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Public participation in a wide range of environmental management and risk policy decisions has increased substantially over the past decades, creating new ground rules and new expectations for a host of federal and state funded actions. Many of these efforts to democratize the development of policies—including opinion polls, focus groups, town-hall meetings, open houses, advisory committees, and a variety of economic surveys—have proven useful. However, too often decision makers cast a wide net for hearing citizens' views but then disappear behind closed doors to interpret what they have heard and to work out the tough conflicts that inevitably arise across disparate points of view. A charitable interpretation is that decision makers' access to tools for deeply understanding the concerns of community residents, technical experts, or interest groups and for incorporating objectives and tradeoffs effectively as part of policies or legislation has not kept pace with the rhetoric of public involvement. It is therefore not surprising that there remains a widespread dissatisfaction with the quality and meaningfulness of stakeholder input to many environmental risk-management decisions.

This same point—that extensive involvement is not synonymous with meaningful public input—has been stated elegantly by the National Research Council (NRC) in its publication entitled *Understanding Risk*.(FN1) The NRC report is one of many influential studies released during the past decade that look to an improved link between public participation and sound science as a means for simultaneously increasing the quality and enhancing the acceptability of environmental policy decisions. Meaningful involvement in the risk decisionmaking process requires not only an invitation to participate but also a forum for careful deliberation and a mechanism for incorporating the results of technical analyses. This two-pronged emphasis on structured deliberation—involving the meaningful input of stakeholders—and targeted analysis—involving input from both the physical and social sciences—is at the heart of the message of the report *Understanding Risk* and central to making smarter environmental management decisions.

Unfortunately, there is little guidance in recent literature on how to achieve this dual objective beyond fairly abstract admonitions (e.g., "be a good listener," "pay attention to process," "beware of using jargon") that fall well short of setting a structure or proposing explicit criteria for working successfully with groups. There are some promising exceptions to this statement: Ortwin Renn describes a "cooperative discourse" model for conducting analytic-deliberative processes in risk management, and Caron Chess and Kristen Purcell present five useful rules of thumb based on the experience of environmental policy practitioners.(FN2) However, what generally appears to be missing is an overall structure for organizing the dialogue with diverse stakeholders so that by the time a recommendation or a choice is made, there is a high probability that it will incorporate the best available scientific knowledge, meet with broad-based approval, and be viewed by taxpayers and elected officials as a sensible way to spend scarce funds.

## **A STRUCTURED PUBLIC INVOLVEMENT PROCESS**

A basic structure for making smarter environmental management decisions already exists in the form of results from behavioral decision research (BDR) and decision analysis (DA). Over the past several decades, this research has begun to make important contributions to the theory and practice of environmental management. One side of this work takes a descriptive focus and investigates why, both in experimental findings and in real-life situations, humans have been shown to be "quite bad at making complex, unaided decisions."(FN3) These results, largely drawn from the work of psychologists, show that individuals systematically employ cognitive shortcuts and appear to have little instinctive ability to structure decision tasks, clarify their objectives, incorporate probabilistic information with accuracy, or balance the dual goals of limiting effort and achieving a satisfactory level of judgmental accuracy.(FN4)

The other side of this work on decisionmaking looks at how prescriptive techniques can be used to improve the quality of individual and group decision processes. This research, largely drawn from the work of decision analysts,

includes value-structuring approaches based in multi-attribute utility theory that focuses on ways to identify and measure stakeholder values, to develop information that characterizes the anticipated consequences of options, to establish tradeoffs across conflicting objectives, and to link these results to support for specified alternatives.(FN5) Stakeholder values are the key to this structured decision process because they identify what matters to participants and, in turn, highlight the consequences that require most careful attention and the tradeoffs that matter most.

Although responsiveness to each management context is essential, a structured decision approach to public involvement generally addresses the following five fundamental tasks:

- \* Framing the decision. What are the key contextual elements of the decision situation, and what is a reasonable goal of the consultation process?
- \* Defining key objectives. How do people think they will be affected by the proposed action, and what values matter the most to stakeholders?
- \* Establishing alternatives. In light of the relevant constraints, what are alternative actions that might be undertaken?
- \* Identifying consequences. What are the most important impacts that could affect stated objectives, and how certain is their occurrence?
- \* Clarifying tradeoffs. What are the important conflicts across desired objectives, and how can this knowledge be used to create new and better alternatives?

These root ideas of a structured decision approach to public involvement reflect common sense and good judgment. It is often worthwhile to quantify important concepts such as the probability of events, the desirability of consequences, or the timing of critical impacts. However, the application of a structured approach emphasizes qualitative guidance for how to think clearly and make smart choices rather than quantitative analysis to make an optimum decision. The primary goal should be to improve thinking and to sharpen communication about critical concerns and tradeoffs in important decisions, rather than to assign numbers to options or to rely on the results of any summary mathematical analysis (see the box below).

The importance of a structured approach is often demonstrated by its absence: Public participation efforts routinely fail to give sufficient attention to developing the foundation for making a good decision. Once the right problem has been identified, the basis for future consultation is the structure provided by specifying the relevant objectives, agreeing on how they will be measured, and creating an initial set of alternatives for consideration. Informed by the findings of behavioral decision research, the group facilitator needs to pay careful attention to the inappropriate use of cognitive shortcuts and to participants' reliance on alternative-focused thinking rather than on value-focused thinking (the negotiations literature frames this as a battle between rigid positions and more flexible interests).(FN6) When either objectives or alternatives are inadequate, the result will be a poor decision. When objectives are clearly stated and the impacts of alternatives are linked to their effects on unambiguous value measures (or attributes), many decisions can be made without further analysis because of the obvious merits of a dominant solution. In other cases, the objectives and alternatives provide the foundation for resource managers or analysts to develop an appropriate quantitative model to provide additional insight that will help guide the decision.

## TILLAMOOK CASE STUDY

In the spring of 1998, with funding support from the U.S. Environmental Protection Agency (EPA) and the National Estuary Program (NEP), a small team of co-workers explored the use of a structured public-involvement process as part of an ongoing study of cleanup and protection options for the Tillamook Bay watershed in northwestern Oregon.(FN7) Although degraded as the result of extensive agricultural and forest development, Tillamook Bay remains a rich ecological base that supports diverse resources including shellfish, runs of salmon and trout, groundfish, and numerous bird species. The bay is integral to the local and regional economies that are still largely based on natural resources, including timber harvest, agriculture, tourism/recreation, and commercial fishing. The local dairy industry is particularly important, with a variety of Tillamook cheeses marketed throughout the world as unusual, high-quality products that depend on the pristine environment of the coastal Tillamook watershed.

The stated goal of the Tillamook Bay National Estuary Project (TBNEP) was to develop a science-based, community-supported management plan for the watershed. Staff efforts were aided by the ongoing work of a management committee made up of local citizens and agency representatives from regional, state, and federal governments. This group took a lead role in the research and analysis leading to development of a Comprehensive Conservation and Management Plan (CCMP) for the Tillamook Bay watershed, with a scheduled completion date of July 1999. The one-year effort described here, therefore, occurred during the critical latter stages of the NEP work at Tillamook Bay.

Some limited public involvement initiatives had been undertaken before the start of this study. For example, open meetings were held at an early stage to elicit ideas for the emphasis of the TBNEP effort and to assist in compiling a record of citizens' concerns. However, there has been no systematic process for examining these concerns to facilitate their incorporation into recommended actions and, as a result, communication between the project and community stakeholders was limited. This lack of communication led to a feeling of disenfranchisement on the part of many community members and presented a dilemma for the TBNEP staff--with only one year before completion of the draft management plan--in terms of learning how to elicit detailed community input to proposed environmental management alternatives and, in turn, how to predict community reaction to the eventual NEP recommendations.

## **FRAMING THE PROBLEM**

This project began by holding a series of meetings with community leaders and members of the TBNEP management committee to help establish an appropriate focus and scope of the effort. These discussions established that the pressing need for the TBNEP at the time this study began was not breadth but depth: to find a way to meaningfully involve local residents at a detailed, action-specific level and to attempt to ensure that participants' judgments recognized the benefits, costs, and risks of the program initiatives under consideration. The goal was to develop a mechanism by which community members could learn about and contribute to the more important dimensions of the proposed actions, and to understand and address the many difficult tradeoffs that were anticipated among their expressed economic, environmental, and social concerns.

## **IDENTIFYING OBJECTIVES**

A first round of discussions on objectives involved undertaking both individual and group interviews and simply asking participants what they cared about in the context of possible actions. This simple line of questioning required that decisions be made about the choice of stakeholders (Who should be involved to cover the range of views adequately? Should elicitation sessions be held with individuals or groups?) and about the limits to the scope of program actions (What things could an NEP initiative reasonably be asked to accomplish?). Quite soon, however, it became clear that a small set of concerns were central to all three of the major stakeholder groups (community residents, state and local resource managers, and technical experts). As shown in the middle portion of Figure 1 on page 39, these six underlying concerns became the fundamental objectives of the program, and further analyses were linked to them.

One of the key distinctions made during the eliciting of values was between the means and ends objectives identified by stakeholders. Although this distinction is straightforward conceptually--ends are valued in and of themselves, whereas means are valued insofar as they contribute to the availability or amount of some other objective--it was often less clear in practice. The distinction led to informative discussions among participants about the relationships among key actions (as shown in Figure 1) and included the anticipated effects of proposed program initiatives on objectives such as water quality, jobs, flooding, and social impacts. In spite of the widespread agreement among all participants on the six fundamental objectives, substantial disagreements surfaced regarding their relative importance and the preferred means to achieve these ends. Another of the important lessons of creating the means-ends objectives diagram was that useful input was received from all stakeholder groups, with technically trained stakeholders (e.g., fisheries biologists and economists) acknowledging the expertise of lay participants (e.g., farmers and private forest-land owners) and with all members engaged in a learning exercise reflecting the linkages between possible program actions and their own values. The dynamic nature of exploring project objectives not only helped to energize the discussions among group members but also served as a mechanism for encouraging brainstorming and creative thinking by all participants.

## **ESTABLISHING KEY ALTERNATIVES**

Through its earlier public involvement efforts as well as through input from program scientists and consultants, the Tillamook Bay National Estuary Project had developed a list of more than 150 possible actions. Whereas many of these actions were either minor or already on the agenda of other state or local agencies, a small set of actions was highly significant in terms of economic, environmental, or social impacts on the community and unlikely to be undertaken without substantial leadership from the TBNEP. Not surprisingly, this smaller set of more controversial actions was receiving the most attention from stakeholders, not all of it helpful or complementary. The staff determined that it was important to provide a transparent mechanism for stakeholders to assist in setting priorities across proposed alternatives and to have direct input into the design of those actions designated as most significant.

In October 1998, meetings were held with representatives of key stakeholder interests (dairy farmers, private and

state foresters, concerned citizens, and residents worried about flooding) to review the proposed actions contained in the draft CCMP, to elicit additional information about the impacts of the actions and their perceived importance, and to identify significant cause-and-effect linkages. These discussions highlighted many previously neglected concerns. One example is the large amount of time that farmers believed it would take them to maintain fencing, an important component of costs that had been omitted from the earlier, primarily financial calculations. Based on these meetings, three critical yet controversial actions were chosen for further in-depth analysis: limit livestock access to streams (to decrease pollution and damage to riparian habitat), protect and restore tidal wetlands (to improve spawning and rearing habitat for salmon), and upgrade forest management roads (to reduce sedimentation in streams, thereby improving habitat and reducing flood risks).

## IDENTIFYING CONSEQUENCES

The TBNEP staff had initiated work on identifying the consequences of the proposed actions. However, because of a general failure to link the analysis of impacts to the principal objectives expressed by stakeholders, some important consequences had been neglected, such as the fencing maintenance costs noted above, and, correspondingly, some time and resources had been wasted looking into impacts of little concern. Another major component of identifying consequences involved improving the understanding of the marginal benefits and costs of actions. In several cases, the analysis showed that a high percentage of the benefits of a proposed initiative could be obtained for only a small fraction of its total cost. One example was that, after upgrading only about one-quarter of the proposed 70 miles of forest roads, nearly three-quarters of the benefits (in terms of reduced sediment loadings) would be realized. The distribution of anticipated benefits and costs to community residents also required additional attention, with many residents holding strong--and often incorrect--opinions about who would likely gain or lose from specific proposed actions.

## DEFINING KEY POLICY TRADEOFFS

Stakeholders at Tillamook Bay wanted to restore local water quality and fish populations, which had been damaged by waterborne pollution from animal wastes and increased sediment loadings, but they also worried about the health of the dairy and forest industries and did not want to impose an unnecessary cost burden on any one group. The problem was difficult for residents to think about because a cost seemed to offset every benefit. Typically, these involved different parties: What helped coastal anglers would hurt regional dairy farmers, and what helped the tourist industry would result in higher costs to forest operators. The structured decision process allowed stakeholders to work through these tradeoffs in a way that attempted to balance their competing objectives and interests and to facilitate an informed choice. As in many such cases, making the costs and benefits of an action explicit allowed for adjustments to a proposed action that reduced its negative aspects while maintaining nearly all of the reasons why it was desired in the first place.

Understanding the technical information (e.g., impact studies, computer models, historical data bases) that will clarify the magnitude and probability of these impacts is essential. Yet technical information must address and inform the tradeoffs that arise with respect to the values and objectives at issue. If insufficient attention is given to identifying the relevant set of objectives, significant time and resources can be wasted in technical studies that fail to address important stakeholder concerns or that will have little ultimate impact on the choice of a preferred alternative.

To clarify the level of stakeholder support for specific program initiatives, the team worked closely with the TBNEP and other local groups (such as the influential Tillamook Futures Council) to develop a mechanism for allowing residents to consider tradeoffs explicitly. After extensive discussion, the project team decided to work with small groups of eight to ten stakeholders who would first study information about the anticipated costs and benefits of key project alternatives and then provide written responses (using a short workbook) to document their reasons for selecting a preferred action. These choices were described in terms of their most significant benefits and costs, as noted by participants in earlier groups, and incorporated weightings of the tradeoffs that these groups thought most important. Workbook respondents were given an opportunity to "vote" directly for their most preferred actions and to explain their thinking, using their pocketbooks (by stating their willingness to pay for an action) and words (by responding to open-ended questions).

The goal was to find a way to present the pros and cons of the three key actions so that tradeoffs could be simplified and addressed in an iterative fashion, with participants encouraged to concentrate on the amount of an objective that would be gained or lost rather than the importance, per se, of the objective itself. This was accomplished using an "objectives by alternatives" matrix, or consequences table, that linked expressed values and impacts. The dimensions of concern (the objectives) came from earlier work with stakeholders, whereas the alternatives, showing different levels

of project intensity, reflected expert judgments about a realistic range of impacts associated with a specific action.

The key to eliciting structured tradeoffs was to set up systematic, coupled comparisons for each of these three key actions by which workbook respondents could identify alternatives that were better than others on all key dimensions. A simple  $2 \times 2$  or  $2 \times 3$  matrix was used (see Table 1 below), with the associated levels of benefits and costs changed systematically to define, for each participant, the point at which alternative actions would be rated equally for a given objective (e.g., they both cost the same, or they achieved the same increase in fish populations). Because the objective then was effectively the same for the two options, it no longer distinguished between the options and (for this action) could be ignored. This type of bartering--increasing the value of an alternative in terms of one objective while decreasing its value by an equivalent amount in terms of another objective--constitutes the heart of what John Hammond, Ralph Keeney, and Howard Raiffa refer to as the "even swap" method for making tradeoffs.(FN8) Tillamook participants found the task informative and relatively easy, although many respondents did comment that they had gained a new sensitivity for the depth of thinking required to address tough resource management tradeoffs effectively.

## **THE GOAL IS DECISION INSIGHT, NOT CONSENSUS**

Vast strides have been made during the past 20 years to improve both the theory and practice of participatory decisionmaking in the context of setting environmental management priorities. One strand of this experience and literature emphasizes the art of facilitating groups so as to achieve consensus solutions. For example, in his review of three successful public participation handbooks, Thomas Webler notes their general agreement that "consensus should be pursued as a matter of principle."(FN9) Elizabeth Peelle and her colleagues take this one step further in defining a successful citizen participation process as one that involves the public in a meaningful way and leads to "any outcome which reduces conflict between stakeholders and agency proponents and results in a legitimate and lasting decision."(FN10) More extreme versions of this viewpoint, such as that adopted by the 1993 Canada National Roundtable on the Environment and the Economy, argue that stakeholder groups should be able to design their own decision processes, including holding veto power over the choice of alternatives. In general, this side of the public-involvement community takes much of its inspiration from the practice of alternative dispute resolution (ADR) and the theory of negotiations, looking for common ground among group participants as the basis for a consensus agreement.

A second strand, which is the focus of this paper, takes quite a different approach in that it advocates the use of insights from behavioral decision research as the basis for guiding consultative processes and for helping to achieve a clearer understanding of participants' preferences and their key value tradeoffs. Disagreements in the expressed values of participants or differences in their interpretation of factual evidence are welcomed and examined in the context of what they can show decision makers about the links from stakeholders' support of, or opposition to, specific options to their underlying preferences.

The evaluation techniques that were developed at Tillamook illustrate one use of a structured decision approach to public involvement in the context of contentious, multidimensional environmental policy decisions.(FN11) The Tillamook effort was successful in that it provided both qualitative and quantitative information, including how much money people were willing to spend for a broad range of environmental and economic initiatives under consideration by TBNEP. This information, along with the accompanying percentage estimates of participants that were likely to support or oppose particular actions, was of direct interest to decision makers and helped to refine recommended actions proposed as part of the final CCMP.

In addition, the study had a second and equal focus on the public involvement and community participation aspects of the evaluation effort. In part, this shared focus defers to the NEP mandate to provide a plan for improving the quality of the Tillamook Bay estuary that reflected local participation, and it is in keeping with the recommendations of NRC's Understanding Risk report. However, this emphasis also reflected the expressed needs of the local, state, and federal policy makers who were direct clients as well as participants in the initial stakeholder-group value elicitation sessions. From decision makers' perspective, precise economic estimates of the value of specific policy options were less useful than were indications of the community funding priorities, which included input to the specific development of proposed actions as well as the creation of a defensible mechanism for examining anticipated community support. Thus, the results of early decision-structuring efforts to refine the list of CCMP actions, provide information on the distribution of costs and benefits and involve community residents in a visible stakeholder-based approach to identifying that high-priority actions were considered at least as valuable as quantitative evaluation of anticipated consequences provided through the workbook results.

The use of a structured decision approach for public involvement, as illustrated by the TBNEP effort, remains

unusual, in part because of the demands created by the simultaneous focus on deliberation and analysis. To many in the public involvement field, these two sides of stakeholder participation are quite separate and require different skills as well as, perhaps, different personalities (in that the flexibility and interactive communications skills needed by the successful facilitator are not always required of the successful analyst). Although a structured decision approach results in a different set of tasks for group leaders as well as a different set of objectives for funding agencies, the dual requirements of the analytical and deliberative tasks are complementary rather than competitive. In this light, four aspects of the Tillamook Bay work were particularly helpful in implementing a structured decisionmaking process for public involvement.

First, stakeholders had to pay attention only to the objectives that would help distinguish among relevant alternatives. It is a common experience for participants in resource management decisions to place great emphasis on one or two objectives that matter most to them. For example, an environmental group will consistently focus on preservation of natural areas, whereas a labor group will focus on maintenance of employment opportunities. Yet the task for the group facilitator is to emphasize that stakeholders are not being asked to make overarching statements of their positions but instead to provide insight to the decisionmaking context at hand: Objectives that are generally important to an individual or to a resource-management agency may not be important in making the particular choice that is on the table because they are not affected by the actions under consideration.

Second, members of the TBNEP staff and stakeholder participants searched for preferred alternatives, in terms of specific actions as well as the desired level of intensity for an action (e.g., whether an action should take place on many acres or only a few, or when action should begin). A useful tool for aiding this communication was the creation of objectives by alternatives matrices that showed key objectives in rows and alternatives in columns (as in Table 1). Visually, it was then easy for stakeholders to track consequences and to see which alternatives could be eliminated because they were inferior in terms of satisfying the relevant set of objectives. The bottom line is that with a smaller number of objectives or alternatives, there are fewer tradeoffs to be made and, in turn, stakeholders' deliberations become easier.

Third, throughout the elicitation of objectives and development of the workbook questions, researchers paid close attention to procedural or process objectives--how to do things--in addition to outcome objectives.(FN12) In general, many of the most important goals of a public involvement effort--and some of the toughest tradeoffs--are encountered in process decisions. Some of the more difficult issues at Tillamook arose in the context of how a government-funded group, largely staffed with employees from outside the area, could gain the trust and confidence of local residents to initiate regional-scale changes in environmental management. At a practical level, this concern took the form of questions about who to involve as part of the advisory management committee, how to select the experts to contribute background information, how to forge linkages with other community-based groups, and how to disseminate information beyond those involved on a regular basis with the TBNEP.

Fourth, analytical techniques were used extensively to improve the quality of stakeholder participation. For example, trust depends not just on cultivating a good feeling among stakeholders but on creating a basis for informed judgments. Tools such as means-ends networks and the objectives-by-alternatives matrices noted earlier are useful because they clarify the distinction between values information, which comes from stakeholders, and factual information, which comes from science or lay (community) experts. The focus on stakeholder values also makes it easy to see why some participants might prefer one alternative over another and, using techniques such as the even-swaps approach, facilitates initiation of structured mitigation designed to create new and better alternatives. Although the value elicitation and group workbook sessions were at times demanding, participants expressed a high overall level of enthusiasm for exploring their own tradeoffs, becoming better informed, and learning about the parallel or divergent views of their peers--all of which contribute to more informed judgments and to recommendations that speak more clearly and forcefully to the ultimate agency or political decision makers.

## **IMPROVED POLICY DEVELOPMENT**

The goal of a structured decision approach to public involvement is to provide policy makers with improved insight about the decision at hand. This contrasts with the goal of a conventional economic analysis, to provide numbers for incorporation to a benefit-cost study, or the goal of a conventional public participation process to achieve consensus. Providing additional insight requires an improved understanding of the concerns of stakeholders, an improved knowledge base for identifying the primary consequences of alternative actions on these objectives, and a transparent mechanism for reflecting the most important tradeoffs in policy development. Accomplishing these objectives requires a close alignment of deliberation and analysis, with stakeholder judgments informed not just by factual information but

also by an active exploration of their own values and, typically, an increased appreciation for the concerns of others.

Implementation of a structured approach remains challenging, in part because it is different from what decision makers or stakeholders have come to expect. It results in a different focus for the group facilitator and client, different responsibilities for stakeholder participants, and a different role for experts trained in the natural or social sciences. It also requires a willingness on the part of policy makers to acknowledge stakeholder expressions of values and tradeoffs explicitly. In particular, rather than shifting the focus away from the divergent views of participants in favor of consensus, a structured decisionmaking approach looks to the differences in expressed values and objectives as the source of valuable insights that can lead to a broadly acceptable agreement. Not all participants need to favor the same alternative, and not all elements of an option need to have everyone's support. Instead, all stakeholders must see a clear response to their values and expressed tradeoffs in a proposed alternative. Policy makers, knowing this information, would then be able to advocate a specific project or program with a more complete understanding of its ability to satisfy the expressed objectives of a wide range of constituents.

#### ADDED MATERIAL

Robin Gregory is senior researcher at Decision Research in Vancouver, British Columbia. His work includes resource policy and multiple objective tradeoff analysis, focusing on the environmental risk management and community-based environmental policy decisions. Gregory is solely responsible for the views expressed in this paper. He can be contacted at rgregory@interchange.ubc.ca.

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#### ILLUSTRATION © NIP ROGERS--STOCK ILLUSTRATION SOURCE

Table 1. Costs and benefits of protecting and restoring tidal wetlands

	Plan A (one-time)	Plan B (ongoing)	Plan C* "Better"
<b>+ Benefits:</b>			
Increased storage for floodwaters	low	moderate	
Increased off-channel coho, chinook, and steelhead habitat	improvement	improvement	
Lower pollution levels in Tillamook Bay	low (200 acres)	high (750 acres)	
<b>- Costs:</b>			
Loss of access to productive farmland	moderate	moderate	
Federal and state taxes for dike removal, replanting, and land purchase	low \$200,000 (\$1,000/acre)	low high \$2.2 million (\$3,000/acre)	

NOTE: The timeline is for five years. \* The Plan C column was included to encourage participants to create a preferred alternative using the Plan A and Plan B benefits and costs as starting points.

SOURCE: Robin Gregory, "Assessing Stakeholder Values for the Tillamook Bay National Estuary Project," Decision Research report, 1999.

Figure 1. Means-ends network for the Tillamook Bay National Estuary Project

#### FOOTNOTES

1. National Research Council, *Understanding Risk: Informing Decisions in a Democratic Society* (Washington, D.C.: National Academy Press, 1996).

2. O. Renn, "A Model for an Analytic-Deliberate Process in Risk Management," *Environmental Science and Technology* 33, no. 18 (1999): 3049-3055; and C. Chess and K. Purcell, "Public Participation and the Environment: Do We Know What Works?," *Environmental Science and Technology*, in press. Renn's model for cooperative discourse

has three primary steps: identify stakeholder concerns and evaluative criteria, measure the impacts of policy choices, and evaluate options using one or more groups of randomly selected citizens. Chess and Purcell's "rules of thumb" focus on five suggested steps in the consultation process: clarify goals, begin participation early, adopt flexible participatory forums, establish sustained interaction, and collect feedback.

3. P. Slovic, B. Fischhoff, and S. Lichtenstein, "Behavioral Decision Theory," *Annual Review of Psychology* 28 (1977): 1-39.
4. Excellent reviews of behavioral decision research are found in J. Payne, J. Bettman, and E. Johnson, *The Adaptive Decision Maker* (New York: Cambridge University Press, 1993); D. Kahneman, P. Slovic, and A. Tversky, *Judgment Under Uncertainty: Heuristics and Biases* (New York: Cambridge University Press, 1982); D. von Winterfeldt and W. Edwards, *Decision Analysis and Behavioral Research* (New York: Cambridge University Press, 1986); and J. March, "Bounded Rationality, Ambiguity, and the Engineering of Choice," *Bell Journal of Economics* 9 (1978): 587-608.
5. R. Keeney and H. Raiffa, *Decisions with Multiple Objectives: Preferences and Value Tradeoffs* (New York: Cambridge University Press, 1993). This classic exposition of multi-attribute utility theory (first published in 1976) sets out a thoughtful and systematic approach to identifying preferences and making value tradeoffs. The approach underlies the practice of decision analysis, designed to help an individual choose among competing options in an uncertain environment.
6. R. Keeney, *Value-Focused Thinking: A Path to Creative Decisionmaking* (Cambridge, Mass.: Harvard University Press, 1992); and R. Fischer, W. Ury, and B. Patton, *Getting to Yes* (New York: Penguin Books, 1991).
7. My co-workers at Tillamook included Katherine Wellman, Tom Green, Tim McDaniels, Ralph Keeney, and Terre Satterfield.
8. J. Hammond, R. Keeney, and H. Raiffa, *Smart Choices* (Cambridge, Mass.: Harvard University Press, 1999).
9. T. Webler, "Organizing Public Participation: A Critical Review of Three Handbooks," *Human Ecology Review* 3, no. 2 (1997): 245-254.
10. E. Peelle, "Beyond the NIMBY Impasse II: Public Participation in an Age of Distrust," *Proceedings of Spectrum '88*, Pasco, Wash., 575-582.
11. For other examples, see R. Gregory and R. Keeney, "Creative Policy Alternatives Using Stakeholder Values," *Management Science* 40 (1994): 1035-1048; and T. McDaniels, R. Gregory, and D. Fields, "Democratizing Risk Management: Successful Public Involvement in Local Water Management Decision," *Risk Analysis* 19 (1999): 497-510.
12. H. Simon, "Rationality as Process and as Product of Thought," *American Economic Review* 68, no. 2 (1978): 1-16.

## SMART CHOICES FOR ENVIRONMENTAL MANAGEMENT DECISIONS

An excellent and highly readable overview of a structured approach to making decisions, communicated in practical language is found in a new book entitled *Smart Choices: A Practical Guide to Making Better Decisions*. Parts of this paper are inspired by the book. The authors state that--for many complex decisions--making a smart choice requires that eight key elements be considered (see key elements below). The first five elements--problem, objectives, alternatives, consequences, and tradeoffs (with the acronym PROACT, a reminder to be proactive)--constitute the core of a structured way to think about decision problems (or, as the authors of *Smart Choices* point out, decision opportunities). The remaining elements of uncertainty, risk tolerance, and linked decisions are familiar to many environmental managers. Perhaps less well-known is the knowledge of psychological traps that can distort thinking about decisions, for example, by relying too heavily on easily salient evidence or by being overconfident in one's ability to make accurate judgments under uncertainty.

### Key Elements of Smart Choices

- \* Problem: Define your decision problem to solve the right problem.
- \* Objectives: Clarify what you are really trying to achieve with your decision.
- \* Alternatives: Create better alternatives to choose from.
- \* Consequences: Describe how well each alternative meets your objectives.
- \* Tradeoffs: Balance objectives when they cannot all be achieved at once.
- \* Uncertainty: Identify and quantify the major uncertainties affecting your decision.
- \* Risk Tolerance: Account for your appetite for risk.
- \* Linked Decisions: Plan ahead by coordinating current and future decisions.

SOURCE: *Smart Choices: A Practical Guide to Making Better Decisions* by J. S. Hammond, R. L. Keeney, and H. Raiffa (Boston, Mass.: Harvard Business School Press, 1999).