replicable models of alternative futures for a forest in terms of the compatibility of its management with the underlying values of the public for whom the forest is managed.

The goals of the VSA methodology are threefold and may be summarized as follows:

- Renew attention to the importance of human uses, interests and values in forest planning.
- Provide a systematic, interactive, and defensible methodology that operationalizes the current social theories about the 'human dimensions' of ecosystem management.
- Promote the true integration of biophysical and social data in ecosystem management.

The validity of the VSA methodology rests upon the following set of assumptions:

- The general public holds multiple values in the environment and national forests.
- The general public can and will prioritize those values in a social survey.
- The values the general public finds in the environment may have identifiable spatial (and temporal) dimensions or locations in the environment.
- The general public can and will identify the spatial dimensions or locations on a map.
- The general public will manifest those values in their attitudes and preferences toward national forest management. (Ajzen & Fishbein, 1980 refer to this process as the "theory of reasoned action".)
- It is preferable to address underlying values rather than expressed attitudes when assessing compatibility of forest management actions and public interests.
- It is possible to evaluate a forest management action in terms of its compatibility with each individual value, and that the compatibility may be different according to each value.

A conceptual overview of the VSA methodology is presented, followed by a discussion of some of the strengths and limitations of the analysis and our actual experience using the VSA methodology in the revision of the Chugach National Forest.

The Values Suitability Analysis (VSA) Methodology

Table 1 depicts the overall sequence of 10 steps in the VSA methodology. Note that several of the steps, such as identify management areas (Step 1) and identify mix of prescriptions (Step 6), are not unique to the VSA methodology: they occur in any national forest planning process. However, the VSA methodology incorporates these steps into a new framework. A number of tables and matrices are produced at each step of the VSA methodology.

Table 1. Steps in values suitability analysis (VSA) process

1.	Identify management areas
2.	Inventory ecosystem values by area
3.	Inventory range of management activities
4.	Assess general activity-value compatibility
5.	Identify range of management prescriptions
6.	Identify mix of activities in prescriptions
7.	Assess general prescription-value compatibility
8.	Assess specific prescription-value compatibility by area
9.	Assess alternatives by prescription by area
10.	Conduct sensitivity analysis

Step 1. Identify Management Areas

The first step is not unique to the VSA methodology. In any forest planning process, whether it involves the VSA methodology or not, meaningful management areas must be identified. Ideally, the selection of management areas should exhibit clear linkages to both ecosystem functionality and administrative feasibility, criteria that unfortunately often conflict. Management areas based on watershed boundaries have received considerable attention for their potential to integrate the disparate criteria but watershed association should be viewed only as a reasonable starting point for the selection of management areas, not the final word. Deviations from watershed boundaries are often necessary to satisfy administrative concerns that include social, economic and political boundaries, either real or perceived.

Step 2. Inventory Ecosystem Values by Management Area

The second step of the methodology, an inventory of ecosystem values, is critical to the process because it lays the foundation for all subsequent analyses. The inventory of ecosystem values must be conducted in a scientifically valid manner with careful consideration to four areas: (1) using an ecosystem values measurement typology that is both inclusive and exhaustive; (2) obtaining representative samples of forest stakeholders as participants; (3) including a preference ranking system for value responses; and (4) including a means to measure the spatial range of ecosystem values and their relative concentration/dispersion. The ecosystem values typology used should provide for the expression of all ecosystem values and the individual ecosystem values should be distinct. Brown & Reed (2000) developed and tested an ecosystem values typology consisting of 13 values (Table 2) that can be used to inventory ecosystem values. While this typology provides a useful starting point, the typology would benefit from further application and refinement.

Whose values should be inventoried is also an important question. In most natural resource planning processes, special interests with a direct stake in the planning outcome are likely to be present and obvious. The extent to which these special interests also represent the values of the general public is seldom obvious to forest managers. To address this potential weakness, the VSA methodology calls for inventories of human values that are broadly defined, yet related to the resource decisions relevant to the general public who will be

Table 2. Forest value definitions used by Brown & Reed (2000)

Aesthetic value: I value the forest because I enjoy the forest scenery, sights, sounds, smells, etc.
Economic value: I value the forest because it provides timber, fisheries, minerals, or tourism opportunities such as outfitting and guiding.
Recreation value: I value the forest because it provides a place for my favorite outdoor recreation activities.
Life Sustaining value: I value the forest because it helps produce, preserve, clean, and renew air, soil, and water.
Learning value: I value the forest because we can learn about the environment through scientific observation or experimentation.
Biological diversity value: I value the forest because it provides a variety of fish, wildlife, plant life, etc.
Spiritual value: I value the forest because it is a sacred, religious, or spiritually special place to me or because I feel reverence and respect for nature there.
Intrinsic value: I value the forest in and of itself for its existence, no matter what I or others think about the forest.
Historic value: I value the forest because it has places and things of natural and human history that matter to me, others, or the nation.
Future value: I value the forest because it allows future generations to know and experience the forest as it is now.
Subsistence value: I value the forest because it provides necessary food and supplies to sustain my life.
Therapeutic value: I value the forest because it makes me feel better, physically and/or mentally.
Cultural value: I value the forest because it is a place for me to continue and pass down the wisdom and knowledge, traditions, and way of life of my ancestors.

impacted by the planning decisions. In the case of a national forest, representative samples of households and communities living in or adjacent to the planning area should comprise the minimum set of participants. If possible, additional households further removed from the planning area should be included for comparative analysis (e.g. a statewide, bioregional, or even national sampling of households).

The values inventory should provide a way for an individual to express preferences among various ecosystem values. The preferential values ranking system should be able to (1) differentiate those ecosystem values that are important from those that are not, as well as (2) rank order the values that are considered important. The ranking methodology used for the Chugach study asked participants to allocate a hypothetical sum of $100 among 13 ecosystem values (see Brown & Reed, 2000). While any number of potential ranking methods can be used (e.g. having respondent rank the highest values 1, 2, 3, 4, 5 …), this allocation method proved effective in pre-testing and offered the additional benefit of providing two separate dimensions of value, the ubiquity of the ecosystem value (frequency of response) and a measure of the relative importance of the held forest value (magnitude of response).

Finally, the inventory needs to incorporate a method for participants to spatially place ecosystem values on the landscape to provide the linkage for potential forest management allocation. The Chugach methodology had participants place colour-coded dots (stickers) on an actual forest map (each ecosystem value had a distinctly colored dot) provided with the mail survey. Although the

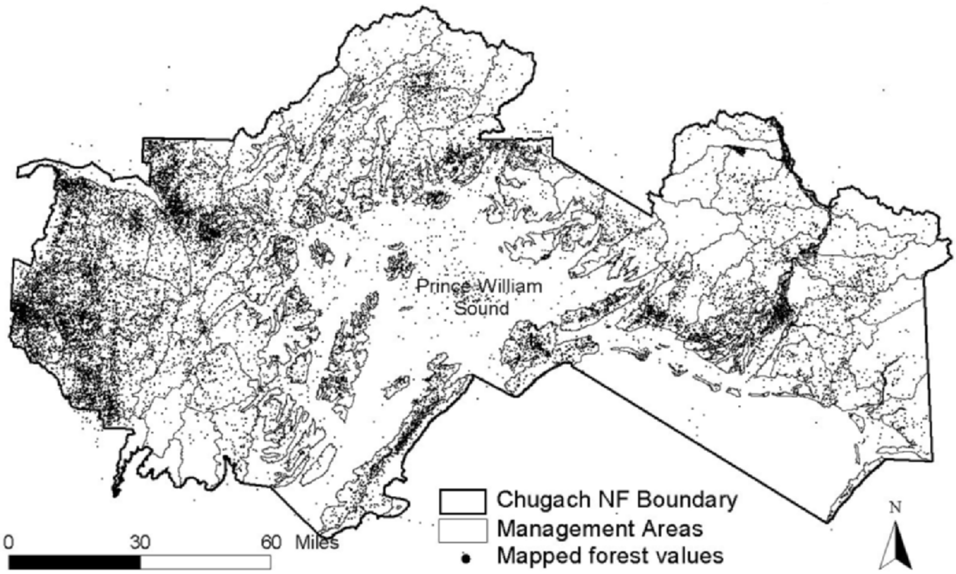

Figure 1. Plot of forest values in Chugach National Forest with subdivision into management areas (watersheds).

exact size and shape of the area of interest is thereby uncertain, this method assumes point locations represent value centroids. Other possibilities would have participants reference grid locations or draw points or polygons on a map (see Jakes *et al.*, 1998). Each of the mapping approaches has practical limitations in a survey questionnaire format and the size of the land area to be inventoried. An important practical consideration is the amount of time required to organize and digitize participant responses. Figure 1 shows the distribution of digitized ecosystem values from the Chugach survey by management area.

The frequency of ecosystem values can be tabulated for each management area to generate indices. Indices enhance point distribution information by providing for comparison of management areas using common metrics. Three indices provide descriptive measures of value distribution: (1) value frequency index; (2) value density index; and (3) value diversity index.

The *value frequency index* is a ratio of the number of value locations within a particular management area to the average number of value points for all management areas. Management areas with high value frequency indices are likely to be areas with high public use.

The *value density index* measures value density by dividing the number of value points in a given management area by the size of the management area. Management areas with high value density indices are likely to be areas with concentrated public use.

The *value diversity index* is a measure of the relative number and strength of ecosystem values occurring within a particular management area and uses the Shannon diversity index commonly used in measuring the diversity of economic structure of an area (Alward, 1996) or biological diversity of an area (Magurran, 1988). A high value diversity index is useful to identify management areas with many different ecosystems values and thus the potential for incompatible land

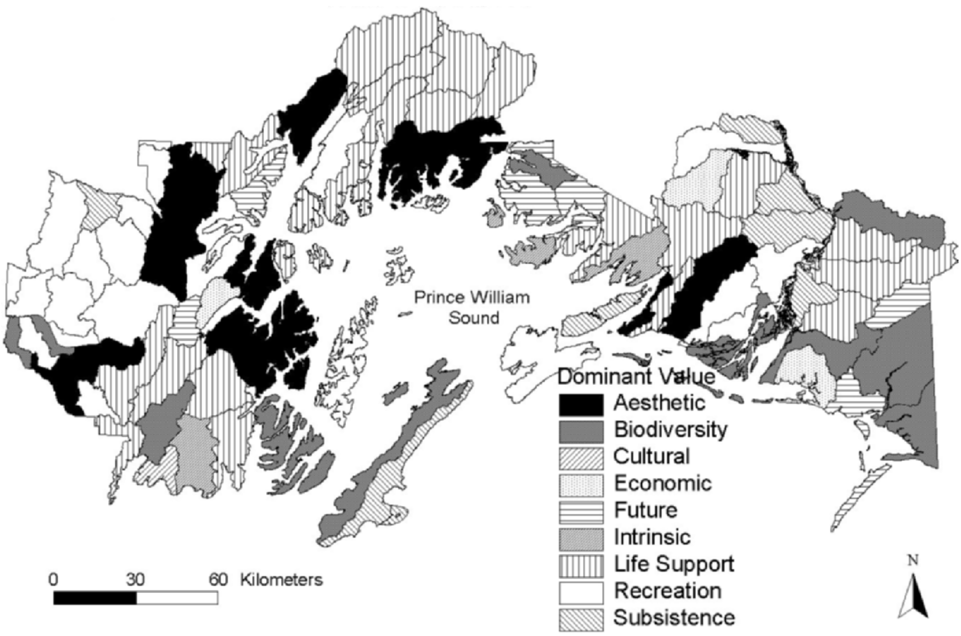

Figure 2. Map of dominant values by management area in Chugach National Forest.

uses or competitive interests in the same area. A low value diversity index would tend to indicate agreement about the relative existence or importance of one or few ecosystem values and thus less potential for incompatible uses. Table 3 provides an example of the type of summary information, including indices, that can be generated for each management area while Figure 2 shows the type of descriptive, landscape-scale map that can be generated showing management areas by dominant ecosystem value.

Step 3. Identify Range of Management Activities

In this step, the planning team identifies the range of potential management activities that might be permitted on some or all the forest. Management activities include those activities initiated by the forest managers as well as forest activities of interest to the public for which there may or may not be a managerial response. This step is not unique and occurs with or without the VSA. Examples might include road construction, timber harvesting, use of motorized vehicles, vegetation manipulation or permitting overnight camping. As the list of potential forest activities and uses can be quite extensive (e.g. Chugach planners identified 42 activities), the scoping process that precedes VSA is useful in identifying the most common and important potential management activities to be examined in the VSA.

Step 4. Assess Management Activity-Ecosystem Value Compatibility

In this step, forest planners must decide how compatible each management activity is with each ecosystem value using clear definitions of both the activity and the value. A useful way to organize this information is to develop a matrix

Table 3. Sample Chugach National Forest management area profile

Management Area: Cape Resurrection		Acreage: 15 800	
		Dominant Value: Life support	
Value	Percent loading	Number of values within 5% of dominant value: 5	
Aesthetic	10.0		
Biodiversity	13.3		
Cultural	3.9	*Index*	*Score*
Economic	11.5	Frequency	59.2
Future	9.1	Density	24.6
Historic	4.5	Diversity	73.1
Intrinsic	0.3		
Learning	8.8		
Life support	13.8		
Recreation	12.1		
Spiritual	5.3		
Subsistence	1.9		
Therapeutic	5.4		

with activities on the top and ecosystem values on the side. For each cell in the matrix, the activity will be characterized as compatible 'Y' or incompatible 'N' with the ecosystem value. A third possible category, 'N/A', indicates there is no real possible effect of a management activity on an ecosystem value. Until empirical studies determine real or perceived compatibility of activities and values, this step necessarily relies upon the judgment of forest planners.

Step 5. Identify Range of Management Prescriptions and Allowed Management Activities

In Step 5, forest planners identify potential management prescriptions. Management prescriptions represent combinations of potential management activities that contain a dominant theme or emphasis. For example, Chugach planners identified 24 different management prescriptions ranging from 'primitive' and 'wilderness study area' to 'resource development' and 'recreation development complex'. An area managed according to a 'primitive' prescription, for example, would provide year-round primitive recreational opportunities in natural appearing landscapes while a 'recreation development complex' prescription would provide developed recreational opportunities in which there are facilities for user comfort and convenience with the ability to accommodate a large number of people. Some prescriptions are the creative outcome of a forest planning process while other prescriptions may be dictated by existing legislation (e.g. wilderness study area).

Step 6. Identify Mix of Management Activities in Management Prescriptions

For any given forest, there are many potential activities or uses ranging from resource extraction to resource protection. In this step, it is necessary to define the set of prescribed and proscribed forest activities associated with each prescription (e.g. motorized or non-motorized recreation, grazing allotments, recreational cabins, etc). A useful way to organize this information is to develop a matrix with activities on the top and prescriptions on the side. For each cell in the matrix, the activity will be characterized as allowed 'Y', not allowed 'N', or conditional 'C' for the prescription. Some activities will be common to many forest prescriptions while other activities may be specifically tied to a given prescription.

Step 7. Assess Management Prescription-Ecosystem Value Compatibility

In this step, the goal is to determine which prescriptions are most compatible with each ecosystem value. A matrix is developed for each ecosystem value that assigns scores based on value-activity compatibility relationships. One way to handle value-activity compatibility is to assign a $+1$ value to a forest activity that is allowed in a prescription where the activity is also compatible with the ecosystem value or to a forest activity that is incompatible but not allowed. Conversely, a -1 would be assigned where there is a mismatch: either when an activity is allowed but is incompatible with an ecosystem value or when an activity that is compatible with an ecosystem value but is not allowed (a missed opportunity). A value of 0 would be assigned in the case of 'conditional' compatibility or no possible interaction. A 'total score' is calculated for each prescription based on summated value-activity compatibility scores. The total score for each prescription is then divided by the maximum possible prescription score to derive an overall compatibility ratio.

To illustrate this process, Table 4 displays a compatibility table for a 'Recreation' ecosystem value in a simplified forest with just four prescriptions and three activities. The three activities are assigned compatibility values of -1, 0, or $+1$ (columns 2, 3, 4) based on whether the activity is allowed in the prescription and whether the activity is compatible with the prescription. The compatibility values are summed for each prescription (column 5). The maximum possible compatibility score for all prescriptions is 3, although the maximum score may be less for some prescriptions (e.g. Fish and Wildlife Habitat Conservation) where activities (timber harvesting) are conditional (column 5).

Each prescription score is then divided by the maximum compatibility score to derive a compatibility ratio showing the compatibility of each prescription with the ecosystem value (column 7). Prescription compatibility ratios can range from 1.0 (ecosystem value and prescription are perfectly compatible) to -1.0 (ecosystem value and prescription are perfectly incompatible). For example, the backcountry recreation prescription is most compatible with the 'Recreation' ecosystem value while the municipal watershed prescription is the least compatible. Finally, the compatibility ratios are standardized on a scale from 0 to 100 (column 8) where the highest compatibility ratio is assigned a value of 100 and the lowest ratio is assigned a value of 0.

Table 4. Compatibility of management prescriptions with *recreation* ecosystem value

Management prescription (1)	Management activity: Road construction (2)	Management activity: Overnight camping (3)	Management activity: Timber harvesting (4)	Total compatibility score (5)	Maximum compatibility score (6)	Compatibility ratio (7)	Normalized compatibility score (8)
Backcountry Recreation	1	1	1	3	3	1.00	100.0
Resource Development	1	1	−1	1	3	0.33	50.0
Fish and Wildlife Habitat Conservation	−1	1	0	0	2	0.00	25.0
Municipal Watershed	−1	1	−1	−1	3	−0.33	0.0

Notes: (2)(3)(4) Assigned values are based on whether activity is allowed in prescription and whether activity is compatible with prescription.
(5) Calculation: sum of columns (2), (3), and (4).
(6) Maximum score is sum of non-zero absolute values from columns (2),(3), and (4).
(7) Calculation: total compatibility score (column 5)/maximum compatibility score.
(8) Standardized score (0 to 100) of column (7); calculation: highest compatibility ratio assigned value of 100, lowest compatibility ratio assigned value of 0.

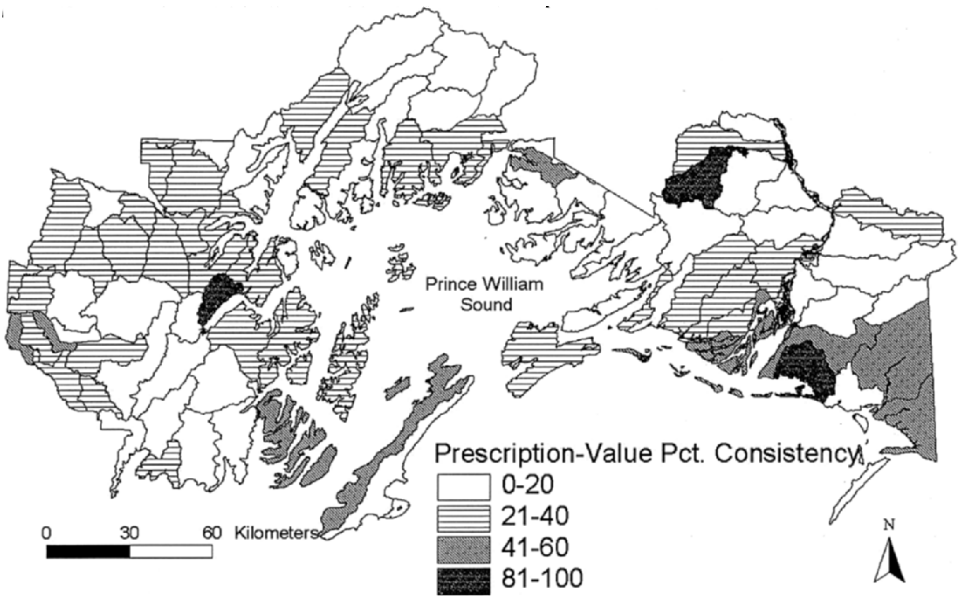

Figure 3. Map of management prescription (forest products emphasis) consistency with forest values.

Step 8. Assess Management Prescription-Ecosystem Value Compatibility by Management Area

In this step, each possible prescription (representing the aggregate of all individual management activities) is evaluated in terms of how compatible it is with a given management area. This process implies that there is generally no single management prescription that is best for all management areas due to ecosystem variation and valuation.

Forest planners array potential management prescriptions for the management areas, then rank each management prescription in terms of its compatibility with the area's values using compatibility scores from the previous step. The highest ranked management prescription is the most logical, but not only, choice for implementation. The prescription compatibility scores should be standardized to determine how much better one prescription is over another, and what is being traded off in terms of compatibility if the prescription with the highest score is selected. Figure 3 shows a Chugach National Forest management prescription compatibility map derived using VSA. The map depicts how the compatibility score of a given management prescription (forest products emphasis) will likely vary across the forest because of the quantity and mix of ecosystem values in each forest management area. It can also be observed that the forest products prescription is generally not compatible with public forest values in the Chugach except in several isolated watersheds.

The VSA compatibility determinations conducted for the Chugach National Forest were done at a landscape-scale, and did not involve explicit, site-scale analysis of biophysical resource suitability attributes, such as soil, slope, aspect, vegetation and wildlife habitat. In effect, this approach was not altogether different than that commonly employed in forest planning: neither approach generates management prescriptions that do not require some subsequent site-scale analysis of biophysical resource suitability for specific project implementation. It is also important to consider that the spatial inventories from Step 2 already involve somewhat implicit consideration of such biophysical factors, albeit often by 'lay persons'. That is, economic values, for example, would in theory not be recognized in areas where developable resources such as timber and minerals did not occur.

Step 9. Assess Management Alternatives by Management Area

An alternative may be viewed as the set of prescriptions allocated to the different management areas on the forest. Step 9 repeats Step 8 in that it evaluates the compatibility of management prescriptions with ecosystem values. However, rather than evaluate individual management prescriptions, different alternatives are evaluated. The number of potential forest plan alternatives can become large with increasing numbers of prescriptions and management areas. For example, Chugach planners initially evaluated almost 30 alternatives before narrowing down to 8. The VSA methodology can evaluate the compatibility of pre-determined alternatives with ecosystem values or it can derive a rationally defensible alternative given some decision criteria about how ecosystem values are to be aggregated within the management areas.

The VSA methodology seeks to optimize the selection of management prescriptions most compatible with the expressed values for a management area. There are at least two ways to determine this: (1) focusing on the dominant value calculated for the management area or (2) putting management emphasis on the expressed mix of ecosystem values. The former is easier to calculate while the latter approach is more comprehensive in evaluating the true mix of ecosystem values. In either case, the VSA yields a theoretically 'best fit' alternative (set of prescriptions associated with management areas) that satisfies the selected decision criteria.

Step 10. Conduct Sensitivity Analysis

In carrying out VSA, a number of decisions and assumptions are made. For example, decisions must be made regarding value-activity compatibility, prescription-activity mix, and prescription compatibility within a management area, among others. These decisions or assumptions are subject to the limitations of the human and organizational decision-making process. Sensitivity analysis is the systematic identification of assumptions or decisions that have the potential to greatly alter the results of the analysis. After working through the analysis and arriving at an initial allocation of prescriptions, some of the least certain assumptions can be altered to determine if the new analysis yields different conclusions. It is thus possible to evaluate how changes in one factor will affect the overall planning outcome.

Like all complex analysis models, the results of the VSA will be questioned and challenged. Sensitivity analysis anticipates these challenges and generates a set of viable alternatives based on a given set of assumptions.

A Brief Note on the Application of VSA for the Chugach National Forest

The values suitability analysis model was developed and tested by the Chugach

National Forest planning team in 1999. The size and complexity of the forest (94 watershed associations, 42 management activities, 24 prescriptions, and 8 alternatives) necessitated computerization of the VSA model using Microsoft Excel©. The final VSA model consisted of over 80 separate but linked tables.

The social survey used for the VSA was implemented by Alaska Pacific University in early 1998. More than 2500 questionnaires and forest maps were mailed to residents in 12 communities surrounding the Chugach National Forest. Some 800 responses were received for an overall response rate of about 35 per cent. The respondents identified more than 15 000 value point locations, and recognized the existence of 13 distinct ecosystem values. All points were digitized and processed for statistical analysis through the use of ArcView© GIS software.

For purposes of illustration, the frequency indices ranged from a high of 5.3 to a low of 0.0 (respondents happened to place no value points in a small watershed association). Density indices ranged from 75 points per 1000 acres to 0 points. The diversity indices ranged from a high of 80 to a low of 0.

A preferred alternative was developed by the Chugach planning team along with six alternative management plans and an eighth 'no change' alternative. The alternative management plans ranged in theme from resource development to resource preservation. All alternatives were evaluated using the VSA methodology. Compatibility scores calculated in Step 9 ranged from a high of 78.9 (no change alternative) to a low of 70.2 (maximum preservation alternative). The preferred alternative had a score of 73.9.

Discussion

Values suitability analysis is a method to operationalize and model qualitative aspects of human dimensions in forest planning. With the VSA methodology, it is possible to analyze and model ecosystem values on a relatively equal footing with biophysical resources. In the past, social and economic considerations in the forest planning process have been qualitative and intractable. With VSA, such considerations become quantitative and explicit.

Early in the development of this methodology, there was a concern that the complexity of the analysis might limit its usefulness. It was feared that VSA might become the social equivalent of FORPLAN, a 'black box' goal programming planning methodology (1) focused on simplistic resource production optimization and (2) so complex that few would trust it because they could not understand it. In the final analysis, the value of the VSA methodology derives from its usefulness in a real-world landscape planning process.

What has been learned from that Chugach National Forest experience with VSA? While the forest planning team embraced the need to assess and inventory ecosystem values on the forest, the VSA methodology was generally considered too experimental to earn the trust of the entire planning team as a support to decision making, although several stakeholders literally demanded that it be more fully integrated. This outcome is familiar terrain for many scientists working on natural resource planning issues. Resource management professionals are often reluctant to trust the judgement of the general public on resource issues (Magill, 1991) and, perhaps by extension, the social scientists who present social data as part of the planning process (Burdge & Opryszek, 1994). The resistance to acceptance of public knowledge in perceived technical areas has several sources, as a status threat to experts and as a form of epistemological anxiety (Yankelovich, 1991). Fortunately, not all experts feel threatened and anxiety can be overcome when thoughtful people understand they are being unnecessarily self-protective of their appointed roles. But even if resistance can be overcome, there remains the challenging task of meaningfully integrating social information into complex resource management decisions.

Historically, qualitative value compatibility analysis, if present, has been transparent or embedded within the larger institutional or political decision framework. The authors advocate for the *explicit* identification and integration of ecosystem values in land use decisions and policies, that qualitative social data be brought ‘out of the closet’ for use in resource management allocation decisions. Management activities should be viewed not as an ‘end’ but as a ‘means’ to protect and enhance social values. This fundamental shift in planning perspective will not be easy to accomplish because it will require a leap in faith that the general public can be trusted to express and articulate values that represent both short and long-term interests in forest management.

Since much of VSA is experimental with but a single application, more research is needed on the weakest aspects of the methodology. First, the assumed positive correlation between forest uses and ecosystem values needs to be validated. Second, additional research should be directed towards validating the subjective characterizations by forest planners of the true ‘compatibility’ of management activities and ecosystem values. Third, alternate means of capturing and recording the spatial extent of the ecosystem values on a map to produce the most geographically correct value boundaries needs attention. Fourth, how do the ecosystem values recognized and rated by local residents compare with those of other individuals throughout the United States? Recent national polls (see for example National Research Group of Fayetteville, 1996; National Parks and Conservation Association, 1998; Forest Watch, 1999; Environmental News Network, 2000a, 2000b, 2000c; League of Conservation Voters, 2000) do suggest that there should be agreement at least in terms of the most important values in both national forest and other public land settings. Finally, the application of VSA to other forests or public lands would undoubtedly help to uncover and resolve other possible methodological concerns. In addition, further application would also help acquaint forest planners with the technical analysis of what they have long considered to be ‘squishy’ data.

Conclusion

It is believed that the unique capabilities of values suitability analysis, while experimental, holds great promise for the true integration of social values into forest planning. The underlying principle of value suitability analysis may also be applied to natural resource planning efforts in a variety of ecological settings. For example, the ecosystem values typology has been applied to planning for marine and coastal areas (Brown, 2001). We advocate its development and use as a decision support tool, with the potential to produce information adding an expanded dimension to planning—one which is equal to that accorded traditional biophysical data. The first practical experience with actual application of VSA in the Chugach forest plan revision suggests that it can be a powerful analytic tool that both stakeholders and planning staffs can utilize for mutual benefit.

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