4

Understanding Objectives

Everyone seems to have something to say about the importance of objectives in guiding our choices. When we suggest to a new group that they need to start by setting objectives, often we're told 'we've already got those'. Usually, what people are describing is a terms of reference, a set of principles, or a list of things to do. Sometimes it's a cold hard regulatory target. Sometimes it's a short narrative from a 'visioning' process. But none of these constitute a set of objectives in the sense we are looking for. Because the decision sciences define 'objective' in a specific way, we need to take a moment to clarify what it is we mean.

The deceptively simple answer is that, in any resource planning or evaluation situation, objectives are the things that matter. We have yet to meet a resource-management context that didn't involve more than one objective; usually there will be four, six or eight things that matter to participants and to decision makers. The clear definition of these objectives is essential for good management decisions. If the objectives are vague, incomplete, or flat out wrong, then everyone will be working to resolve the wrong problem: as Yogi Berra is reported to have said, 'If you don't know where you're going, chances are you will end up somewhere else'.

If your decision context is choosing a restaurant to take your mother to for dinner on Friday night, for example, your objectives might pertain to the quality of the food, the convenience of getting to the restaurant, the price, and how long it may take to get served. You could compare the likely performance of different restaurants on these objectives by looking at their quality rating in a local restaurant guide, the time to travel there by car, the average price of a meal, and the ratio of staff to diners. In an environmental management context such as cleaning up pollution in a coastal estuary, your objectives might include improving water quality, keeping the financial cost of actions low, and enhancing recreational opportunities. The performance of alternative approaches against these objectives might be characterized by corresponding performance measures for each objective, such as the annual reduction in units of pollution entering the estuary, the discounted dollar cost of clean-up actions, and the number of recreational user-days for boating and bird-watching.

Brain surgery this is not. However, clarifying objectives is not always this simple. Many of the things that matter most when making a choice are qualitative in nature and are closely tied to an individual's perceptions or a community's cultural values. When you're choosing a restaurant, for example, the ambience might be as important as the price. But what are the elements

Structured Decision Making: A Practical Guide to Environmental Management Choices, First Edition. R. Gregory, L. Failing, M. Harstone, G. Long, T. McDaniels, and D. Ohlson.

of ambience that you value? Is your definition of ambience the same as that of other people? In environmental management, decisions often hinge on these more qualitative considerations. What is the effect of a proposed development on a community's sense of place? How should a plan assess the effects of a development on the spiritual value of a burial ground for a local aboriginal community? So strong is our usual reliance on the scientific paradigm and our attachment to 'objective' science-based decision making, that these more qualitative values are often either overlooked or, at times, explicitly excluded. Whenever that happens, something that is important to people – something real, that matters to individuals or to their communities – is left out and, as a result, subsequent analyses of the anticipated benefits, costs, and risks of proposed actions are incomplete and the quality and defensibility of the decision is compromised.

SDM does not deliver value-neutral decisions. It does make explicit the subjective basis for difficult choices. Rather than sidestepping values that are difficult to measure or articulate, an effective decision-making process provides both analytical techniques and an overall framework that allows them to be put on the table alongside more conventional objectives (see Gregory, Failing & Harstone[1]). Scientific and economic considerations retain the importance they've always had while less easily quantifiable social and cultural concerns are incorporated in an equally rigorous fashion. This serves to level the playing field and to provide a visible entry point for community members, aboriginal resource users, and others who have often felt excluded from environmental planning processes.

Before going too far down this road, let's back up and cover some basic concepts about the use of objectives in SDM applications. First we'll introduce some core ideas about objectives and sort out some terminology. In the second half of the chapter, we discuss some of the trickier aspects of applying these ideas in the complicated and disorderly world of environmental management.

4.1 The basics

4.1.1 What are 'objectives' in structured decision making?

Objectives are concise statements of 'what matters'

In SDM, objectives are concise statements of the fundamental interests that could be affected by a decision – the 'things that matter' to people. Together with performance measures, they become the basis for creating and for evaluating management alternatives. For use in decision making, the statement of objectives can be kept pretty simple. Essentially, they consist of the thing that matters and (usually) a verb that indicates the desired direction of change:

1. Increase revenues to regional government.
2. Reduce the probability of extinction of wild salmon.
3. Minimize emissions of greenhouse gases.
4. Maximize year-round employment.
5. Minimize adverse effects on subsistence food gathering.

If the verb causes controversy, you can omit it provided the directionality of the objective is clear – that is, whether more or less is preferred, all else being equal. The verb really can become a point of controversy. The difference between 'improve' and 'maintain' embeds a value judgment about the outcomes of the process, and it's way too early to be having that conversation. People may object to 'maximize' and 'minimize' arguing that it's not possible to maximize or minimize and make trade-offs at the same time. So, the practical advice is, as long as the preferred direction is clear, you can move on.

Decision-relevant objectives are context-specific

This means they are defined for the decision at hand, not for universal usage. If we did not say that objectives and measures were context-specific,

then it would be difficult – in many cases, impossible – to get agreement on them. By carefully structuring objectives and measures, we can take important but ambiguously defined things that matter – like biodiversity, visual quality, river quality and spiritual quality – and define them, *for the purposes of this decision*, with objectives, sub-objectives and performance measures. This frees us from endless philosophical and technical debates about the proper, universal narrative definition of 'river quality', or 'ecosystem health'. It takes us to a very practical place where the exact name we give the 'thing that matters' is less important than the clear definition given to it by the sub-objectives and performance measures we will use to assess it for the purposes of *this* decision.

Objectives are not targets

In the decision sciences a target is a desired level of performance towards an objective. 'Create 1000 jobs' is a target – a specific quantitative level of performance we want to achieve. 'Increase employment' is an objective (employment is the thing we want, more is better than less). Choosing a particular target usually has implications for multiple objectives. In SDM, we treat targets as alternatives and we compare the implications of one target versus another on the set of objectives. We include more on why we avoid setting targets at the objective-setting stage later in this chapter, and more on treating them as alternatives in Chapter 7.

4.1.2 What are good objectives?

Although there are no 'right' objectives, there are – at minimum – some that are more useful than others. A good set of objectives focuses decision makers on what matters in terms of outcomes of the decision and helps to identify and evaluate alternatives. In addition, a good set of objectives provides a sort of score card to assess outcomes of initiatives. Here we list five properties of a good set of objectives.

1. *Complete*. This means that no essential objectives are missing. A good set of objectives will capture all of the things that matter in evaluating proposed alternatives. In most cases, this will include the key environmental, social, economic, health, and cultural outcomes that may be affected by the decision. In some cases, it may also be important to include process considerations relating to how the decision is made or how actions are implemented.

   To know whether your objectives are complete, you need to consider the range of alternatives under consideration. When you start developing a recovery plan for grizzly bear, for example, you may discover that a primary means of creating habitat is prescribed burning (i.e. planned burning of forested areas in order to create better shrub/berry foraging). This may lead you to have an objective related to the impacts of such activities on neighboring communities (loss of tourism income or adverse health effects, for example, resulting from poor air quality), something you might not initially have considered.
2. *Concise*. This means that nothing is unnecessary or ambiguous. Similar objectives are grouped together and there is no double accounting. The harsh reality is that people can keep as many as 6–10 objectives in their minds, but any further additions just muddy the waters. Thus a good set of objectives should ensure that all the important consequences can be described with the fewest possible objectives and measures. Similar objectives are grouped together in hierarchies by creating sub-objectives that define the components of the general objectives.
3. *Sensitive*. This means that the objectives are influenced by the alternatives under consideration. If an objective shows the same level of achievement for all of the alternatives under consideration, then it is not useful in distinguishing among the alternatives. It's just more mud in the water.
4. *Understandable*. The objectives should be stated in a way that they are immediately

understandable to everyone and speak directly to the things that matter. Use commonly understood terms rather than scientific jargon. Avoid ambiguity but bear in mind that many objectives are only made understandable through the use of sub-objectives and eventually specific performance measures. For example, 'conserve biodiversity' is clearly stated, but may be interpreted in dramatically different ways unless it is more clearly defined by lower level sub-objectives and specific performance measures that define how biodiversity is to be understood in this decision context. As a result, conserve biodiversity might have a sub-objective to 'maximize the diversity of native plants' as measured by a 'species richness' index.

5 *Independent*. It is good practice to check that the objectives are also independent – or more formally, 'preferentially independent'[2]. This means that they contribute independently to the overall performance of an alternative, and you don't need to know what's happening on one objective in order to know how important another objective is.

If that sounds complicated, think of it in terms of green vegetables. Imagine you're serving both beans and broccoli for dinner. How important is it to you that your daughter eats a lot of broccoli? Well, it depends on how many green beans she eats, because what you really care about is not that she eat broccoli but rather that she eats some green vegetables, or even more fundamentally, that she gets appropriate nutrition. Thus you want an objective that speaks to this higher-level concern, and the trade-offs you're interested in when preparing or consuming meals are (likely) between nutrition and cost and perhaps time available for leisure activities (if we assume that a good meal takes longer to prepare), and not between consumption of broccoli and consumption of beans. Because preferential independence is almost always implicitly assumed by people using objectives in decision making, it's best to make sure that the assumption is valid to avoid errors of logic when evaluating alternatives. It is possible to deal with objectives that are not independent, but more complex analysis is required. The good news is that carefully structuring your objectives – especially separating means from ends and grouping similar objectives – will almost always solve preferential dependence problems.

If that all still sounds complicated, don't worry about it. Make sure you have 'fundamental' objectives as opposed to 'means' objectives as described in the next section and you'll satisfy this condition well enough.

Noticeably absent from this short list of properties of good objectives is 'measurable'. Our experience has convinced us that objectives should state the thing that matters, whether we know how to measure it or not. At some point, performance measures will be attached, and yes, these more specific measures should be amenable to clear and consistent assessment. But when eliciting objectives in a decision problem that involves multiple environmental and social outcomes, the last thing you want to do is to brand a concern as illegitimate because it might be hard to measure.

4.2 Developing a good set of objectives

In this section we outline an approach to generating objectives that we can safely identify as a recognized 'best practice'. Based on Ralph Keeney's value-focused thinking approach, it has become the most widely cited and well-used approach to generating objectives in the decision sciences. As a decision maker or participant in a decision process, defining your objectives is one of the most important things you can do to improve decision quality. It's definitely an art, but it's an art that's easy to get good at by systematically practising five basic steps:

1 Brainstorm what matters.
2 Separate means from ends.

3 Separate 'process' and 'strategic' objectives from 'fundamental' objectives.
4 Build a hierarchy of objectives.
5 Test to make sure they are useful.

4.2.1 Brainstorm what matters

A good way to kick off a brainstorming session is to simply ask: what are we trying to achieve or what concerns are we trying to address? To encourage original thinking, it's usually best to ask people to write down their own ideas independently before starting to refine them as a group. By initially freeing each participant to search his or her mind without being limited by (or anchoring on) others' thoughts, the final result will be a more comprehensive set of objectives that more accurately reflects everyone's concerns[3].

If you're having trouble getting what seems like a comprehensive list, you may need to prompt people with more questions. Ask them what would make them really happy? Or ask them to role play and imagine themselves as other stakeholders. What would they be concerned about? If people have anchored on a particular solution, ask them to list what's so good about it; this list may contain great ideas for objectives. Conversely, if participants are in strong opposition to a proposed alternative, ask them why. What would they most want to avoid? What are the hidden agendas or political 'realities' that could thwart things despite a great analysis? The answers to these questions will yield information about objectives that haven't been stated yet.

If the list of issues becomes very long, participants can be asked to start to think about categories of concerns that should be considered and begin to organize sub-points under them.

In the early stages of a decision problem, you're likely to generate dozens (if not hundreds) of 'issues' – a complex mix of actions and objectives, hopes and fears, advice, and accusations. Without structuring, discussions tend to take on the form of what we've come to call the 'conversational swirl' (with a nod to colleague Basil Stumborg). Discussions quickly either bog down in details or blow out in a shotgun of thinly-related concerns, many of which eventually get forgotten or ignored. Taking the time to structure this swirl of issues into a set of 'objectives' and a set of 'alternatives' is essential.

4.2.2 Separate means from ends

The first step in structuring is to start separating these issues into objectives (what matters) and alternatives (what actions can be undertaken). On the objectives front, 'fundamental' or 'ends' objectives are the basic things that matter, the outcomes you really care about regardless of how they are achieved. Means objectives refer more to specific methods of meeting the fundamental objective.

Clarifying means and ends is one of the most important things you will do in developing a useful set of objectives[2,4]. To do this, we get a long way by asking only two questions: why is that important and how could we achieve that?

Consider a case where stakeholders are considering improvements to a park near an urban center. One of the suggestions, to fertilize a small lake, is immediately opposed by other stakeholders who don't want to introduce artificial chemicals into the area. So why might lake fertilization be important? One likely answer: because it increases nutrients in the lake. Why does that matter? At this point, it's often helpful to sketch out a means–ends network, while continuing this same line of questioning. As shown in Figure 4.1, increasing nutrients is important because it increases lake productivity, which in turn increases the number of fish, and so on toward the right hand side of the figure.

You know you've hit bedrock when the answer to the question of 'why is that important' is a perplexed shrug: 'it just is!' You've arrived at an objective that appears to be important, in its own right, regardless of how it was achieved. It's easy to see from this that the distinction between means and ends isn't black and white; it's a continuum. In this case, maximizing the fishing experience is a fundamental or 'ends objective', while increasing lake productivity is a 'means objective'.

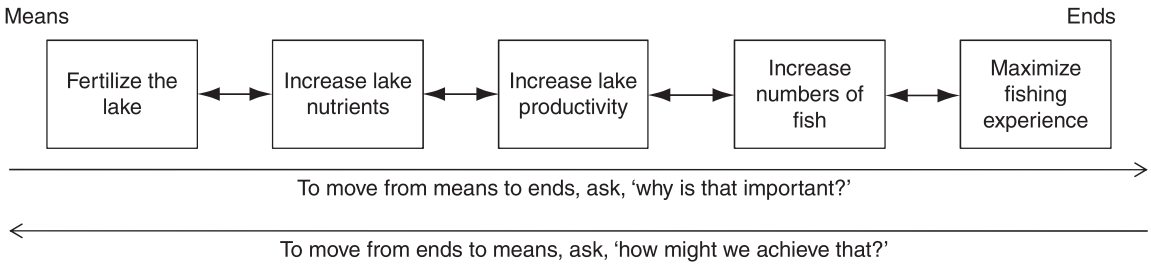

Figure 4.1 A simple means–ends diagram.

In Chapter 3 we talked about the tricky business of figuring out the right framing for your decision, which is directly linked to the choice of fundamental objectives. The right fundamental objective is the broadest objective that will be directly influenced by the alternatives and within the control of the decision maker.

Once we learn that the fundamental objective is to maximize the quality of the fishing experience in the park, then we can ask 'how else could we achieve a better fishing experience?' This would result in new pathways being drawn back toward the left side of the diagram in Figure 4.1, leading to the definition of other alternatives, positioned in parallel with 'fertilize the lake', such as stocking with hatchery raised fish, making lake access more convenient for people with boats, banning jet skiers, or perhaps improving access to another nearby lake. Through this process the person who first proposed fertilizing the lake will come to see that fertilization is an alternative, not a fundamental objective, and that it will need to be evaluated alongside other alternatives.

This all might sound a bit elementary. But remember that, when making decisions in a group setting, we need to make sure that everyone sees their concerns captured, can talk about them using a common language, and can understand at what point they will be addressed in more detail. When we talk about objectives, we're referring to the things that later will be used to generate and to evaluate management alternatives. By clarifying the distinction between means and ends, particularly with the use of means–ends networks, people see that their concerns and interests are not being swept aside; those that are identified as alternatives are important, and will receive more detailed treatment later. But it's not just about process: distinguishing between means and ends is absolutely essential for thinking clearly about the evaluation of alternatives.

4.2.3 Separate fundamental and means objectives from process and strategic objectives

Does this two-way distinction between fundamental and means objectives cover all the objectives that regularly come up as part of environmental management choices? The short answer is no: two further types of objectives frequently are raised by participants. The first is process objectives, which refer to how a decision is to be made. Examples of process objectives include: maximize public participation in the decision, encourage implementation partnerships, complete the analysis within schedule and budget constraints, incorporate uncertainty.

Sometimes, however, things that look like process considerations will directly influence the design of a management alternative; in these cases they are fundamental objectives. Consider the case where the community that is likely to host the incinerator has little trust in the management authority. As a result, one objective of the facility design and siting process may be to 'build trust'. This concern could affect the design

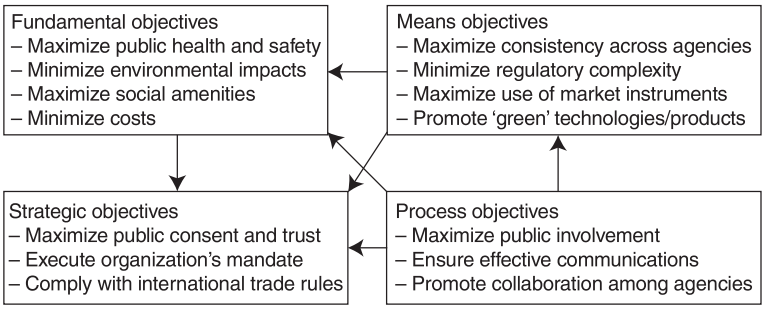

Figure 4.2 Examples of different types of objectives (adapted from Keeney[5]).

of the decision process but it could also affect the selection of alternatives, for example by favouring alternatives that involve local citizens as part of management teams over alternatives that are implemented unilaterally by the municipal government.

Strategic objectives, the second special type of objective, relate primarily to an individual's or an organization's own strategic priorities or direction. They are objectives that are relevant for all the decisions made over time by that organization or individual. Typically, strategic objectives relate only indirectly to the outcomes of the decision at hand. For example, corporations and some governments might have a strategic objective of 'increasing competitiveness' or 'maximizing public consent to operate' (which refers to building public trust and support for the organization). Such objectives are not likely to become shared objectives in a multi-stakeholder process. However, if the decision is an internal one, this objective could play an important role. It might even be useful (or politically important) to use the exact words as reflected in the organization's strategic documents in the statement of objectives.

A useful way to approach process and strategic objectives is to map them to the fundamental and means objectives of the decision at hand. As shown in Figure 4.2, fundamental objectives can influence the achievement of strategic objectives. Means objectives can influence the achievement of both fundamental and strategic objectives and process objectives can influence all of the other three.

4.2.4 *Build a hierarchy of objectives*

Once you've actually developed some fundamental objectives you may be dismayed to discover that they are rather vague. Now is a good time to ask the next set of key questions: what do you mean by that?; can we identify subcomponents of that?; or sometimes, what are the critical means of achieving that? For example, if we've identified a fundamental objective to maximize fish abundance, the sub-objectives might be related to various species or locations (maximize salmon, maximize whitefish, etc.). Alternatively, the sub-objectives might be related to critical 'means' (as in the water use planning example in Chapter 1, where the sub-objectives were maximize spawning habitat and minimize stranding). We need to disaggregate enough to be clear and to characterize the decision properly, without introducing unnecessary detail.

What typically emerges from this is known as an objectives hierarchy. A hierarchy for a fairly complex decision problem involving development and operation of an open pit mining operation is shown in Table 4.1. As often occurs, objectives are included for environmental, economic, health, and social/cultural considerations. In this

Table 4.1 A typical objectives hierarchy.

Maximize safety
Maximize operator safety
Maximize public safety
Maximize net revenue
Maximize revenue from ore sales
Minimize capital costs
Minimize operating costs
Minimize impacts on First Nations traditional use activities
Minimize impacts to ceremonial sites
Minimize access impediments to traditional food gathering areas
Minimize adverse environmental impacts
Minimize soil contamination from tailings
Minimize material waste
Minimize air emissions
Minimize impacts on groundwater
Minimize disturbances to recreational activities
Minimize disturbance to viewscapes
Minimize trail access blockages
Minimize noise from construction /operations

case all the objectives have several sub-objectives but this is not always the case.

The list of fundamental objectives needs to be both concise and complete, capturing everything important in as few objectives as possible. New objectives may well arise at later stages of the process, and these should be welcomed.

Importantly, this one set of objectives represents the objectives of all stakeholders. Sometimes we start out with one list of 'industry objectives' and another of 'community objectives' and so on. But ultimately, for collaborative decision making, a group needs to agree on a common set of objectives that all warrant consideration when evaluating alternatives. Different participants will weight them differently of course, but it's important to agree that all are relevant.

A good objectives hierarchy is a critical milestone in a decision process. If you're participating in a decision process that is beginning to look in detail at alternatives, and you do not yet have an objectives hierarchy that looks something like this – STOP! Even if you never assess consequences in a formal way, a good set of objectives will help to ensure that you can identify good value-focused alternatives.

Table 4.2 Initial consequence table shell, showing objectives.

Objectives	Wood waste	Natural gas	Sewer heat recovery
Minimize greenhouse gas emissions			
Minimize cost to residents			
Minimize negative health effects			
Maximize security of supply			
Minimize noise			
Minimize loss of visual quality			

4.2.5 Test to make sure the objectives are understood and useful

The litmus test for a good set of objectives is whether it is useful and sufficient for evaluating management alternatives. The best way to test them is to lay them out in the format that's needed to help make a decision – usually a consequence table. You don't need to have identified a detailed set of alternatives to do this; you just need to know the range of things under consideration. Suppose you're examining local energy supply alternatives for an urban community (see Table 4.2). An initial consequence table would clearly set out the range of alternatives under consideration (in this case, neighborhood-scale energy systems fueled by wood waste, natural gas and sewer heat recovery) along with your proposed objectives: minimize greenhouse gas emissions, minimize costs to residents, minimize negative health effects from local air emissions, maximize security of fuel supply, minimize loss of visual quality, and minimize noise (from trucking in waste wood).

Looking at a sketch of a consequence table, imagine it filled with data, text, or plusses and minuses in each cell. Ask yourself (and participants in the process):

1 'In choosing among these alternatives, are these really the things that matter?'

2 'If information is collected about the impacts of alternatives on these objectives, will you then have all the information you need to make an informed choice?'

4.2.6 *Don't weight objectives (at least, not yet!)*

Strictly speaking, this isn't a step of course. But trying to weight objectives at this point is such a common and serious mistake that we need to address it. First of all, as we discuss more fully in Chapter 9, you can't meaningfully weight objectives without information about the extent to which they're affected by the alternatives. (If the volume of emissions produced by different alternatives can vary by orders of magnitude for example, it will likely be weighted much higher than if it changes very little across alternatives.) But this is information (about predicted consequences) that you don't yet have. Second, by agreeing on a set of objectives, you've just built a shared understanding of what matters. Most, if not all of the people in the room will agree that all of the objectives are important things to consider. At this point in the decision process, you are better off building on this common ground of shared values than worrying about differences in how they are weighted. And third, there is simply nothing to gain in terms of insight about the decision by weighting objectives now – and perhaps ever. In some decision processes (as we'll discuss in Chapter 9) weighting objectives is essential to understanding key trade-offs and developing alternatives. In other situations a well supported solution can be found without ever explicitly assigning weights to objectives.

4.3 Working with objectives in environmental management processes

In this section, we cover some of the trickier territory related to identifying and working with objectives. Many of these insights will be familiar to seasoned practitioners of SDM. However, we've been bitten enough times by these issues to have learned that they merit special emphasis in the world of environmental management.

4.3.1 *Do decision makers know what they want?*

Once the intent is explained, we rarely encounter any opposition to the suggestion that a good decision process should involve developing a clear set of objectives. It might be expected that career decision makers would find this an easy task; after all, who should be better at knowing what they want than people whose job is to make choices? Yet when it comes to objective-setting, our experience is that decision makers are often in need of help. And we're not the only ones to say so. In three empirical studies of how well individuals are able to generate self-relevant objectives, Bond, Carlson, and Keeney[6] noted that participants consistently omitted nearly half of the objectives that they later acknowledged to be vital for the evaluation of alternatives. This finding held even when participants were given the opportunity to reflect, and it remained true when the participants were experienced strategic decision makers at a private corporation.

Decision makers also need help in clarifying exactly what they mean by the stated objectives. In a group context – for example, when stakeholders representing the multiple perspectives on an environmental management issue come together to seek a joint solution – participants may agree on the importance of an objective only to learn later that they understood the objective to mean profoundly different things. For example, scientists working on a fisheries restoration problem may quickly reach agreement on an objective of 'conserve native fish', only to learn they really have fundamentally different objectives: one seeks conservation of species diversity, another an increase in the production of harvestable fish, and a third avoidance of the low-probability collapse of a single endangered species.

Table 4.3 Illustrative situation of competing objectives.

Objective	Indicator	Alternative Plan 1	Alternative Plan 2	Alternative Plan 3	Alternative Plan 4
Maximize protection of panda bears	Expected no. of panda bears	2800	3000	3200	3400
Maximize community jobs creation	No. of full-time jobs created	100	50	20	10

The bottom line: decision makers often will not think they need help defining objectives. But they do.

4.3.2 How can it be useful to work with 'competing' objectives?

Suppose we are comparing hypothetical industrial development plans and are trying to balance economic benefits with negative effects on a plant or wildlife species that many people care about passionately, such as old-growth trees or polar bears or pandas. When we suggest to participants in a deliberative group that we're trying to simultaneously 'maximize protection of panda bears' and 'maximize economic development', some people look at us like we're nuts. How can we possibly do both? And, from a group process perspective, how can we expect an industry representative to agree that an objective is to maximize protection of pandas, or a conservationist to accept an objective that 'maximizes' economic development?

Although SDM does not offer a panacea, there are two aspects of a decision structuring approach that we find can greatly help in this situation. First, recall that people are being asked to consider public decisions from a societal perspective. While they are of course there to bring their own perspective to the table, they are being asked to work toward solutions that are in the best interest of society as a whole. This requires considering trade-offs across multiple objectives and finding an appropriate balance. An objective is legitimate and should be included if someone affected by the decision cares about it (and of course if it is sensitive to the decision, as above). However, as noted earlier, each individual can (and will) assign a different importance (or weight) to each objective. Some people may give some objectives no weight at all if they believe that from a societal perspective, it warrants no consideration in the decision. Again, at the objective-setting stage, focus on identifying relevant objectives, not weighting them.

Second, recall that the ultimate task is to use what is known about objectives (and performance measures and consequence estimates) to develop a broadly preferred alternative. Table 4.3 shows a very simple situation where two objectives (pandas and jobs) are what we care about. All else being equal, we want more of (i.e. to maximize) both. It would be perfect if we could find a way to get lots of panda bears and jobs. A key goal of the structured decision process is just that – to explore how and to what extent different alternatives can help to achieve different levels of competing objectives. We first see if it's possible to iteratively improve the alternatives by weeding out inefficient alternatives and seeking joint gains (alternatives that deliver gains on multiple objectives). The remaining trade-offs are then examined to help groups find the alternative or alternatives that represent the best possible balance across the identified objectives. Or, in many cases, to identify a set of alternatives that all deliver an acceptable balance. Which is the best alternative in Table 4.3 depends on how you feel about the trade-offs involved. The table doesn't make the decision; it facilitates a discussion about the best balance between pandas and jobs by trying to maximize both and seeing what the alternatives tell us is possible.

If this seems obvious to you, then great. But be aware that it sometimes isn't immediately obvious to everyone.

4.3.3 The trouble with targets

Targets refer to desired minimum levels of achievement on key environmental, economic or social considerations, and typically operate as constraints on actions by eliminating those that don't achieve them.

The above discussion on conflicting objectives should provide some insight into why we avoid objectives that embed targets. Targets on an objective constrain trade-off explorations in a way that makes us blind to the consequences: if we can't have both 1000 hectares of shorebird habitat and 1000 hectares of salmon spawning habitat, then setting a target of 1000 hectares of shorebird habitat hard-wires a trade-off. And in terms of group dynamics, because the target embeds a value-based trade-off, you'll probably never get agreement on it at this early stage of a decision process.

This is an important point. The act of setting quantitative targets is itself a decision, a multi-objective value-based decision, and should be based on a good understanding of objectives, alternatives and the consequences associated with different targets. If the goal is to conserve a 'viable population' of a particular species then a key question is what constitutes a viable population. An appropriate course of action is to explore a range of alternatives, which might for example represent different levels of abundance or different probabilities of persistence. For example, Tear *et al.*[7] examined three alternatives that deliver respectively a 75%, 95%, and 99% probability of persistence of the species to 100 years. Each of these implies a different degree of risk for the species concerned. If the 99% alternative has no incremental costs or other negative consequences relative to the 95% alternative, then anything less than 99% may be unacceptable. If enormous economic hardships or severe consequences for another species are associated with the 99% option, then 95% may be perfectly acceptable. The bottom line is that a key factor in deciding whether risks are acceptable is the availability of alternatives and an assessment of trade-offs across them.

Sometimes, of course, targets have been established by legal mandates, such as a requirement to achieve a minimum level of returns as part of an endangered species recovery program or to set aside a specific percentage of old growth forest. In such cases, the objective can be expressed in terms of the probability associated with achievement of the mandated quantity, which takes the discrete language of a target (yes/no to meeting a number) and replaces it with the continuous language of an objective (measured via changes in the associated probability).

However, unless the threshold is legally absolute and 100% non-negotiable, even this application serves only to unduly limit thinking. Suppose, for example, that an agency wants to restore at least 100 hectares of riparian habitat each year. The target is met if 101 hectares are restored but not met if only 99 hectares are restored. Depending on the relative costs of the alternatives, it seems likely (especially if there's any uncertainty about the predicted habitat) that the 99 hectare alternative could be preferred if it was substantially less expensive or had other merits, but that possibility wouldn't be explored under a 'targets' approach.

4.3.4 Should we worry about double counting?

The short answer is yes. The long answer is yes, but be careful (some things that look like double counting, aren't). And the practical answer is, yes, but sometimes it's the lesser of two evils. We treat each of these in turn.

Double counting in objective setting happens when we count what is essentially the same interest more than once. It is unquestionably a problem, for two reasons. First, it leads to errors of logic in the evaluation of alternatives – decision makers may overweight a concern that is represented

Text box 4.1: How much is enough?

This is the million dollar question that plagues environmental regulators, managers, and advocates everywhere. It's at the forefront of controversy surrounding threshold-based approaches to managing cumulative effects in many parts of the world. Much effort has and continues to be put into the science of thresholds – the identification of indicators and dose-response relationships in order to understand the influence of development pressures on environmental change. But there has been limited success with implementation.

There are two key problems. First, only rarely are there any bright lights or thresholds that demarcate a line between what is 'enough' and 'not enough'. Instead, what exists is a continuum – more habitat is generally better, but there is rarely an objectively definable point at which one can say with certainty that 'enough' habitat has been protected. As a result, no amount of analysis will change the fact that the regulator charged with approving a development project needs to make value-based judgments about how precautionary to be. While some progress has been made in developing systems of tiered thresholds that recognize uncertainty, very little progress has been made in implementing them.

This is because of the second problem, which is a failure to distinguish between setting thresholds – which provide *information* useful for interpreting the significance of change – and making a *decision* to limit development. Such a decision must deal explicitly with both value based trade-offs (across environmental, social, and economic objectives) as well as fact-based uncertainties. Science panels are regularly established to set 'science-based' performance thresholds: minimum populations of valued species, minimum set-asides of 'old growth' forest, maximum road densities. etc. Such initiatives fail to distinguish between providing information about possible response thresholds and deciding on limits. As a result they end in heated conflict between scientists, industry, and environmental advocates. As Tear *et al.*[7] note 'conservation objective setting often mixes scientific knowledge with political feasibility in such as way that one cannot tell where the science stops and the political pragmatism takes over' (p. 836). At the heart of this problem, more often than not, is the mistreatment of targets and thresholds.

The inconvenient truth is that there is no objectively right answer to the question of how much is enough. Regulatory agencies need processes that are socially robust – that is, rigorous, transparent and defensible from a public and legal perspective. They need to know that the answer to the question 'how much is enough' will be inescapably value-based and will need to reflect trade-offs among multiple objectives.

twice. Second, it unnecessarily complicates both analysis and deliberations. In environmental management problems already burdened by multiple objectives and high levels of complexity, this is not something to take lightly.

The following is a simplified example of some work we did recently in Australia, looking at protocols for ranking invasive pests in terms of their consequences on the national interest[8]. Like many risk-ranking protocols, this one assigned points for different types of negative consequences, and then calculated an aggregate 'score' to reflect the significance of a pest in terms of the national interest (presumably for the purposes of efficiently allocating management resources). The protocol assigned 'points' for impacts on

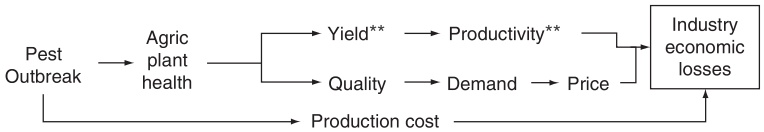

Figure 4.3 Simplified influence diagram linking invasive pest outbreak to economic loss.

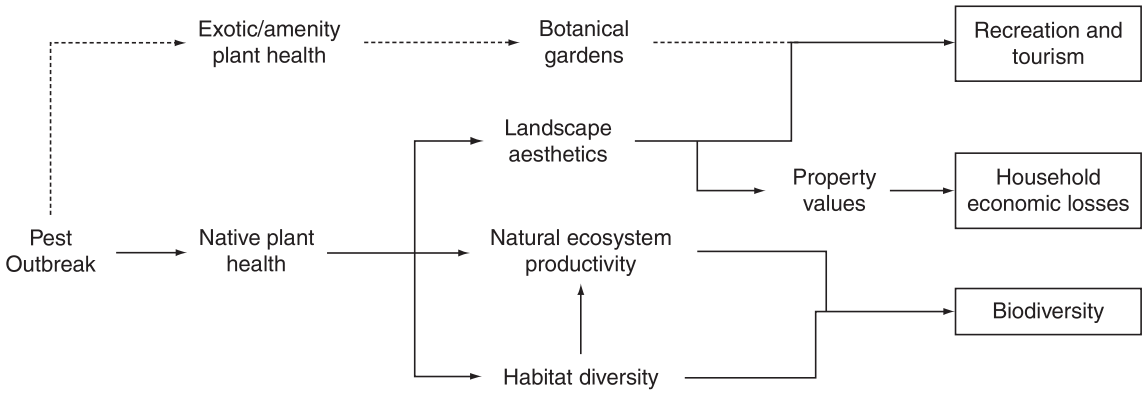

Figure 4.4 Simplified influence diagram linking invasive pest outbreak to multiple objectives.

'agricultural plant health' as well as for impacts on 'economic production'. When we asked 'why is agricultural plant health important', we were told, 'because it results in economic losses'. Figure 4.3 traces this relationship: a pest outbreak causes changes in agricultural plant health, which affects crop yield and quality, which affects productivity, demand, price, and which ultimately affects economic losses for industry. Since in this case, agricultural plant health is important only for its impacts on the economy, then a ranking protocol that counts both agricultural plant health and economic effects would indeed be double counting.

Now consider Figure 4.4. Here we show the (hypothetical but representative) effects of pest outbreaks on Australia's native plants and on amenity plants. Impacts on amenity plants affect recreation and tourism via effects on botanical gardens (amenity plants die, fewer tourists visit the gardens). Impacts on native plants also affect recreation and tourism, but via effects on landscape aesthetics (defoliation, etc.). Aesthetic losses also affect property values, resulting in household economic losses. Native plants also affect natural processes and ultimately biodiversity. We sometimes hear the argument that if we consider all three of the fundamental objectives at the right hand side of the diagram (recreation and tourism, household economic losses, and biodiversity) that we are double counting (in this case triple counting) the effects of changes in native plant health, since all of the objectives are significantly affected by native plant health. (we have even seen this argument in textbooks.) However, this is *not* double counting. Suppose that Pest A affects only amenity plants, and results in a loss of 1000 user days in recreation facilities. Pest B on the other hand, affects native plants. Let's assume it incurs the same losses for Recreation and Tourism as Pest A (1000 user days). In addition to these losses, it also causes household economic losses and biodiversity losses. If we are using all three objectives to

evaluate alternatives, then of course alternatives that control Pest B will score higher than alternatives that control Pest A. But they *should*! We are not double counting native plant health in this case. We are simply acknowledging that improvements to native plant health have multiple benefits, and a dollar spent there will deliver greater societal benefits than a dollar spent on improving amenity plant health.

Now let's consider when we might just decide to plug our noses and live with some double counting. Consider the following, still working on invasive pest problems in Australia. In one example, an initial list of objectives generated by managers includes an objective related to protecting an established World Heritage Site, something that is obviously both highly valued by Australians and an international legal commitment. Another objective is to maximize the coverage of eucalyptus forest. If one of the valued characteristics of the site in question is eucalyptus forest, then we have some double counting going on. Separating these is possible, but could be both difficult and ultimately quite unnecessary. We suggest three key questions for deciding whether double counting is really a problem:

1 *First and most important*. Does the double counting expose an important value based trade-off that managers are likely going to face when it comes to working with stakeholders in evaluating alternatives? If the answer is yes, then you may be better off leaving it than trying to eliminate it. In the above example, managers might make decisions to allocate control resources to the World Heritage site and accept losses to the broader eucalyptus forest beyond the park borders, or they might accept impacts to the park in order to preserve larger tracts of non-park forest. Further, the actions taken within the park might be quite different than actions taken in the broader land base, in which case leaving the offending objectives in place will help to facilitate thinking about alternatives.
2 *Second*. How bad would it be to leave the offending objectives in for a while? Sometimes it's better to retain an objective until people see that it is indeed double counting – if it's truly double counting then in all likelihood retain an objective will be perfectly correlated (respond to alternatives in identical ways), and people will agree to remove one (or merge them together) later on, once an understanding of the assessment process has become better established.
3 *Third*. What role do you anticipate for quantitative trade-off analysis, which is when double counting could really raise a problem? The majority of management decisions will never proceed to that stage. In the deliberations-oriented practice of SDM, we try to minimize our reliance on quantitative weighting methods and focus instead on tools for 'talking through' the best solutions to a problem with a group. We're not structuring problems to fit our favourite analysis. We're helping people structure and evaluate alternatives in order to gain insight into which to choose. All of this is to say that, although we work hard to avoid egregious examples of double counting, we rarely lie awake at night worrying about it.

4.3.5 Does every objective need to have a preferred direction of change?

Yes. For every objective, we need to know (a) the subject of concern, and (b) whether we want more or less of it: Decrease deaths. Make more money. Protect more pandas. If you're having trouble getting agreement on whether people want more of something or less of it, then you probably are either trying to combine two objectives into one or you're confusing means and ends.

Often we'll hear participants say that they don't want to necessarily increase or decrease something, they want to optimize it. Optimizing and balancing are wonderful things, but they are what we do *across* objectives – indeed optimizing or balancing across objectives is the goal of the overall decision process. We cannot optimize a single fundamental objective. To understand why 'optimizing' an objective is problematic, suppose we say we want to 'optimize forest stand density'.

And suppose we have two alternatives. Alternative A has a density of 2800 plants per hectare, while Alternative B has 3600.

Judging which alternative is preferred, even on the basis of this single 'objective', is a messy mix of fact-based and value-based judgments. Forest stand density is clearly not the fundamental objective – it is important because it influences other things we care about. So judging which alternative is preferred involves both (a) identifying which things really are valued (should we be thinking about the effects of forest stand density on burrowing owls? split toed frogs? carbon sequestration? forest-sector jobs?) and (b) estimating the consequences of forest stand density on those things (which requires specialist knowledge). Setting up an objective to optimize something will almost certainly mean:

1. That you're focused on something other than the fundamental objective.
2. That specialist knowledge will be required to make judgments about which alternative is best, leaving non-specialist participants with little meaningful role.
3. That those specialists will apply not just their technical expertise but also their values about what matters when making judgments about the best alternative, in ways that are not transparent.
4. That you will have little hope of diagnosing the causes of disagreements about preferred alternatives, because preferences are influenced by hidden value judgments and different access to information.

The bottom line: do a good job of uncovering all the objectives and separating means and ends, and the direction will be obvious. If it is not, go back and ask 'why is that important?'

4.3.7 What if what matters is hard to measure?

Count what counts. If something matters when choosing among alternatives, then it should be on the list of fundamental objectives, whether it is easily measured or not.

Some stakeholders may at first be sceptical when informed that concerns such as traditional ways of life, sense of place, or the degree of local participation in decision making can be incorporated into formal analyses of alternatives alongside considerations such as the tons of emitted pollutants or the dollar values of expected tax revenues and resource rents[9]. This capability to enlarge the set of objectives to include all those things that fundamentally matter and meaningfully assess them can be a powerful tool in encouraging stakeholder participation and deliberation, because it provides evidence that decision makers intend to take these things seriously.

If an objective sounds like it would be difficult to measure simply because it's ambiguous, however, then that's another issue. Good structuring at the objectives stage involves a relentless assault on ambiguity. Sometime terms that are popular and in wide use but don't have a clear and consistent meaning, like 'naturalness' or 'sustainability', are often proposed as objectives. There are obviously legitimate values underlying these concepts, but they're not helpful for decision-making purposes in their current form. Why? One reason is that they're really metaconcepts – there are several ideas bundled together that need to be unpacked if we are to have a chance of understanding what the speaker is actually meaning. Interestingly, this unpacking often reveals that people disagree on which of the underlying concepts are most important, leading to some very insightful discussions.

Let's take 'naturalness' as an example. When we ask participants to tell us exactly what they mean by this term, the list we get usually involves issues such as:

1. *Likeness to a previous historical state*. If 200 years ago the natural state for an area was a dense rainforest and now it's a grassland, is this by definition a bad thing? What if 'historical' conditions already had been modified by aboriginal groups: would this matter?

What about natural changes in land and climate characteristics over time?

2 *Ecological performance*. For some people, naturalness is important because it is understood to be a measure of environmental productivity or diversity, based on the assumption that undisturbed areas generally exhibit more of both qualities than disturbed areas. In this case, 'ecological productivity or biodiversity' might be preferable since the meaning is less ambiguous. An interesting and important trade-off occurs when the natural state of a forest has lower biodiversity than the current state.

3 *Visual aesthetics*. If participants believe that a 'natural' environment just looks better, then efforts to improve the aesthetics of a site might be welcomed. This will not be captured if the stated objective is 'naturalness'. Again, an interesting trade-off occurs when naturalness and aesthetic preferences are at odds.

4 *Distance from the equilibrium state*. Arguably a more sophisticated aspect of naturalness is a characterization of how far alternative managed states are from the unmanaged state. In investigating this question at Yellowstone National Park[13], for example, one of the proposed measures is the energy required to keep any given managed solution away from the unmanaged equilibrium state. For parents of kids with messy bedrooms, or for engineers familiar with the notion of entropy, it's easy to appreciate this dimension of naturalness.

Our point in this discussion is not to dismiss the validity of the use of the word 'naturalness' if a participant raises it in decision context (the same goes for 'sustainability' and others of that genre) – far from it. Rather, the discussion needs to continue so that the real value behind this concern, in this decision context, can be identified. If we cannot do this, we get back to the trap of requiring someone to tell us, in an arbitrary way, which alternative is (for example) 'most natural' on a case by case basis. More generally, the message is that ambiguous terms such as biodiversity, sustainability, equity, naturalness, and so on, need to be unpacked and made as unambiguous as possible, either by defining different objectives, or by specific sub-objectives that clarify what is meant. Once again, the question 'why is that important?' is the most important question in your toolkit.

4.3.8 What if what matters isn't what was stated?

This is a broad topic, filled with nuances about people and what they want and how they seek to present themselves to their peers, or to decision makers, in a deliberative group setting. However, at least one common example is fairly straightforward: stakeholders deliberately put forth a false objective in place of what really matters because they feel that their true concerns will not be considered 'legitimate'. In one example, townspeople participating on an advisory committee concerned with the siting of a proposed incineration facility were concerned that the incinerator and the visibility of its emissions stack would hurt their rural image. However, this was not thought to be a legitimate concern in the eyes of the decision makers and so instead townspeople spoke about their fears of adverse health effects – respiratory illnesses, childhood cancers, and the like. Despite the presentation of solid scientific evidence that these health-related fears were unfounded, there was little movement and a serious impasse threatened to block all progress on the negotiations. At an informal side-meeting, held in a local café, one of the townspeople divulged that, in fact, the health fears were not a serious concern but, instead, were a cover for the residents' worries concerning loss of their rural image. Once this issue had been clarified, then the formal consultations as part of the advisory committee shifted focus to ways that the visual impact of the incinerator could be mitigated and the rural character and agricultural reputation of the area could be protected or even enhanced.

4.3.9 What if 'what matters' is outside a manager's mandate?

SDM processes are fundamentally about the integration of multiple objectives and multiple perspectives as part of a multi-issue, multi-stakeholder evaluation or planning process. But sometimes managers' perceptions of their mandate create problems when trying to identify a full suite of objectives.

The problem often arises in environmental agencies. For example, government environmental agencies or departments may have a mandate to 'protect' the environment, to 'conserve' species, or to 'promote' environmental sustainability. Projects or goals are thus defined in terms of these single objectives even though everyone acknowledges that, in practice, multiple objectives are affected and need to be addressed if the implementation of plans is to move forward. Yet within many environmental agencies stating this obvious truth is viewed as heresy, and the recognition that trade-offs will need to be made across conflicting objectives is viewed with fear because environmental goals may be compromised. As a result, tension is created in working with other departments, particularly those whose mandates might emphasize the single objectives of employment or tourism or cultural protection or health, and lengthy delays are created in developing broadly acceptable initiatives.

A similar situation can occur in corporate or business settings. We've had clients who accepted that particular decisions had multiple objectives and wanted to participate fully in exploring trade-offs among them, but simply could not participate in a process that set 'objectives' related to environmental performance, as that would imply a level of responsibility for managing environmental outcomes that they did not feel their organization owned. For such projects, we switched the terminology from 'objectives' to 'accounts', dropped the verb, and otherwise continued the SDM process (so the objective 'maximize fish abundance' became the account 'fish abundance').

4.4 Case studies

4.4.1 Objectives for watershed management: Tillamook Bay, Oregon

The Tillamook Bay estuary management plan provides a good example of the benefits of identifying the multiple objectives potentially affected by an environmental management plan and using means-ends diagrams to facilitate dialogue. With support from the US Environmental Protection Agency (EPA) and the National Estuary Program (NEP), we were part of a team that explored the use of structured decision methods for clean-up and protection of the Tillamook Bay watershed in northwestern Oregon[10]. The stated goal of the effort was to develop a science-based, community-supported management plan for the watershed. Although staff scientists had a legal obligation to incorporate input from an advisory committee, composed of local residents and resource users along with representative of regional, state, and federal resource management agencies, the focus had been on development of a biology-driven plan, with little attention given to social, economic, or process considerations (e.g. who was involved, when meetings were held, etc.). Conflicts between tourism, forestry, and local agricultural interests were handcuffing the effectiveness of the committee.

After initial meetings with staff and the advisory committee, it quickly became clear that the pressing need was ' . . . to find a way to meaningfully involve local residents at a detailed, action-specific level' and to ' . . . develop a mechanism by which community members could learn about and contribute to the more important dimensions of the proposed action' [10] (p. 38). The critical missing element was the articulation of a comprehensive set of fundamental and means objectives. Staff scientists had focused on biological health and water quality in Tillamook Bay, but had failed to involve community perspectives on what actions might be taken. As a result, local farmers were worried about impacts on farm management (e.g. riparian protection limits on

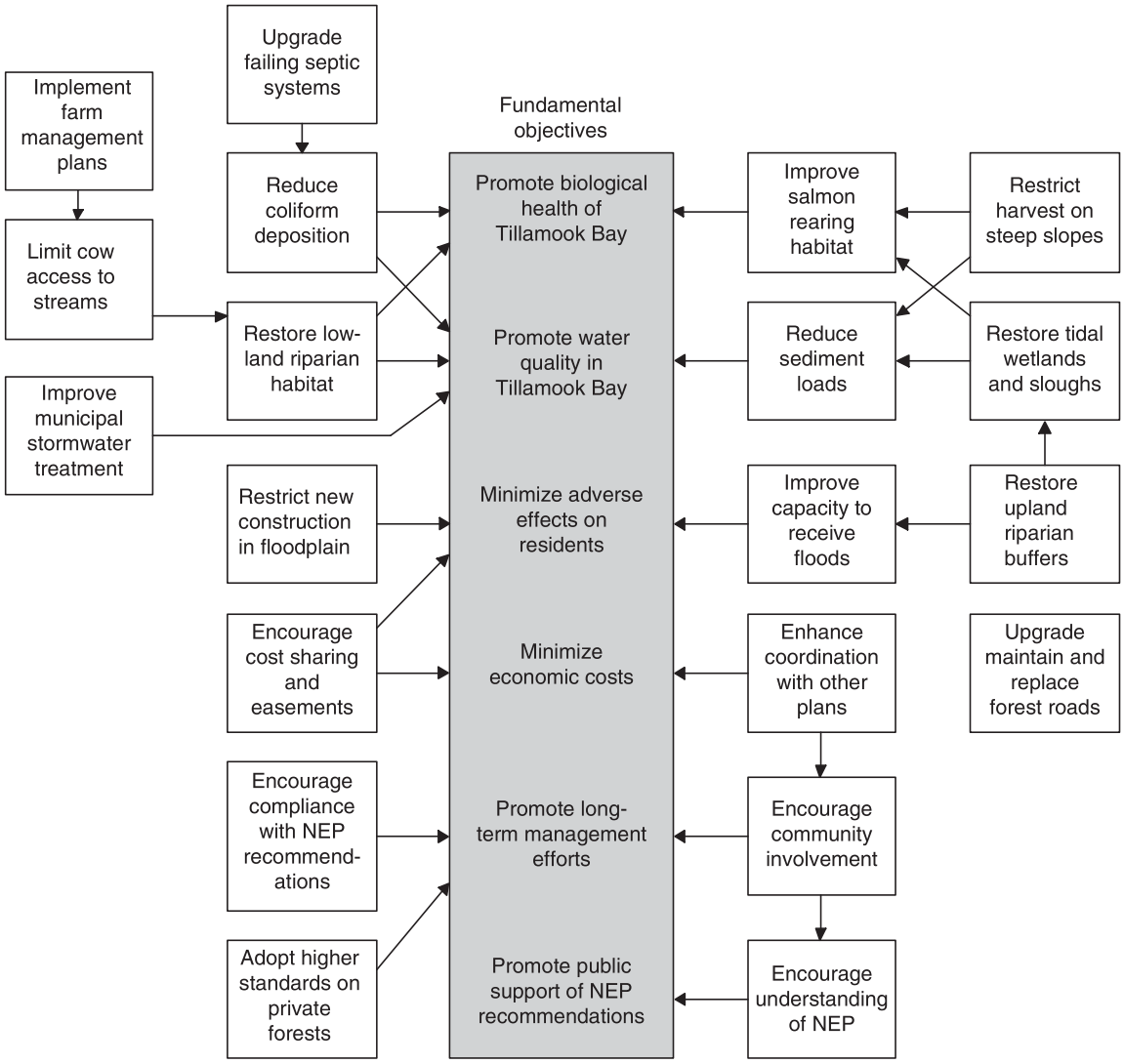

Figure 4.5 Means–ends diagram developed for the Tillamook Bay estuary plan (source: Gregory[10]). NEP, National Estuary Program.

the access of cows to fields), other residents were worried about the cost implications of changes to municipal storm-water and septic systems, and many residents were worried about trade-offs between estuary management and flood protection. In addition, the staff scientists had largely ignored a variety of non-biological objectives important to local residents and to government. After several heated meetings with the advisory committee, NEP staff, and local residents, a new and more comprehensive set of objectives was proposed (shown at the centre of Figure 4.5) that included minimizing adverse effects on local residents, minimizing regional economic costs of the

management plan and floods, and encouraging efforts to promote public support of the NEP recommendations.

Figure 4.5 is a means–ends diagram produced as part of the process. First worked out on a blackboard in the community school with participation from tourism, forestry, and local agricultural stakeholders, development of the diagram helped clarify how alternative actions (means objectives) contributed to a small set of fundamental objectives, most of which were shared among all participants.

The figure helps to illustrate the point that both means and ends are critically important to a decision, but that they need to be treated differently. 'Restore Upland Riparian Buffers' (at the right of the network) is an action but also a 'means objective' because riparian buffers (vegetated areas alongside lakes and streams) are a key means for improving the capacity of communities to 'receive floods', and thereby minimize or avoid flood damages. This, in turn, will reduce adverse effects on the quality of life of local residents – something of fundamental importance. Riparian buffers are also viewed as a critical means to restore tidal wetlands and sloughs, which will both improve salmon-bearing habitat and reduce sediment loads. These improvements influence, respectively, the biological health and water quality of the estuary – outcomes that also are fundamentally important.

The restoration of upland riparian buffers may thus turn out to be very important to the success of clean-up efforts in Tillamook Bay. But it's important because it's an alternative, or a component of an alternative that could contribute significantly. It may turn out to be a recommended alternative, but it should be compared against other alternatives for achieving the same fundamental objectives. If we use riparian buffers as a fundamental objective, then we will be evaluating alternatives on the basis of whether and to what extent they improve riparian buffers. For example, 'Restricting harvest on steep slopes' is shown as an alternate way to improve salmon-bearing habitat, but we can't evaluate it in terms of impacts on riparian buffers. So if we want to compare the relative merits of restoring riparian buffers with restricting harvest on steep slopes, then we must do it by assessing their relative effects on some more fundamental objective(s). This logic becomes self-evident with the use of a means-ends diagram, and because it's an accessible visual tool it can stimulate both understanding and helpful deliberations.

In this case, the means–ends diagram served as an essential tool for gaining agreement within a group on a small set of truly fundamental objectives, which then shifted attention in future analyses to those things about which participants cared most strongly.

With these new fundamental objectives in place and with several new common sense process-based initiatives (such as changing meeting times and locations to accommodate local residents), the program began to enjoy much higher levels of public trust, support, and participation – which in turn led to new ideas for improving management actions and for ensuring that recommendations could quickly be implemented.

4.4.2 Objectives for land-use planning: Sabah, Malaysia

In highly visible and controversial settings, the failure to define objectives carefully can lead to political turmoil and social unrest. Once derailed, can a single SDM workshop help? This was the challenging case we worked on in Sabah, Malaysia (the northern portion of the island of Borneo) where we were asked to lead a workshop with a stakeholder group about future development options for the Maliau Basin, a pristine rainforest area where large coal reserves recently had been located[11]. Previous discussions about land-use alternatives had generated anger, frustration, political conflict, and little insight. The charge given the workshop by the Secretary of State was to provide insight to decision makers about the

choice between a preservation alternative, supported by regional and international environmental interests, and a mining alternative, supported by national economic interests and industry. We began the three-day workshop by asking representatives of these different interests to describe their concerns and to address the pros and cons of these alternatives. We then met with each of five stakeholder groups for a more structured elicitation of objectives.

By the second day of the workshop the following five fundamental objectives (with no ranking) had been identified and agreed to by participants. The first three of these are common to most environmental management issues, although their interpretation is always a little different. In this situation, for example, social impacts included concerns about workers coming in from other countries. The last two objectives are unusual but considered important because of the international implications associated with selection of a recommended alternative:

1 Maximize direct and indirect economic benefits.
2 Minimize adverse social impacts.
3 Minimize adverse environmental impacts.
4 Maximize positive political impacts.
5 Maximize increases in international prestige.

A comprehensive list of means objectives also was developed, with connections shown to one or more of the fundamental objectives. For example, under economic benefits, a means objective was to 'maximize eco-tourism'. With this information in hand (presented for discussion purposes on large blackboards in front of the group), it quickly became obvious that the initial 'preserve or develop' framing of the problem was very limited. With a clearly defined set of objectives in place, it was possible to generate value-focused alternatives: different ways to develop the coal reserves were possible (at somewhat higher cost) and different ways to preserve the natural amenities were possible (limiting degradation to less significant areas). Participants were able to see that it might be possible for protection of the site to also yield economic benefits (e.g. through eco-tourism and other initiatives) and that limited development of the site might also yield environmental benefits (e.g. through contributions to a fund that would help pay for active protection of key forest resources).

This new basis for deliberation, built on the clear expression of fundamental objectives, had the added benefit of dramatically shifting the emotional context for the discussions. By dropping the 'preserve vs develop' framing of the problem, which divided the group into two angry and conflicting parties, suddenly there was an active exchange with both sides contributing to the development of new alternatives and providing information helpful to the broader range of objectives (e.g. mining engineers agreeing to release information of interest to environmental agencies). For decision makers, one of the most helpful aspects of this brief workshop was therefore the establishment of a greatly improved basis for future communication, dialogue and negotiation among the different stakeholders.

4.4.3 Objectives for cultural and spiritual quality: the voice of the river

As part of the development of an adaptive management plan for the Bridge River hydroelectric system, resource managers identified objectives related to fish, wildlife, and riparian vegetation as part of the experimental flow treatments. In addition, elders and community members from the St'at'imc First Nation noted their concerns about the impact of water flows on the 'spirit' or 'voice' of the river, which was captured in a cultural and spiritual quality objective.

To obtain information to better define this objective, we collected input from both individual and group interviews with St'at'imc community residents and were able to define four key components of cultural and spiritual quality:

Table 4.4 Objectives used to evaluate experimental flow regimes on the Lower Bridge River.

Objective	Measure	Units of measure
Salmon	Total biomass	kg
	Chinook biomass (Reach 3)	kg
Species at risk	Harlequinn duck abundance	Presence/ absence
Riparian health	Adult cottonwood growth	mm/year
	Juvenile cottonwood growth	mm/year
	Recruitment	Yes/no
River health	Benthic community abundance	Millions of individuals
	Benthic community diversity	% EPT
Spiritual quality	Scale: voice of the river	1–5
Finances	Value of electricity	$million/year

1 Sound, including: the voice of the water and birdsong.
2 Smell, including the smell of the water itself and the ambient smell at water's edge.
3 Movement, including the movement of water (seasonally appropriate) and the diversity of movement (pools/riffles).
4 Interaction (of people and water), including shore access and ability to wade in or across the river at desired locations.

These four components clearly do not provide a universal definition of cultural or spiritual quality. They define the aspects of cultural and spiritual quality thought to be relevant for the evaluation by St'at'imc of a suite of alternative flow regimes and habitat enhancement activities on the Lower Bridge River, within the flow ranges considered. This objective became part of the objectives hierarchy that was used to evaluate experimental flow treatments (Table 4.4).

Working with St'at'imc community residents, we developed a scale for reporting differences in spiritual quality across different flow regimes, and an assessment protocol was co-developed by the Stl'atl'imc community and the utility and regulatory management staff to minimize biases and inconsistencies in field assessment over time. Key elements of the protocol include:

1 Assessment to be done by a committee of three to eight experts designated by the St'at'imc community with oversight by a multi-party monitoring team.
2 Observations recorded four times per year, under a range of test flows.
3 Observations recorded at two designated sites per reach, over three reaches.
4 Documentation of a visual record at each observation site, using video camera and still photography.
5 Use of a simple, replicable, and transparent scoring system for assigning scores to each component in each reach.
6 Use of a transparent and defensible methodology for weighting and aggregating scores across observers, components, reaches, and seasons.

This 10-year plan is in the early years of implementation and it remains to be seen how consistent and useful it will prove to be as an aid to future resource decision making. But stop for a moment to reflect on the importance to the St'at'imc elders of what was done here. We've said, 'tell us what's important to you' and have incorporated the answer on an equivalent level to more conventional objectives such as cost and environmental considerations. If we'd hesitated because it might be tricky to measure these things, then we might have missed the objective altogether (and potentially disenfranchised the St'at'imc community).

4.5 Key messages

There is a discipline to defining objectives. If you're designing a decision process, here are some key things to look for:

1 The set of objectives should be complete, concise, sensitive, meaningful and independent.
2 Objectives should state the thing that matters, whether we know how to measure it or not.

Text box 4.2: A personal perspective on using SDM approaches in consultations with aboriginal communities

SDM practitioners have worked on a variety of environmental management issues that involve aboriginal or indigenous populations; examples include work with Native Americans in the United States, First Nations and Inuit and Metis communities in Canada, tribal groups in Asia, rural communities in Africa, and Maori in New Zealand [1,9, 12, 14, 15]. In Canada, several of these efforts have involved authors of this book in collaboration with Cheryl Brooks (Indigenuity Consulting Group), a member of the Sts'Ailes First Nation, who frequently draws on SDM concepts and methods in her work. Cheryl's observations follow:

> 'As a resource person working with numerous aboriginal groups to facilitate processes of decision making, identifying priorities and developing strategies I have repeatedly heard peoples' expressions of frustration about outcomes not reflecting their inputs. Through coincidence I was introduced to the decision sciences and in particular a form of decision analysis called Structured Decision Making. Though at first view, with a lot of tables, charts and data, it looked fairly complicated to me, I soon learned otherwise, gaining understanding that this is an excellent and systematic way of organizing and presenting volumes of complex information in a way that people can see all inputs including their own, whether quantitative or qualitative. Most importantly the various organized ways of presenting information tend to stimulate thorough discussions and substantive learning in diverse groups. Then I learned how to tangibly include values in the data and the decision making and have concluded that it is probably the best tool I have personally ever used in complicated discussions with the aboriginal groups, with whom most of my work is done.
>
> So, what am I really talking about here? Start with the proposition that the goal of consultations by government is to identify and implement policies, programs or actions that satisfy lawful, statutory and regulatory obligations, and to do so in an efficient manner. First Nations have been clear that they expect, indeed will only participate in, meaningful processes in which their interests and concerns are identified and clearly expressed, and given at least equal weight as other factors including environmental, economic, social, health, and safety goals. One observation is that most First Nations participants tend to take a much longer term view than many current government decisions reflect and decision analysis works well to build long-term options.
>
> In my opinion, a decision-aiding SDM model is the best choice for many complex decision-making processes with aboriginal groups, for several reasons.

1. It builds on the values and objectives of the different technical and community-based parties, so that their key concerns can be identified clearly and, as a result, a plan or strategy can explicitly be responsive to those things that matter most to people.
2. The emphasis on 'values-based' thinking as part of deliberative processes seeks to increase dialogue and trust among participants while developing a more informed basis for making decisions. This frequently requires overcoming prior misinformation or misunderstandings.
3. It recognizes that being clear about what matters can be difficult, particularly if the decision context is complex or emotionally charged. As a result, particular care is taken to help the participants define key objectives and key information needs, including values such as ceremonial and spiritual values, or intergenerational knowledge transfer, that often are left out of consultations with First Nations.
4. It takes enough time to fully explore issues and solutions so that participants do not feel pressured into choosing options before they are at the point where they are confident they are well informed and able to provide meaningful comment.

5 It can be used as a complete process with some sophisticated models and analysis presented as part of the data, or you can use segments of it in processes – for example identifying what is important and performance measures alone can facilitate excellent discussion. Also, if you are working through the entire process it is relatively easy to loop back and incorporate new or additional information at any time.

Overall, an SDM approach offers three significant advantages in terms of addressing some of the most important challenges facing Aboriginal peoples in working with governments to create sound policies. The first is an ability to help participants think through and express their values and construct a clear perspective on what matters most in the context of the decision at hand – which is crucial given that some of the decisions Aboriginal leaders make today can literally affect survival of their Nations. The second advantage is an ability to help participants understand the factual information relevant to their choices, including the diversity of information sources (e.g. scientific, community, First Nation) that merit close consideration and to better understand the uncertainty associated with estimates of anticipated consequences. Thirdly, this process provides well-organized information to explain why certain decisions were reached and how they dealt with the interests of the people – a valuable resource for getting collective consent and support'.

Besides being important for finding good solutions, this helps to level the playing field and keeps diverse stakeholders engaged in the process.

3 It's important to be diligent in distinguishing between means and ends.

4 Each objective needs a clear, universally agreed directionality, which both clarifies thinking and enables the use of some useful trade-off analysis methods later on.

5 Objectives are not targets: avoid setting targets, and the muddling of facts and values that goes with it, at the objective-setting stage.

6 Objective-setting is intended to build an understanding about shared values among diverse participants and is an important way to build common ground early in the process. Weights should *not* be assigned at early stages of the deliberative process, when the focus is on identifying and clarifying concerns (rather than making trade-offs, which comes later on).

The discussion also emphasizes that, without decision-aiding assistance, decision makers tend to be strikingly deficient at generating a comprehensive set of objectives. How can an SDM process help? To create a good set of objectives, we recommend working with stakeholders and decision makers to:

1 Ask what matters in this decision? In choosing among alternatives, what things are important? What will other stakeholders think is important?

2 Separate means and ends by asking 'why?' Why is that important?

3 Eliminate ambiguity by asking 'what do you mean by that'? Are there sub-components of that?'

4 Organize long lists of objectives into a concise hierarchy.

5 Test objectives to make sure they're useful. Put them in a consequence table with some alternatives – do they help you compare the alternatives?

Objectives lay the foundation for all that follows. They are used to both identify and evaluate alternatives. So take whatever time is needed to get a useful set.

4.6 Suggested reading

Chapter 3 of Clemen, R.T. (2004) (*Making Hard Decisions: An Introduction to Decision Analysis*, 4th edn. Duxbury, Belmont) clearly describes objectives and contains some great problems to get the reader

thinking more about issues associated with their identification.

Fisher, R., Ury, W. & Patton, B. (1991) (*Getting to Yes*, 2nd edn. Penguin Books, Harmondsworth) neatly distinguishes between interests (i.e. objectives) and positions, with great examples of how to articulate objectives clearly when working with groups.

Keeney, R.L. (1992) *Value-Focused Thinking: A Path to Creative Decisionmaking*. Harvard University, Cambridge. The discussions and case-study applications covered in this book, appropriately titled *Value-Focused Thinking*, provide many of the principles and techniques that underlie SDM methods with respect to identifying objectives.

Keeney, R.L. (1988) Structuring objectives for problems of public interest. *Operations Research*, **36**, 396–405. A short introduction to methods for structuring objectives of public policy problems.

Turner, N.J., Gregory, R., Brooks, C., Failing, L. & Satterfield, T. (2008) From invisibility to transparency: identifying the implications. *Ecology and Society*, **13,** Article 7. Retrieved from http://www.ecologyandsociety.org/vol13/iss2/art7/ This article emphasizes the need for a broader and more inclusive approach to defining objectives in the context of land-use decisions, including cultural and environmental values that are often not recognized by resource managers or government decision makers.

4.7 References and notes

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