Practitioner's Guide

Applying Impact Management

(Third Edition)

Goal

Fundamental Objectives

Desired Future Conditions

Enabling Objectives

Mitigating Actions

Gap Analysis

Primary Management Actions

Collateral Impacts

Actual Conditions

Managers' Concerns

Stakeholders' Concerns
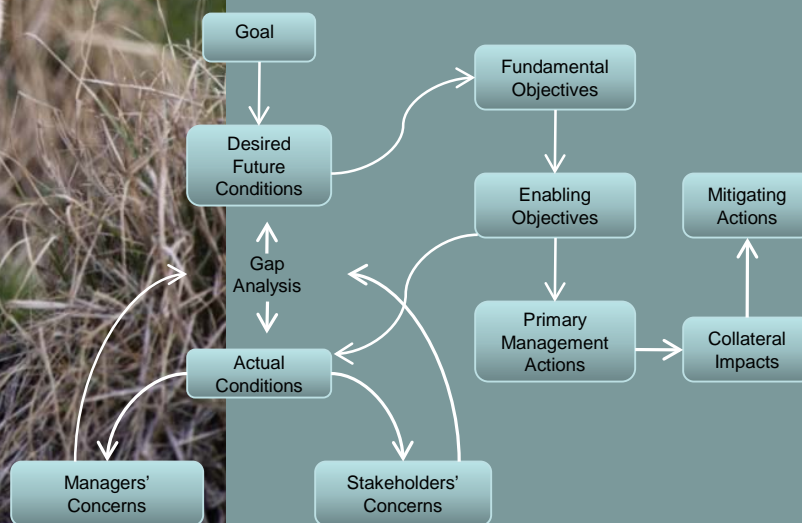
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PREFACE

We wrote a little book titled "Thinking Like a Manager" to share some basic ideas that we believed would help professionals engaged in managing wildlife amid changing expectations for governance of wildlife resources. Written as a novella and published by the Wildlife Management Institute in 2006, the piece presented several ideas we had published in the formal literature. We received mixed reactions to that effort, but one message, reinforced in subsequent contacts with wildlife managers engaged in a variety of trainings we have offered, was that managers interested in the ideas we presented desired a more comprehensive, practical guide. They were especially interested in the approach we call impact management or adaptive impact management. We developed elements of such a guide for several workshops we have offered. These have been reviewed and revised several times based on feedback from workshop participants and others.

Based on these experiences, we prepared this "practitioner's guide" for impact management/adaptive impact management. You'll see that we focus mostly on impact management, which we regard as useful and achievable for anyone—it's the practical approach that most managers should be able to engage in with the time, talent and treasure they typically have available.

The ideas and process described in this guide are still evolving as managers put

them to practice. They were derived originally from practical experience and will continue to evolve with experience. We do not offer a sure-fire recipe for success, but based on feedback from the field, the ideas have proved useful for managers in many contexts. We believe impact management is vital to adapting to the changing societal, scientific, and environmental changes facing wildlife managers. We believe this guide will help managers who are striving to improve the quality and use of stakeholder input and the integration of biological and human dimensions of management into decisions about public wildlife resources. If we had to reduce the message of this book to one thought it would be:

> Given the growing emphasis on stakeholder participation in governance of wildlife resources, focusing on impacts will enhance your effectiveness in wildlife conservation and better serve society by increasing the probability that decisions about fundamental objectives of management and means of achieving them are acceptable, supported and therefore enduring until such time as changes in context indicate the need to recalibrate (i.e. adapt).

Thus, our hope is that this practitioner's guide contributes to building capacity for more effective and durable wildlife management.

DJD, SJR, JFO, WFS, LHC

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PART I

CONCEPTUAL FOUNDATIONS FOR IMPACT MANAGEMENT

1 Introduction to Conceptual Foundations for Impact Management

Adaptation and change are key processes in the evolution of societies and their institutions. During its evolution, the institution of wildlife management has adapted to challenges presented by societal, scientific, and environmental changes. The wildlife profession began by serving a limited suite of interests, principally those associated with consumptive uses, but the array of active interests in wildlife during the last three decades has diversified. During this period, expectations for involvement in governance of wildlife resources (e.g., participation in various levels of decision making and action implementation) have grown dramatically among stakeholders. Although these changes discomfort some wildlife managers, many welcome stakeholders' desire to be more involved and also embrace more diverse interests in wildlife. The situation creates a need for approaches to decision making that integrate biological and human dimensions of management. We propose impact management as such an approach (Riley et al. 2003).

In Part I (Chapters 2-5) we lay out key concepts and describe impact management/adaptive impact management. We emphasize the need for learning and adapting from management experience. Steps in impact management are presented. We conclude this set of introductory chapters with an evaluation of a multi-year application of impact management. The approach and lessons learned are instructive for anyone using this approach.

In an earlier book, *Thinking Like a Manager* (Organ et al. 2006), we present a set of concepts to improve performance as a wildlife manager whether you are working on imperiled or abundant, game or non-game species, and whether you are working with wildlife issues on the rural/urban interface, farmed or forested rural landscapes, or wilderness settings. These concepts, reviewed here in Chapter 2, include a focus on: stakeholder-defined impacts as fundamental objectives of management; consideration of scale, capacity and limits; and explicit structured-decision processes for making decisions. In *Thinking Like a Manager* we also suggested that application of these ideas can be thought of as either an impact management or an adaptive impact management approach (IM or AIM, respectively).

Although we outline "steps" for impact management in Chapter 3, this guide is meant to be a road map rather than a cookbook. We describe how to apply essential concepts for management (we call them "essence concepts" derived from a paper titled *The Essence of Wildlife Management* [Riley et al. 2002]), along a gradient from impact management to adaptive impact management (with the chief difference being the extent of learning and subsequent adapting that occurs [Chapter 4]). The information conveyed in this guide stems from our direct experiences in wildlife management (e.g., Chapter 5) and through teaching workshops about applying the essence concepts with professionals from a variety of states and provinces. If you are not a manager *per se* – that is, if you are not directly involved in decision making – this guide should still help you contribute to management decisions within your organization.

Part II of the guide (Chapters 6-11) instructs you in creating a manager's model,

a device we developed with input from and pilot use by over two dozen wildlife managers to help them think through the process of impact management prior to formal planning and implementation. A manager's model is simply your articulation of the management system in which you work with respect to a particular wildlife issue. We suggest that developing a manager's model is often best approached initially as an internal exercise, a way to help a management team think about a management issue. Part II describes a way to articulate such a model and express it as an annotated concept map. The intended outcome of a manager's model is not prediction of outcomes from any particular management intervention, but is greater understanding – shared understanding when done by management teams – of the management system in which managers function. Creating a manager's model encourages managers to become systems thinkers while focusing on impacts.

A set of three examples of impact management are presented in Part III. These hypothetical applications are based on real-life situations, modified to demonstrate the challenges and opportunities of an impact management approach. The instructive case scenarios in Part III are aligned along a continuum reflecting different degrees of evaluation involved. There is no single best way to implement impact management. An active adaptive approach is not warranted or even appropriate in every case. Indeed, our opinion is that an experimental approach should only be used when the funding and expertise, as well as political support, are readily available and assured for the duration needed to see an experimental approach through to fruition.

A glossary of terms and suggested readings that provide background for concepts presented can be found at the end of the guide.

2 Key Concepts for IM Application

"One of the anomalies of modern ecology is the creation of two groups, each of which seems barely aware of the existence of the other. The one studies the human community, almost as if it were a separate entity, and calls its findings sociology, economics and history. The other studies the plant and animal community and comfortably relegates the hodge-podge of politics to the liberal arts. The inevitable fusion of these two lines of thought will, perhaps, constitute the outstanding advance of this century."
Leopold 1935 (in Meine 1988:359-360)

2.1 Introduction

This practitioner's guide is designed to be a resource for wildlife professionals interested in learning how to integrate human and biological dimensions of wildlife management by applying impact management (IM) and adaptive impact management (AIM) principles to decision making and strategic planning. In previous writings, we defined key concepts underlying the core work of a wildlife manager (Riley et al. 2002, Riley et al. 2003, Organ et al. 2006). We review those concepts in this chapter and provide brief illustrations of their application within an IM/AIM approach. Part III contains more extensively developed IM/AIM application scenarios. Those management scenarios further illustrate means by which teams of wildlife professionals can address key concepts in practice.

2.2 Key Concepts

We have been working with wildlife managers for decades, striving to integrate biological and sociological knowledge bases to inform management decisions and actions. We have witnessed the many challenges and opportunities that wildlife managers face in their jobs. Working alongside managers compelled us to think long and hard about the core work of wildlife management – what it is, why it is done, and how it can be done better.

Insights we gained are reducible to five key concepts. We believe that managers who take these concepts into account through a practice of impact management can make significant strides toward the ideal of integration that Aldo Leopold spoke of three-quarters of a century ago, an aspiration indicated by the quote above.

2.2.1 Values[1]

Simply put, human values are the reason for wildlife management. This is such a fundamental truth that it often goes without saying, but it's actually important for practicing wildlife managers to keep this point in mind all the time. Being explicit on this point is a counter balance to the often heard statement, "I work for the resource."

Human values (from which beliefs and attitudes arise) are the basis for how people define effects of human-wildlife interactions and ascribe relative importance to them. Thus, values determine which effects become impacts for management attention. Values also fundamentally influence human behavior. Wildlife managers who have an accurate understanding of stakeholders' values with respect to a wildlife issue are better able to formulate appropriate objectives and anticipate how people will respond to proposed management interventions. Widely held values that manifest

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[1] Here we use the term values to include what social psychologists would call values, basic beliefs, value orientations, attitudes and norms.

as social norms are predictors of people's attitudes and behavior. Discovering stakeholders' values with respect to a given situation is central to the design of management that addresses stakeholder needs and interests, consistent with the public trust responsibilities of a wildlife agency.

Acknowledging the centrality of human values in wildlife management is not new. Human dimensions specialists were writing about this decades ago (Decker and Goff 1987). Today, it would be difficult to find a wildlife manager who believes that wildlife management is a value-free enterprise. Nevertheless, improving the way that managers consider values looms as a major challenge.

Wind farm development offers an example of the values dilemma. Like any public issue, debates about wind farms are replete with psychological, social, economic, political, and cultural influences that are broadly referred to as the human values or social values environment (Keeney 1992). Any wildlife manager embroiled in a controversy over wind farms will recognize that values conflicts are operating. But how does she consider such conflicts in management decisions? Does she give greatest weight to keeping healthy populations of migratory birds and butterflies? To keeping bat populations at levels that can control crop loss to insects? What about the value of viewsheds near the proposed wind farm? Or is the main consideration the price of electricity? Perhaps it is national security—our national imperative for reducing dependency on foreign oil.

Wildlife professionals are trained to bring technical and scientific expertise to bear on wildlife management issues. Research helps managers understand problem systems, but that is only part of the puzzle. Wildlife management is largely the process of making or informing decisions (discussed later in this chapter) about appropriate objectives and acceptable actions, and then implementing and evaluating their actions. Decisions are based upon values and informed by biological, ecological and social data. Science from many disciplines is necessary but not sufficient

to make wildlife management decisions. Managers of necessity must embrace values which can be identified with social science, and learn to deal with the thorny challenge of weighting values as part of a thorough situation analysis.

The field of human dimensions research emerged in part to help managers understand the human values wrapped up in wildlife management (Manfredo et al. 1995). Fortunately, gains in values measurement and in experience incorporating values in decision making are taking place and we can say with confidence that systematically obtained human values insight can be effectively incorporated into wildlife management. Progress to date notwithstanding, the purposes and approaches for integrating human values in wildlife management are applied inconsistently. Some agencies seek to achieve greatest gain in delivering benefits from wildlife, while ensuring sustainability of the resource. Others seek citizen "buy in" to agency proposals rather than optimization of benefits for diverse stakeholders. This guide focuses on the former, more progressive purpose behind integration of human values. We pursue this by promoting an impacts management approach.

2.2.2 Impacts

Although values are *the reason for* management, impacts are the focus of management decisions and actions. Impacts are a subset of the various effects arising from events or interactions involving: (a) wildlife, (b) stakeholders, or (c) wildlife management interventions. Impacts are significant beneficial and detrimental effects, defined and weighted by human values. Impacts are the actionable manifestations of values. Managing levels of impacts identified by stakeholders and wildlife professionals becomes the primary focus of management within IM/AIM.

Implementation of primary actions can result in unintended effects on people and wildlife. Those secondary or "collateral" and "subsequent" effects (described later) can be positive or negative. For example, an agency may institute a broad wildlife feeding ban to address a primary impact

(spread of chronic wasting disease in a deer herd). That management action may have the unintended secondary impact of reducing wildlife viewing opportunities of nonhunters who use grain to attract squirrels, turkeys, and other birds to sites where they can be observed. For some of these stakeholders, the negative secondary impacts may outweigh the benefits associated with managing a primary impact. But for others, the containment of chronic wasting disease is paramount. Thus, even before a values-weighting process can begin, managers must first identify impacts perceived by key stakeholders.

Early experiences with impact management demonstrate the practicality of impact identification as part of a managers situation analysis. Black bear managers in New York used multiple stakeholder engagement techniques to identify impacts and found that that effects and impacts could be aggregated into just a handful of broad categories: ecological, economic, sociocultural, health and safety, psychological (discussed in Chapter 5).

2.2.3 Limits and Capacity
A comprehensive view of limits and capacity is needed in any management scenario, as well as recognition that capacity possibilities include thoughtful reflection on opportunities as well as limitations. For many managers, staff size and funding immediately come to mind as limits, but that is a narrow view of capacity. Application of capacity concepts to both the biological and the human dimensions of an issue can promote integration of these dimensions within the wildlife profession.

Capacity is most often viewed in the classical ecological sense of biological carrying capacity (BCC), the natural limit of a wildlife population. Yet, BCC is only one of several capacity concepts a wildlife manager could consider. A more robust consideration of capacity can help managers integrate biological limits with social, economic, institutional, administrative, cultural and legal limits. Considering social capacity concepts explicitly recognizes that bounds exist on the impacts stakeholders will accept—it acknowledges that they

will tolerate negative impacts associated with wildlife only to a point, and they will accept loss of positive impacts only to a degree. Concepts such as wildlife acceptance capacity (Decker and Purdy 1988), cultural carrying capacity (Ellingwood and Spignosi 1986), social carrying capacity (Minnis and Peyton 1995), and wildlife stakeholder acceptance capacity (Carpenter et al. 2000) were developed to consider human tolerance for impact levels.

Consider both upper and lower limits. Although we often think of limits mainly with respect to the upper reaches of a trait, such as carrying capacity of a population or tolerable amount of agricultural damage, lower limits should be of equal concern. For example, what is the lower acceptable limit of benefits from wildlife viewing, ecosystem services provided by wildlife, hunting opportunities, etc.? Identifying upper and lower limits for impacts when they vary among different stakeholders often requires inquiry. Furthermore, stakeholders' capacity for a given impact at both the individual stakeholder and group levels can change over time, so monitoring acceptance capacity is often advisable.

2.2.4 Scale
Wildlife management issues often cross the jurisdictional boundaries of any single agency. This requires wildlife managers to consider multiple levels of scale to achieve management objectives. Commonly, managers find they need to coordinate their management actions with others working at different scales.

Wildlife managers applying an IM/AIM approach consider at least three kinds of scale: spatial, temporal and operational. Perhaps the most straightforward is spatial scale—the scope or geographical extent of a particular impact. For example, the spatial focus of one impact may be local or regional, while the spatial scale of another impact is national or international. The likelihood of designing a management program responsive to diverse stakeholders' values is often greatest at the local community scale. Some wildlife concerns of stakeholders (e.g., safety concerns associated with presence of large carnivores) often become

community issues, and communities in which they arise may need or want to share ownership of any processes to influence impacts. Obviously, there isn't the need, nor the resources, to bring all wildlife management down to the community level with equal attention to all communities affected. Indeed, many wildlife management issues are best addressed at larger scales.

Managers applying an IM/AIM approach also consider temporal scale, the amount of time involved in a process (e.g., a management intervention) that influences an effect or impact. Both actions and system responses have temporal dimensions. Some actions (e.g., regulated hunting) can achieve relatively rapid system response. Other actions (e.g., habitat restoration) can take a long time to implement and to achieve measureable system response. Articulating temporal dimensions of an issue and its management is valuable for internal decision making and for communication with program stakeholders.

Operational scale—the scale at which managers have control or influence – is the combined jurisdictional, spatial and temporal extent of a particular impact that management can affect. Pragmatically, operational scale matters most in management design, as it incorporates jurisdictional, political and economic realities. Operational scale can be small and simple (e.g., responsibility for managing conflicts between Canada geese and users of a specific municipal park) or large and complex (e.g., managing a suite of conflicting impacts across a national refuge system or national park system).

A frequent hazard in decision-making is defining operational scale using only biological criteria; another decision trap is to define the operational scale of management efforts before impacts are identified. That's putting the cart before the horse. First, define impacts, then define relevant temporal and spatial scales. With that information in hand, managers can pursue meshing biological and social scale considerations.

2.2.5 Decision Making
Designing or implementing effective decision-making processes is the core work of

a wildlife manager. By effective, we mean processes that (a) define the ends or fundamental objectives of management in terms of stakeholder-defined impacts and (b) develop socially acceptable interventions that result in desired changes in those impacts. We also believe that effective decision processes carefully articulate and clarify the differences between ends and means, where means include enabling objectives, primary management actions and mitigating actions (if needed).

Decision making in wildlife management typically is directed at one of two levels of management decisions. The first focuses on identifying *fundamental objectives* (outcomes based on impacts); the second, on developing *enabling objectives* (directed at specific aspects of the management system) and the strategies and actions to achieve them. "Good" decision making results in durable objectives and sustainable actions, but not objectives and actions that are never to be revisited when context changes -- thus good decision-making processes expect and allow for modification that allows management to be adaptable.

No single specific process of decision making works in every situation—decision making needs to be "context appropriate." Thus, quality decision making is much more than selecting a particular set of steps or processes that help a decision maker choose a course of action from among a few alternative actions. Furthermore, perfect decisions do not exist in real-world wildlife management, so one has to learn to accept decisions that are initially "good enough," but that may be improved with experience by following an analytic, evaluative, and adaptive approach. It may be useful to mention here that it is important to distinguish between the decision - informing role of staff versus the decision - making role of policy makers (i.e., commissions, legislators, etc.).

Decisions by policy makers should incorporate stakeholders' perceptions, scientifically-derived knowledge (biological and social), and experience-based insight of the wildlife manager. The diversity of human values, beliefs and attitudes is often messy

and confounds decision making, but addressing values is a central aspect of decision making. Values need to be considered in all phases of management. Stakeholders should be involved to identify and weigh impacts, and to help select acceptable actions to achieve impacts within legal, fiscal, technical and other limits. Thereafter, stakeholders also bear some responsibility for decisions about both fundamental and enabling objectives and for the "tradeoff analyses" (e.g., regarding acceptability of action alternatives, and weighing of collateral effects associated with different actions) that inevitably are made. This is a key ingredient for durable, sustainable decision making.

Complex wildlife management issues involve conflicting values. They wouldn't be public issues if they were simple problems. Although applying the integrative concepts described in this chapter does not make your toughest decisions easy, it gives you tools to make better decisions. Considering these integrative concepts becomes a valuable part of structured decision making, and improves your decision-making process in ways that contribute to achievement of fundamental objectives articulated in terms of stakeholder-identified impacts desired from the wildlife resource.

To recap -- effective, lasting conservation efforts are most apt to result when definition of problems, identification of opportunities, development of solutions, and implementation of management are shared processes among resource agencies and citizens at scales where effects are perceptible and impacts identifiable to stakeholders (Mangel et al., 1996). The scale of management (both ends and means) needs to be consistent with the scale of impacts being addressed. Following a decision pathway such as we outline cannot guarantee that the outcome will always be ideal. Yet, the only way a manager has to increase the odds of achieving desirable outcomes more often than not is to follow such a process.

3 Steps in Impact Management

3.1 Introduction

In *Thinking Like a Manager*, we defined the core work of a wildlife manager:

> "*…in our view, the wildlife manager has three essential tasks to achieve management goals. The first … is to integrate biological and social science knowledge. The second is to involve the public, as necessary and appropriate, in management decision making. The third is to design effective decision processes that identify and differentiate between fundamental objectives (ends based on impacts) and enabling objectives (means or strategies to achieve ends). "* (Organ et al. 2006:89)

Borrowing from general management science in the early 1980s, Crowe (1983) introduced the basic elements of a wildlife management process as setting goals and objectives, selecting actions to achieve objectives, implementing actions, and evaluating actions. That model was expanded and refined through the years to conceptualize wildlife management as a comprehensive decision-making process founded on an integrated ecological and human dimensions information base. We proposed "adaptive impact management" (AIM) (Riley et al. 2003) as an innovation for such integration in adaptive management, which Walters and Holling (1990) introduced earlier as a method to improve learning while conducting management.

Although we strongly promote a philosophy of "learning while doing," we recognize that it is not always necessary, feasible, or even appropriate to take an active-adaptive management approach requiring experimental management. A focus on impacts, regardless of whether management is active or passive adaptive, focuses managers on what is important to their stakeholders and thereby enhances their efforts as public trustees of wildlife resources. Thus, we discuss both AIM and impact management (IM). Although IM lacks the rigorous experimental aspects of AIM, IM nevertheless should be implemented with a commitment to evaluating effectiveness of management actions for meeting enabling objectives. The key feature, whether you are conducting AIM or IM, is defining objectives in terms of stakeholder-identified impacts. To reiterate, the distinguishing characteristic of AIM versus IM is an emphasis on learning with an active adaptive approach in AIM. In both AIM and IM monitoring and evaluation are critical components of learning and making progress in wildlife management.

Several interrelated components of AIM distinguish it as an innovation in the process of decision-making. Most notably, AIM builds on the traditional management cycle by adding: (1) a focus on stakeholder-defined impacts as the basis for setting fundamental objectives; and (2) use of systems thinking or systems models to inform decision making. Components of an AIM process, taken stepwise from the point of initializing the process, include situation analysis, objective setting, model development, identification and selection of alternatives, management interventions, monitoring, and adjustment of models and management based on them (as appropriate).

3.2 Situation Analysis

In addition to complex ecological conditions, wildlife management occurs amid diverse psychological, sociological, economic, political, and cultural influences. Sorting these out takes analytic effort that

falls under the general category of situation analysis, the process of collecting and analyzing information to frame and understand a problem or opportunity that calls for management. The principal need in this initial step is describing the management context or "environment" and identifying potentially relevant impacts (i.e., the expression of values vis-à-vis wildlife that should be addressed as fundamental objectives). Situation analyses use existing information, and often new inquiry, to improve understanding of relevant impacts. Such knowledge is used to construct a first-generation "map" of the management system—the set of ecological, social, and institutional subsystems that are interconnected and determine the purpose, limits, and opportunities for management. We refer to the initial map of these coupled systems as a manager's model and describe in detail how to construct this helpful decision aid in Part II of this guide.

Decision framing is a process of central importance in IM/AIM. Frames are mental structures people create to organize and simplify the world, serving as perceptual "windows" through which people view opportunities or interpret problems, and establish direction for management efforts. Just as the way a house is framed dictates where the windows will be and how the occupants view the world, how a decision is framed dictates how decisions are described (in terms of fundamental and enabling objectives) and what types of alternatives are viewed as practical for achieving the objectives. Decisions in wildlife management, or any other context, are best framed with respect to values of those people who are affected by the decisions. In wildlife management, we focus on the values of stakeholders, those people affected by or who affect wildlife or its management.

Both managers and stakeholders are prone to common decision traps, such as the tendency to focus on means for achieving some end (e.g., how do we reduce the size of a cormorant population?), without first fully considering the desired ends in terms of impacts (e.g., what outcomes are

we trying to achieve with respect to cormorant management?). Perspectives about the management environment resulting from deliberative stakeholder processes may influence formulation of impact-focused fundamental objectives, the enabling objectives and management interventions chosen to achieve desired impacts, and the social acceptability of the interventions.

The types of questions to be addressed in a situation analysis are: (1) what is the range of impacts occurring now and desired in the future; (2) who are the key stakeholders; (3) what are the operational scales (geographical and temporal extent; jurisdictions involved) of the anticipated impacts; (4) what are the capacity and limits of the resource, stakeholders, and the management entity? These four interrelated questions are best addressed simultaneously.

Precisely defining impacts to be managed may not be possible at early points in the process. Nevertheless, it is possible to anticipate the range and relative importance of many potential impacts. Articulation of impacts is a prerequisite for developing objectives.

Impact management can help people avoid some common decision-making traps because it encourages managers and stakeholders to view issues through the same conceptual "window," which they select collectively. Wildlife agency staff who are familiar with a management issue often have considerable knowledge for situation analyses. Eventually when moving into formal planning, it is necessary and valuable to involve key stakeholders in this analysis, which normally complements agency perspectives while contributing to an open process.

3.2.1 Stakeholder Involvement in Situation Analysis

The process of developing a manager's model helps managers identify and articulate critical components of an impact-management process. When considerable uncertainty exists about desired impacts, some level of stakeholder engagement may be desirable during a situation analysis

even before formal planning begins. Stakeholder involvement is most effective when it matches the geographical, temporal, and social/institutional scale of the issue. Local citizens and local governments generally are most able to address and offer useful insight about issues affecting their communities. Similarly, regional nongovernmental organizations and state or provincial public agencies should be engaged in issues that involve many communities.

Determination of relevant scales for wildlife management issues and relevant stakeholders to engage requires good judgment. Such judgment is as important as science in wildlife management and comes from experience and thoughtful reasoning (i.e., thinking like a manager). Scale of subsequent management interventions should be aligned with the scale of impacts managers seek to influence. This seems very logical, but we have discovered that scale of intervention often is not consistent with scale of impact or factors influencing impacts. (For example, the scale of socio-economic factors affecting hunter recruitment and retention in many states is far beyond anything a state wildlife agency can influence alone, yet we often see very "small" responses with unrealistic expectations of effect.) Relevant scales for each impact tend to be identified through interactions between stakeholders and managers rather than being determined by managers alone. That is not to suggest a management team should not give thought to scale prior to discussions with stakeholders, just a caution to avoid becoming close-minded about the scale of an issue and the scale of management response needed.

The level of stakeholders' involvement also must be appropriate to their capacity for involvement and that of the management agency to coordinate or facilitate productive stakeholder interaction (among stakeholders and between them and the agency). When pre-existing conflict associated with an issue reduces capacity of stakeholders to work toward a common goal, some level of conflict resolution is needed early in the process.

In some instances, it is useful to convene a formal committee of stakeholders to obtain stakeholder input. Membership of such a committee should be tailored to the specific issue. Selection of stakeholders to serve on such committees depends on anticipated impacts involved. In almost every case, it is valuable to include some level of education effort as part of stakeholder engagement. Informed stakeholders can contribute more than uninformed stakeholders.

3.3 Objective Setting: Identifying Targets for Management Success

Goals are statements about the purpose of management, couched as general, long-term conditions to be attained. In the context of impact management, goals are expressed as *desired future conditions*. Future conditions are reached by accomplishing more specific objectives, or desired outcomes (impacts!). Objectives normally are characterized by describing a situation, an object, a direction of preference, and a time limit in which to achieve the objective. Objectives form a basis for identifying possible management interventions and evaluating alternative actions to gauge success of selected interventions.

In endeavors such as wildlife management that often involve disparate values, it is not always obvious who should determine objectives. Objectives arising from citizen participation, however, are more likely to result in sustained actions because of greater support by stakeholders. The process of formulating clear, acceptable objectives normally receives inadequate attention relative to its importance in the process of management. Too often, people assume everyone knows and agrees on what the objectives should be (another decision trap!).

3.3.1 Fundamental and Enabling Objectives

Two types of objectives are essential to impact management. Fundamental objectives characterize the reason for management in terms of desired impacts. Typically, a set of fundamental objectives guides development and evaluation of alternative management interventions (i.e., means→enabling

objectives and their associated actions). A fundamental objective of black bear management could be to increase the psychological well-being of a community in which negative black bear–human interactions are frequent. A second type of objectives, enabling objectives, state how fundamental objectives will be achieved. Enabling objectives in the black bear example could be to (a) increase the level of stakeholder knowledge of appropriate behaviors to avoid attracting black bears to their homes, and (b) create a social stigma associated with intentionally feeding bears. Actions to achieve these specific enabling objectives might include ramping up public education and increasing fines (and associated law enforcement effort) for feeding bears. Reactions hopefully would lead to human behavioral change essential for successfully living with black bears.

Fundamental and enabling objectives are initially hypothesized during situation analysis, but are galvanized after adequate stakeholder engagement, during which they may be modified substantially. Chapter 5 describes how fundamental and enabling objectives were developed and differentiated for black bear management in New York.

3.4 Model Development

Wildlife management takes place within ecological and social systems that are dynamic, nonlinear and linked (i.e., coupled social-ecological systems). With few exceptions, humans perform poorly at decision-making without decision aids in a multifaceted system such as wildlife management. Systems thinking and modeling offer at least three important strengths for impact management: (1) better structure to guide and communicate thinking; (2) increased decision-making capacity; and (3) increased rates of learning. The management approaches (along the IM←→AIM continuum) we advocate in this practitioner's guide use modeling in several ways.

The first use of modeling, described in Part II, is developing what we call a manager's model. A manager's model is an explicit, articulated mental model of the management system. A manager's model

is used in situation analysis and frequently refined during successive management cycles. To ease communication about a manager's model, we depict it as a concept map that visually portrays primary components of the model and the connections between them. Files of more detailed information are associated with the various components, as needed.

This type of modeling builds a shared understanding of the management system. Developing a model of this type by a management team or by a team working with partners and selected stakeholders, is a means to understand and communicate about uncertainties, complexity, and nonlinearity of systems affecting a wildlife management issue. Manager's models encourage examination of potential management interventions, and help identify tradeoffs among management options. Assumptions behind policy or implementation of management objectives are made explicit and therefore more easily subject to evaluation and improvement over time. Modeling also leads to systematic identification of information deficiencies that can be addressed by research.

The second way models are used, when it is desirable to move to an AIM approach, is building mathematical depictions, or occasionally even computerized simulations, of what is believed to be key components of the management system. In most cases, because uncertainty exists about the management system and managers' ability to affect the system in predictable ways, several competing models may surface because consensus about a single best-fit model that explains and predicts factors affecting impacts cannot be reached. Kai Lee (1999) presents a critique of adaptive management, and suggests, "The essence of managing adaptively is having an explicit vision or model of the ecosystem one is trying to guide." Managers and stakeholders seldom have a common or easily communicated understanding of ecosystems. Modeling, especially when done by a management team, helps organize thinking and communicate the complexity of management systems among managers and stakeholders. Model development also

reveals important uncertainties and assumptions about the management system. Uncertainties are reduced and assumptions are examined through rigorous monitoring and evaluation of management actions conducted to test the models. Belief in a single best model is built over time through multiple iterations of the management cycle and monitoring of results.

Monitoring within an adaptive management approach can be done at two levels of intensity. Using the active-adaptive approach, managers treat interventions as learning experiments that allow for revision of quantitative models of system behavior. A number of constraints make it difficult for agencies to implement active-adaptive management (Enck et al. 2006, Feldman 2008). Passive-adaptive management (Meffe et al. 2002) is less demanding and offers a second approach to monitoring. In a passive-adaptive mode, managers monitor system changes to estimate the extent to which levels of impacts change after a management intervention. Although learning may be expected to occur more slowly and with less precision and confidence, passive-adaptive management is achievable in most management contexts. While we encourage managers to aspire to conduct active-adaptive management, we anticipate most will practice passive-adaptive management.

3.5 Identification and Assessment of Potential Alternatives

In this step, potential management actions are identified that have potential to create positive impacts and minimize or mitigate negative impacts. Management alternatives represent the range of potential options for achieving enabling objectives. Typical interventions used in wildlife management are actions aimed at influencing populations, habitats, or people. The collective effects from management actions should yield or make possible positive impacts that are describe in fundamental objectives of management.

When considering alternatives, managers tend toward another decision trap, maintaining *status quo* and reliance on rules of thumb, which tends to keep managers

thinking "inside the box"—a box trap! To counter this tendency, options evaluated should not be limited to those believed to be available. Stakeholders often have creative ideas for alternatives and perspectives about potential collateral impacts (discussed below). Input of this nature can be solicited through stakeholder participation. Ask, "Would this action achieve the enabling objective?" and "What secondary effects might each action create?" During this step, indicators of management performance should be developed. These indicators form criteria that might eventually be used for evaluating progress toward achieving objectives.

Management interventions may create *collateral and subsequent* impacts – the secondary consequences of any management action. Collateral impacts are unintended impacts that occur simultaneously with the implementation of primary management actions; collateral impacts typically are the focus of mitigating actions. Subsequent impacts are unintended impacts that occur as a result of accomplishing primary management objectives. These secondary impacts have the potential to cascade if left unmitigated. Managers can assume that collateral and subsequent impacts are likely to occur although they may not always be foreseen.

When selecting alternatives you should attempt to anticipate and understand the likely consequences of each action. Stakeholders can be helpful, perhaps essential, in identifying potential collateral and subsequent effects of various action alternatives. Stakeholders can also help identify acceptable actions to mitigate collateral and subsequent effects.

3.6 Monitor and Evaluate

Careful evaluation of impacts sought from interventions leads to greater learning about effectiveness of management. Primary performance measures are the fundamental and enabling objectives identified in the objective-setting step. Whether operating in an active- or passive-adaptive mode, two questions need to be addressed: are the actions achieving enabling objectives and is achievement of enabling objectives leading to progress on fundamental objectives? If in

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active or passive mode, one also asks — to what extent? If in active adaptive management mode, one additionally asks "why?" A subtle but crucial distinction is that *both* monitoring *and* evaluation occur. Monitoring provides data on which to measure the performance of management relative to achievement of objectives. Evaluation is the process of making judgments about management effectiveness based on performance.

In an active-adaptive mode, AIM model variables and probabilities are updated through Bayesian analyses based on what is learned after management interventions are conducted. A goal of AIM is to provide compelling evidence that refines belief probabilities based on monitoring of management interventions of one model towards a probability of 1.0. The probabilities in this case being an estimate of the selected model representing a true depiction (probability = 1.0) of the system. The purpose of this process is to focus impact

management guided by the model believed to be the best representation of the system.

3.7 Adjust

System models are adjusted (i.e., beliefs about relationships between system components change) as knowledge about the management system is obtained or as changes occur in the system. With time and experience, confidence in the "surviving" model improves. Management of the system also changes, as enabling objectives and management actions are modified to improve management performance (i.e., improve effectiveness in producing desired outcomes). Management alternatives predicted to be viable sometimes fail because of poor implementation. Adjustments are then made to the implementation process, not to the model structure. Should monitoring reveal that enabling objectives are not achieving fundamental objectives, adjustments to the enabling objectives are made. This may require changes in management actions, as well.

4 Learning and Adapting

4.1 Introduction

Learning from experimenting and then applying what you learned to further experimentation and subsequent learning is what makes management adaptive. Treating a management action as an experiment requires rigor in conceptualization and design of the management intervention so that before any action is taken, the manager will know what level of monitoring will be necessary to detect effects. Fielding an experiment may require funding and staff resources beyond those available in many instances. Nevertheless, not having the resources to conduct a full-blown active-adaptive impact management approach does not mean you can't learn from your actions and adapt. Although your ability to detect effects and your understanding of how management triggered those effects will be less, a great deal of information can be gained from systematic evaluation. Basically, the degree to which you are able to attribute important change in effects to your management intervention depends on where your management approach is on the continuum from impact management (IM) to adaptive impact management (AIM).

4.2 Learning in IM vs. AIM

Regardless of where one operates on the IM to AIM continuum, a manager's model serves as the foundation. The model identifies fundamental and enabling objectives appropriate for the management system. It also articulates what managers believe to be major system components and relationships between them. The model overall is a grand hypothesis about the actual system.

Achieving desired impacts is the goal of management, so learning whether and why your management interventions are or are not helping to achieve the goal is the best way to improve program outcomes. Executing a management intervention without any attempt to learn from that action is not good professional practice. Through management implementation experience, one can learn about the validity of the manager's model, but only if care is taken to distinguish between issues with the model versus operationalization of actions to achieve desired impacts.

Let's look at an example of management without learning, what it would take to make it a full AIM approach, and how it could be scaled back to an IM approach with learning from your management actions still a key component.

4.2.1 A Colonial Waterbird Example

Beaches along the Atlantic coast can be ideal nesting habitat for certain colonial waterbird species, as well as prime vacation habitat for humans. The two seldom mix well, with human disturbance and predation by pets causing bird losses, and in some cases tree-nesting waterbirds creating unsanitary conditions around homes. Conflicts arise around one colony where beach use by summer residents, who arrive after nesting started, seem to cause colony abandonment. The following year the entire beach is closed to all human use from May 1 to July 30. Losses of tourist revenue and rental income, as well as impediments to traditional beach uses, motivate many local residents to form a coalition seeking a political solution that would reopen the beach. A management process is initiated and the wildlife managers begin to conduct a situation analysis. They seek answers to questions such as – what's happening,

what do we know, what's at stake, who are the stakeholders? Stakeholders are engaged to assist in modeling the system, identifying desired impacts and related fundamental objectives. And, after becoming better informed about current conditions, stakeholders participate in developing the management model. Consensus is reached that the desired future condition is beach habitat that sustains the waterbird colony while human uses of the beach are restricted to those that disturb the colony little or not at all. The fundamental objectives identified are: (a) keep a successfully reproducing colony on the beach; and (b) maintain compatible beach use by human residents during the nesting period. The primary enabling objectives are: (a) stop disturbance of nesting birds by pets and (b) allocate beach use by birds and humans such that birds have adequate nesting habitat.

Specific management actions identified are fencing a large area around the bird colony to prevent direct human disturbance and requiring all pets be leashed, contained in kennels, or kept indoors. Residents are allowed to use the unfenced portion of the beach, which covers three times the area of the fenced portion. Biologists will conduct a survey at the end of the season to see if the bird colony is still intact.

Is the effort described a valid experiment? If the bird colony is abandoned what will you learn? If the bird colony does not abandon the site what will you learn? You really have not learned much. If the colony is abandoned you don't know whether it was from people going into the fenced area, pets being allowed to roam free, harassment by wild predators such as owls, foxes and coyotes, or weather. The management action could have achieved the enabling objective of eliminating anthropogenic disturbance; you just don't know. Conversely, if the bird colony doesn't abandon the site you don't know whether there still were enough disturbances to result in higher levels of chick mortality. In either scenario you don't know whether the residents were satisfied with the level of beach use they experienced or with the time and space allocation scheme. The only indication of satisfaction is unsolicited contacts (likely complaints) and media reports, with no way of assessing whether those indicators are representative of residents' attitudes overall.

An AIM approach calls for monitoring the effects of the management actions and using what is learned to revise and refine the manager's model, implement revised management interventions, monitor further, learn more, and adapt as needed. For example, the monitoring might require having staff on site to observe the bird colony from blinds and record the level of resident compliance with avoiding the fenced area. Nighttime monitoring with night vision equipment or camera traps documents wild and domestic animal predators. Track surveys along the fence line provides further data on wild and domestic predator encroachment. To address the fundamental objective of residents being allowed to enjoy the beach, a number of monitoring approaches are incorporated. A focus group of residents convened prior to, during, and after the nesting season provides insights on core interests among community members. These insights feed into a face-to-face, telephone or mail survey instrument designed to assess residents' satisfaction with the level of beach access they are allowed, and their attitudes towards the purposes and implementation of the management program.

What do you learn from such inquiry? You may learn that fencing alone is not adequate to prevent human disturbance. An adaptation could be adding some level of law enforcement surveillance or presence, and monitoring to see if human disturbance is reduced. You may learn that the bird colony's proximity to a patch of woodland puts it in range of a great-horned owl, and persistent predation causes abandonment regardless of efforts to control anthropogenic factors. How can you learn and adapt? Prior to the waterbird nesting season (and after owl nesting, which is initiated during winter), survey the woodland patch using owl recordings. If an owl is present, then a decision can be made about the most prudent management action. Alternatives could include a predator baffle strung over the colony, or, if

that is impractical, applying for a permit to remove or relocate the owl. Then monitor the colony to see if predator control results in the desired impact.

So what effect is all this management having on the waterbird population? Is the colony growing, declining, or remaining stable? You could be investing a lot of effort only to maintain a population sink. You might want to revisit your fundamental objective and fine tune it to something like 1.3 birds fledged per nesting pair. You then need to include fledging estimates as part of your monitoring. What if estimates are below target? Do you know why? Design a monitoring protocol to identify causes of nest failure and chick mortality. Further management interventions can be directed towards minimizing those.

Are the residents satisfied with the level of beach use they have been allowed? If yes, great. If no, further inquiry can shed light on what the remaining issues are. If it's a matter of inadequate space to accommodate the demand, an assessment of resident vs. visitor use may be warranted, and if non-resident use is exceeding the capacity then control of that use for the benefit of residents could be initiated. If space is really not an issue, and underlying resentment over birds excluding humans is at the root of the issue, then communication efforts can be directed towards influencing public attitudes.

Okay, so now you've directed so many resources towards this one bird colony, no monitoring or management can occur on any other colony. Can you get by with less effort and still learn? Yes, you can do so and remain "adaptable," though you lose the ability to truly practice adaptive management. Compared to AIM, your assumptions are greater, your knowledge gain is less, and your confidence in your management interventions do not improve at the rate possible under AIM. Taking the waterbird colony example to illustrate impact management, let's go back to the situational analysis and the management system model. Through deliberation and with input of stakeholders, the management team determines the probable key

factors influencing colony viability. If the consensus is that human disturbance is the main problem, then fencing can be constructed, and a pared-back monitoring system can be designed. Volunteer "wardens" could be recruited and a monitoring schedule and reporting form developed. In the end you do not have the robust monitoring data derived in the more costly AIM approach described above, but you do have information you can use to learn about the relative efficacy of the fence in reducing human disturbance.

If you do not have the time and resources to invest in a well-designed, systematic, large-sample mail survey, you can still assess general attitudes of residents. A telephone survey of a small, random sample of residents can provide insights into general levels of satisfaction with primary management actions. Your survey instrument is not as refined or extensive as you would like, and your confidence in drawing inferences from the results is not as great, but you have quantitative and qualitative data to establish broad benchmarks to help you develop and modify management interventions.

It is important that you identify up-front any information gaps with respect to stakeholder traits and preferences. You want to have clearly in mind what assumptions these gaps cause. When resources devoted to stakeholder assessment are constrained, your adaptations in management interventions may be more drastic because your ability to detect effects is much less, and possibly requires coarser-scale interventions. As long as you recognize and account for limitations of a modest assessment, we encourage you to make some effort at it.

You are much better positioned as a manager when you have information resulting from your interventions that you can learn from and apply to future interventions until your understanding of the management system improves and you ultimately achieve the desired impacts. Learning from management speeds progress in conserving wildlife.

5 Lessons Learned from IM Application: A Black Bear Management Case Study[2]

5.1 Introduction

This chapter describes an application of impact management that began in 2001, when a team of wildlife managers in the New York State Department of Environmental Conservation (NYSDEC) (2003a) decided to use AIM concepts as a framework for their black bear management program. They became a standing committee that completed a full cycle of AIM steps. In the process, they demonstrated that AIM is not a tidy set of sequential steps. The NYSDEC experience shows how the steps overlap in practice, as a team of managers goes back and forth among steps, sometimes repeating activities associated with a given step several times (Table 5.1).

Two of the authors (Siemer and Decker) worked as partners with NYSDEC managers, from inception of AIM-based management, to completion of the first full cycle of application for black bear management. Working with these managers over several years produced many unique learning opportunities with respect to impact management. In this chapter, we describe how a real AIM application unfolded and we share some of the lessons we learned along the way.

5.2 Organizational Setting for the Case

With approximately 120 full-time staff divided among a central office (in Albany) and nine regional offices, the Bureau of Wildlife (BOW) is a relatively small subunit within NYSDEC. Although BOW is the largest state wildlife agency in the Northeast, it is smaller than many agencies across the U.S. Moreover, the number of staff employed by BOW has declined markedly since the 1990's (at its peak, BOW had approximately 300 employees). Thus, this case of AIM was not implemented in an agency flush with staff. On the contrary, it was completed by an organization continually being asked to "do more with less."

5.3 University-Agency Partnership

In this case, researchers in the Human Dimensions Research Unit (HDRU) at Cornell University and staff of Cornell Cooperative Extension worked with wildlife professionals in NYSDEC to develop a statewide black bear management plan. This team planned an AIM intervention for black bear management that led to an interactive process of stakeholder engagement and empirical research to identify impacts and consider agency actions to manage impacts. NYSDEC supported multi-year human dimensions research to understand what stakeholders wanted from the black bear management program (i.e., desired impacts), then they carefully considered whether their current management actions were achieving the outcomes (i.e., impact levels) desired by their stakeholders. Along the way, the team implemented, evaluated, and revised their stakeholder engagement actions. Evaluative research findings from HDRU came back to the entire group of participants in the form of debriefings, discussion sessions, and written reports.

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[2] This chapter is drawn from a doctoral dissertation on the first full implementation of AIM (Source: Siemer, W. F. 2009. *Toward a practice of impacts management: insights from an exploratory case study.* Unpublished doctoral dissertation. Department of Natural Resources. Cornell University, Ithaca, New York).

Table 5.1. Components of an AIM process and corresponding activities related to black bear management in New York State, 2001-2008.

Component	Related activities in New York
Situational analysis	• Human Dimensions Research Unit (HDRU)-Department of Environmental Conservation (DEC) team work to synthesize past stakeholder input • Nominal group meetings with stakeholders in 3 regions • 2002 statewide survey of stakeholders (assessed impacts, etc.) • Stakeholder input group (SIG) process implemented in 4 locations to obtain local insights about impacts • Media content analysis to understand messages about impacts • Regression analysis to examine contributions of media use and personal frame of reference on one kind of psychological impact (bear-related risk perception)
Objective setting	• HDRU-DEC teamwork to define initial objectives matrices • HDRU-DEC teamwork with SIG participants to craft objectives statements and ends-means matrices • Objectives identified by SIG groups were posted on DEC website • HDRU-DEC teamwork to craft final ends-means matrices
Model development	• AIM workshop with DEC staff (2001) • Group model-building (GMB) with Bear Team (2004 – 2006) • HDRU-DEC pilot test simulator with stakeholder group
Identify and select management interventions	• Bear Team recommendations to senior leadership in agency • Developed standard operating procedures manual (SOPM) • Changes in hunting regulations • Education pilot program • DEC-sponsored video on bears, preventing problems with bears • Curb service by DEC staff in response to severe problems
Monitoring	• DEC improved record keeping on bear complaints • DEC tallied complaints before and after hunting regulation changes • HDRU assessment of learning outcomes from SIG process • HDRU assessment of learning outcomes from GMB process
Refinement of models or objectives	• Re-evaluation/revisiting fundamental objectives would signal the start of a new cycle

Those findings were used by the team to inform decisions about ongoing stakeholder engagement and agency actions taken as part of the bear management program.

5.4 AIM for Black Bear Management in New York

Implementation of a full AIM cycle (from situation analysis through monitoring action outcomes and adapting) took place as a series of linked activities between 2001 and 2008 (Table 5.2). The temporal dimension of this case was not unusual. Decker and others (Decker and O'Pezio 1989; Decker et al. 2001a) described three black bear management cycles in New York State during the period 1970 to 1988 (i.e., it took six years on average to complete a bear management cycle).

Five innovative aspects distinguished this process from previous bear management cycles: extensive situation analysis,

Table 5.2. A summary of significant research and outreach tasks related to impact identification, clarification, and communication between 2000 and 2008.

Time period		Project milestones, influences on AIM adoption
2000	Winter	HDRU awarded funding for a Hatch grant proposal titled "Development of adaptive impact management: a novel approach to wildlife management." Matched with other funding (Cornell University Agricultural Experiment Station), this allows HDRU staff to initiate work on concept papers and begin exploring the impacts concept in deer management studies. (support for AIM development)
2000-2002		HDRU and BOW staff collaborate on writing projects to articulate AIM concepts leading to multiple meetings, correspondence, and collaborative writing with members of DEC Bear Team or Bureau Management Team (served as initiation stage of adoption)
2001	Spring	BOW leadership contracted with HDRU to begin a new activity titled "Input for black bear management plan." That research activity was established to support HD information needs related to BOW's work to create a comprehensive, statewide management plan for black bears in New York. (support for AIM implementation)
	Summer	Initiated work with managers to define impacts. (situation analysis: impact identification)
	Fall	Completed 3 nominal group processes (yielded stakeholder-defined impacts). (situation analysis: impact identification)
2002	Winter	Finalized instrument, began implementation of statewide mail survey.
	Spring	Completed 2002 statewide mail survey.
	Summer	Coded survey data, began data analysis; completed post-fatality telephone survey, following a bear-related fatality of an infant in New York.
	Fall	Analyzed mail and telephone survey data; consulted on development of management planning framework.
2003	Fall	Bear management framework document published.
	Winter Spring	Oral presentation of study results; consulted on development of management planning framework.
	Summer	Developed stakeholder input group (SIG) process framework.
	Fall	Summary report from mail survey; initiated 3 SIG processes.
2004	Winter	Finished 3 SIG processes.
	Spring	SIG process final report completed.
	Summer	Presented additional survey data analysis.
2005	Spring	Completed Region 7 SIG process.
2006	Spring	Completed East of Hudson SIG process.
2007	Summer	Consulted with Bear Team on revision of management framework document.
2007	Fall	Bear management issue education meetings.
2008	Spring	Region 3 SIG process (Dutchess, Putnam counties) planned, but not implemented due to staff time constraints.

an explicit focus on stakeholder-defined impacts, informed transactional stakeholder engagement, use of quantitative systems thinking techniques, and a conscious decision by the management team to consider the entire experience as a learning opportunity. The management team took a risk on an unproven approach. They later reported that the risk paid off in several ways, which we describe here. The implementation also had limitations, which we share as well.

5.4.1 Preparing the Ground: Deciding to use AIM Concepts

Organizations can be expected to go through an initiation phase before they make a decision to apply AIM concepts. The initiation phase of innovation adoption includes awareness of an innovation, analysis of the innovation, and finally, intention to use the innovation.

Initiation in this case took place over a two-year period (2000-2002). Three leaders in BOW were first exposed to AIM concepts in 2000, when we began collaborating with them on a writing project that culminated in a paper titled, "The Essence of Wildlife Management" (Riley et al. 2002). Through a series of deliberations associated with writing and publishing that paper, the authors (who included two agency leaders) developed a shared belief that managing to achieve stakeholder-defined impacts is the essence of wildlife management.

Extensive HDRU-BOW interactions between 2000 and 2001 (i.e., multiple workshops, meetings, correspondence, collaborative writing) served as an initiation period for BOW leaders to become aware of and consider impacts management in principle. During the same time period black bear management was emerging as a priority for the Bureau. BOW responded by creating a new working group –the Black Bear Plan Team (Bear Team)—to develop a comprehensive statewide management plan to address public concerns about problem interactions with bears. BOW leaders approached HDRU in 2001, requesting human dimensions research support to inform development of a new statewide bear management plan. HDRU

proposed that the work be structured around the concepts of AIM. That proposal was accepted by BOW leadership, who had been exposed to AIM concepts on multiple occasions over the preceding year. Working with the Bear Team, HDRU staff designed the new human dimensions research activity to gain information for short-term and long-term decisions identified by the Bear Team. In the short term, the Bear Team requested a study that would fulfill BOW's immediate information needs (e.g., characterize stakeholder experiences with bears, attitudes towards bears, and views about hunting and other management actions). Over a longer time frame, the Bear Team requested technical support and research to apply AIM concepts to their bear management program. A period of situation analysis focused on impact identification and clarification.

5.4.2 Operationalizing AIM Concepts

Charged to develop a statewide comprehensive bear management plan, BOW's Bear Team worked collaboratively with HDRU staff to develop a new framework for black bear management planning in New York State in 2002. BOW's management framework document was finalized, approved, and released to the public in 2003 (NYSDEC 2003a). Based on the precepts of AIM, the framework established a cyclical process for adapting New York's management program to changing social and environmental conditions. Key elements of the planning framework were captured in a schematic (Figure 5.1) that also documents the team's implementation strategy for stakeholder engagement in bear management. Consistent with concepts presented earlier in this guide, stakeholder engagement, a focus on impacts, manager-stakeholder deliberation, and adaptive management were incorporated as featured elements of the planning framework.

Figure 5.1 depicts the basic components of an iterative process of stakeholder engagement applied in New York's approach to bear management. All of the planned
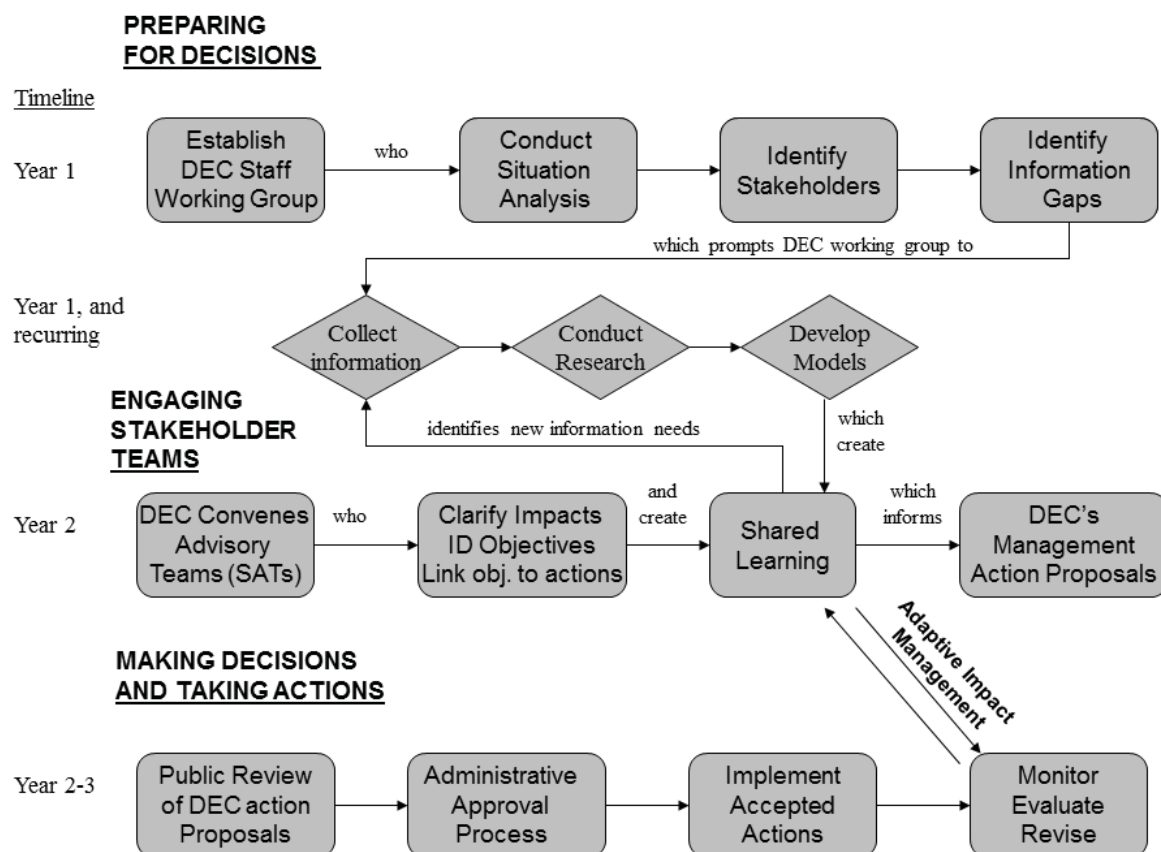
Figure 5.1. An outline of the cyclical process DEC staff developed as a framework to revise the black bear management program in New York (Source: NYSDEC 2003a).

activities were completed in some fashion between 2001 and 2008, and some of them more than once.

5.4.3 Situation Analysis

Figure 5.1 largely depicts AIM situation analysis designed to identify and clarify stakeholder-defined impacts. In the following sections, we summarize the series of engagement exercises and feedback activities the Bear Team conducted between 2001 and 2003 to identify impacts and fundamental objectives linked to impacts (Table 5.3).

Most of the activities conducted in this case (Table 5.3) represent consultative forms of public engagement (Rowe and Frewer 2005), where stakeholders convey information to policy makers through processes initiated by the policy-making body (BOW, in this case). The final exercise listed in Table 5.3 (i.e., the stakeholder input group [SIG] process) represents a transactional form of engagement, with two-way information exchange between stakeholders and BOW. In transactional forms of

engagement, structural elements such as dialogue and negotiation are expected to create opportunities for opinion change in stakeholders or members of the policy-making agency. Because the SIG process was designed to encourage deliberation and focus on impacts, it provided opportunities to question both stakeholders' and managers' assumptions and mental models. The SIG process was employed as part of a comprehensive engagement approach, not as a replacement for engagement mechanisms like public information campaigns, stakeholder surveys, or established regulatory review processes. Each of the public engagement mechanisms used by the team is summarized below.

Bear Team synthesis of past input. First, the BOW Bear Team generated a preliminary set of impacts, based in part on insights from a series of public meetings conducted between 1992 and 1994 as a means to solicit input on proposed bear hunting regulation changes.

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Table 5.3. A summary of public engagement exercises and input synthesis processes utilized by BOW to identify and characterize black-bear related impacts in New York State, 2001-2003.

Public engagement exercises	Synthesis processes used by engagement organizer
Input for bear hunting and dog training regulation changes (1992-1994)	
	Facilitated process to synthesize past public input and managers' experience as preliminary impacts statements (2001)
Nominal group sessions held in 3 regions to generate lists of effects that might be impacts (2001)	
	Facilitated process used to synthesize input from nominal group sessions as guidance for preparation of a mail survey instrument (2002)
Mail survey implemented to collect representative input on impacts by region (2002)	
	Facilitated process used to synthesize new input on impacts (2003)
Stakeholder input groups (SIGS) convened to provide detailed insights at a local level, and begin discussing ends-means connections (2003)	

Nominal groups. Next, the Bear Team collaborated with HDRU to design and implement a series of regional nominal group meetings, which obtained input on the range of impacts recognized by stakeholders in 2001. Nominal groups are small, ad hoc groups of individuals selected to reflect a diverse set of stakeholder perspectives.

Statewide survey. Findings from the 2001 nominal group meetings informed design of a self-administered mail-back questionnaire. The questionnaire was used as the data collection instrument for a statewide survey implemented in spring, 2002. The stakeholder survey allowed HDRU researchers to improve description of the effects that stakeholders recognized as impacts, and to quantify differences in stakeholder experiences and attitudes across regions (e.g., Catskills vs. Adirondacks), stakeholder groups (e.g., hunters vs. non-hunters) and value orientations.

SIG process input. Input from the 2002 mail survey was supplemented with input from a stakeholder input group (SIG) process. The SIG process (Figure 5.2) was designed to help BOW staff articulate area-specific management objectives (based on identified impacts) and potential management actions. HDRU, Cornell Cooperative Extension (CCE) and BOW personnel developed, implemented, and evaluated the SIG process as it was applied in three locales in 2003: the upper Catskill region, lower Catskill region, and western New York. BOW and HDRU personnel served as technical advisors to SIGs, answering questions about the biological and social dimensions of black bear management.

BOW created SIGs to be temporary, ad hoc entities. Each SIG had about a dozen members. CCE facilitators selected participants from candidate lists they developed together with NYSDEC staff. Facilitators selected participants to reflect diverse stakes in and perspectives on black bear management (i.e., people experiencing different kinds of impacts), and to minimize over representation of any single interest.

SIG participants were asked to: review two background documents; seek input from others; contribute local experience and knowledge; participate as an individual (not as an official representative of a particular group); and keep an open mind. CCE, HDRU, and BOW were expected to:

Situation: AIM underway for black bear management. SIG process initiated to refine understanding of impacts in specific geographic locations.

Inputs

Outputs, Activities, Participation

Outcomes

What we invest:	What we do:	Who we reach:	Short term results:	Medium term results:	Ultimate results:
Staff time - BOW, HDRU, CCE; financial resources; meeting facilities Materials (program documents, presentations, equipment, etc.) AIM Planning Framework Volunteers' time (participants)	Facilitate, provide technical information; share research; educate Ensure diverse perspectives / stakes reflected Clearly state expectations Be flexible - adapt process as we go Communicate with one another, with participants, with broader public	SIG participants Broader public? Information reaches us!	Summary report Input resulting from thoughtful deliberations that can inform management planning Learning among participants and agency staff	Better problem definition "Better" management action proposals Enhanced trust?	"Better" management decisions that lead to desired impacts? Relationships with CCE and SIG participants that could contribute to plan implementation?

Assumptions: Managers can improve decision-making frames through issue education focused on impact management.

External Factors

Figure 5.2. Logic model for stakeholder input group (SIG) process for AIM of Black Bear in New York State.

facilitate meetings, provide subject matter expertise, respond to participants' questions and information needs, keep an open mind, and incorporate input as feasible into proposals for management actions.

Each SIG was expected to: clarify bear-related impacts, identify priorities for impact management, and suggest actions to manage key impacts. The initial meeting of each SIG was designed to develop a common information base among participants. During the first meeting, CCE, HDRU, and BOW personnel introduced the planning framework and SIG process, presented information on bear natural history, introduced the concept of impacts, and instructed participants to seek input from others in their community or stakeholder group.

In the second meeting, facilitators asked participants to review, clarify, and add to the list of bear-related impacts that the Bear Team had developed from prior stakeholder engagement activities. Participants were then asked to indicate which impacts were most important in their region of the state.

Each group was asked to select priority impacts on which to focus further discussion. In the third meeting, facilitators led discussion and ends-means linking exercises that helped participants express their interests and concerns as a set of fundamental and enabling objectives. They also began to describe potential management actions.

5.4.4 Objective Setting (ends-means linking)

A series of ends-means linking exercises were employed in this case as an aid to objective setting. Members of the Bear Team went through an iterative process to develop fundamental objectives linked to impacts, and to conceptualize linkages between fundamental objectives, enabling objectives and management actions. That body of work, which synthesized managers' experience and stakeholder input, culminated in a set of eight ends-means matrices (Siemer and Decker 2006). Figure 5.3 provides one example of the ends-means diagrams that were developed to
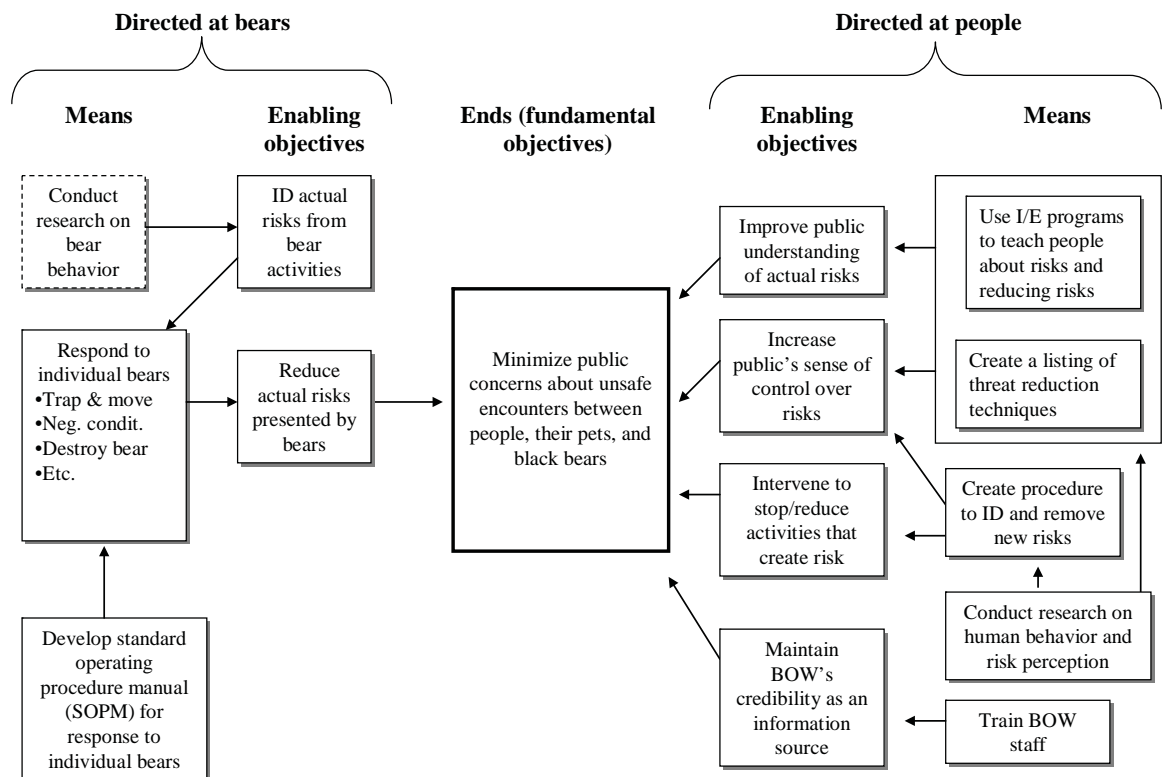
Figure 5.3. Ends-means diagram to represent how bear management program might address a psychological impact (i.e., concern about unsafe human interaction with bears) associated with bears in New York State (source: Siemer and Decker 2006).

Table 5.4. Connections between the systems thinking method, systems thinking skills, and the group model-building intervention with wildlife managers in New York, 2004 – 2006.

Steps in the systems thinking method	Systems thinking skills (source: Richmond 2001)	Group model building (GMB) activities
Specify problem or issue	1.Dynamic thinking: framing a problem in terms of a pattern of behavior over time.	• GMB workshop 1 and 2:
	2. System-as-cause thinking: Seeing internal actors who manage the policies and physical components of the system as responsible for behavior.	• Development of problem statement, dynamic hypotheses
	3. Forest thinking: Seeing beyond the details to the context of relationships in which they are imbedded.	
Construct hypotheses (or model)	4. Operational thinking: Understanding how a behavior is actually generated.	• GMB workshop 3-4, model construction
	5. Closed- loop thinking: Viewing causality as an ongoing process, not a one-time event, with effects feeding back to influence causes, and causes influencing each other.	• Development of causal loop diagram
	6. Operational thinking: Understanding how a behavior is actually generated. Quantitative thinking: Knowing how to quantify, though you can't always measure.	• Development of stock-flow model
Test hypotheses (or model) Implement changes	7. Scientific thinking: Knowing how to define testable hypotheses.	• Development and use of policy simulation interface • Policy simulations bolstered current staff beliefs; no policy changes were made
Communicate understanding	Encouraging wildlife professionals and management stakeholders to develop systems thinking skills 1-5	• Stakeholder workshops (e.g., Woodstock meeting) • Presentations to professionals, peer-reviewed publications

articulate fundamental objectives based on impacts, and then link fundamental objectives to enabling objectives and potential management actions. The thought processes embodied in these ends-means diagrams help illustrate how biological and human dimensions of management are linked to one another to achieve a fundamental objective.

Although wildlife managers made progress toward the ideal of integration in this case, they encountered challenges in their ends-means thinking as part of objective setting. Like others who have applied AIM concepts, members of the Bear Team found terminology related to fundamental and enabling objectives to be unfamiliar. Some also were reluctant to engage in strategic planning activities. Thus, to make progress, the team needed both the capacity and confidence to conduct ends-means linking exercises; in this case these needs were met by a process facilitator.

5.4.5 Modeling the Systems that Create Impacts

One tenet of AIM is using systems thinking and systems models to inform selection of enabling objectives and related management actions. Several ways exist to integrate systems thinking or systems modeling into an AIM approach. In this case, managers decided to pilot test a technique called group model building (GMB).

In 2004, HDRU staff began working with a system dynamicist to complete a GMB project with the Bear Team. The GMB project had two research objectives: improve understanding of (1) *why* complaints about residential problems with black bears were increasing in New York; and 2) *how* managers might best intervene to control those problems. Four outcomes were desired from the project: (1) *understanding* of the system that was generating impacts; (2) *consensus* about the problem definition; (3) *commitment* to management actions; and (4) *simulations* for use in issue education. The Bear Team regarded their GMB exercise as an opportunity to pilot test GMB as part of an AIM process and as a decision support tool for BOW management teams.

Building a system dynamics model has been described as a seven-stage process that includes: problem identification and definition, system conceptualization, model formulation, analysis of model behavior, model evaluation, policy analysis, and model use or implementation (Richmond 2001). The Bear Team completed those stages with technical assistance from a modeling consultant and HDRU staff. The GMB project included a set of full-group activities (i.e., 4 facilitated workshops with the project team) as well as extensive periods of model development and revision completed independently by the modeling consultant and HDRU staff over an 18-month period (February 2004 – July 2005). Over time, the project addressed all seven systems-thinking skills proposed by Richmond (Table 5.4). Description of model sectors, dynamic hypotheses, techniques the facilitators used to implement the model-building process, and simulation run outcomes can be found in Siemer and Otto (2005) and Otto and Siemer (2009).

We worked with BOW participants to articulate and integrate dynamic hypotheses about the problem system as a causal loop diagram, revealing participants' understanding of the complex interactions occurring between community residents, wildlife agencies, hunters, and black bears. The GMB process culminated in completion of a quantitative stock and flow model (Sterman 2000). The final model contained over 200 variables (including 16 stocks) and six model sectors, which we labeled: bear population, hunters, food, bear-human interactions, knowledge or interest, and agency resources. Simulation runs using the quantitative model enabled Bear Team members to explore how changes in (1) hunting opportunity (i.e., amount of land open to hunting, season dates, season length), (2) agency effort devoted to problem prevention education (i.e., agency resources expended on information/education actions), and (3) agency staff capacity to respond to bear-related problems (with on-site technical assistance to residents) influence the frequency and severity of human-bear interactions in residential areas.

The GMB project produced a quantitative model suitable for bear management policy testing. Nevertheless, BOW staff had difficulty both in using the original modeling software themselves and in interpreting simulation results when the facilitators ran the software. Thus, HDRU staff and the modeling consultant continued working with the modeling team to design a simple interface they could use to produce management simulation runs. We completed the model interface between fall 2005 and summer 2006, using an iterative process of design and interactive sessions with a 3-member subgroup of the modeling team, followed by an interface pilot test with a regional audience of wildlife management professionals. The simulation interface was published in 2007 as part of a practitioners' guide on black bear management issue education (Siemer et al. 2007).

In a follow-up evaluation, all BOW participants regarded the GMB project as a valuable learning experience. They consistently reported learning the most from

the process rather than the product of the exercise. Most participants said that the experience helped them gain better understanding of one another, the bear management system, and how to manage negative interactions with bears in residential areas. Participants responded unanimously that the project had achieved research objectives 1 and 2 (i.e., they believed the project increased their understanding of the problem system and the main actions their agency takes to manage the problem). They believed that the GMB project will encourage NYSDEC staff to approach bear management as an ongoing, dynamic process.

Feedback at multiple points suggested that participants learned the most in the early stages of the project, and that the process was valuable as a catalyst to help them learn from one another. Participants regarded the project as having far less value as a technical decision support tool. Members of the Bear Team remained uncomfortable with the knowledge gaps in the model, and they never gained confidence in the model as a decision support tool or a vehicle for communication about bear management with external stakeholders. In the end, they endorsed the general practice of systems thinking as part of agency planning processes, but their experience in this case did not persuade them to incorporate quantitative systems modelling into future strategic planning activities.

5.4.6 Identifying and Selecting Alternatives

Members of the Bear Team used quantitative modelling to think about three management actions they were already using [i.e., hunting, problem prevention education, staff response to problems]. They were considering hunting changes as the main action even before they decided to adopt an AIM approach for bear management. Modelling work did not change their belief that agency intervention should focus on expanding bear hunting opportunity. Thus, AIM implementation did not result in much change in the course of action BOW was considering. What did change was the process they used to think more critically

about their overall program and specific interventions within that program.

5.4.7 Taking Actions

Management intervention included: a series of hunting regulation changes that liberalized bear hunting opportunity; a problem prevention education pilot program in one community; and additional education activities intended for a statewide audience. BOW made no changes in allocation of staff time to respond to problem encounters with bears in residential areas. The agency was in a period of marked downsizing in staff, making this action infeasible.

5.4.8 Monitoring and Evaluating Change in Impacts

BOW improved the system they use to monitor citizen reports of interactions with bears. They also began paying even closer attention to bear harvest, especially in areas with new seasons. They took no action to monitor indicators of change in other impact levels. This lack of increased monitoring forestalled active AIM implementation. Monitoring activities often receive low priority in resource management agencies, and this case followed that norm.

5.4.9 Refining Interventions or Models

To date, the Bear Team has not revisited their modelling work or made any refinements to their interventions based on monitoring. Rather than following the textbook definition of active adaptive management, this case is better described as an example of "passive" adaptive management, or simply as a case of being adaptable. Active adaptive management is a high standard that was never achieved here, perhaps in part because the management team involved did not believe that their issue warranted that level of management intensity.

5.5 Project Outcomes

The injection of resources, energy, planning, and momentum created during this cycle of bear management resulted in creation of many bear management products between 2000 and 2008, including: a standard operating procedure manual

Box 5.1. BOW Bear Team beliefs about the ways in which an explicit focus on stakeholder defined impacts enhanced their agency's performance.

> **Focusing on impacts:**
> - was useful as a means to obtain, synthesize, and integrate human dimensions considerations into decision recommendations
> - speeded the pace of regulatory change
> - helped articulate a statewide management plan
> - helped agency staff come to a common understanding of their problem and a common protocol for unified statewide response to that problem
> - increased defensibility of the team's decision recommendations
> - increased public credibility of BOW
> - increased BOW's capacity to manage proactively
> - encouraged systematic thinking about a management issue
> - led to instrumental and communicative learning by stakeholders and managers

(Henry et al. 2001); a framework for making bear management decisions and action recommendations (NYSDEC 2003a); a publication on black bear natural history and management (NYSDEC 2003b); identification of effects that stakeholders in New York regard as impacts (Siemer and Decker 2006); a stakeholder education video ("Living with New York Black Bears: Secrets to sharing the landscape with bears," available <www.dec.state.ny.us>); a bear management webpage (www.dec.ny.gov/animals/7215.html.); bear management education brochures and billboards; a compact disk of bear harvest records, bear-related complaint reports, and other data resources on bear management in New York, compiled for use by BOW staff (i.e., the "Bear Management Digest 2008" [NYSDEC 2008]); and a practitioners' guide to working through bear management issues (Siemer et al. 2007).

This level of investment and growth in the bear management program is unprecedented in the state. Before this period, black bear management was a background program that received relatively little public attention. With the creation of a permanent staff team to guide the program, and implementation of an AIM approach to bear management, the status and public visibility of the program was elevated markedly. By any metric, the period between 2000 and 2008 was a productive and dynamic chapter in the history of bear management in New York. Interview comments suggest that all BOW staff with responsibilities

for bear management believe the products and processes developed during that time period, especially their explicit focus on stakeholder-defined impacts, improved the performance of their agency in multiple ways (Box 5.1). Their comments in post-project interviews suggested that agency staff believed that adoption and implementation of AIM was one important element that contributed to this organizational success story. Evaluation of the project supported assertions by Riley et al. (2003) that a well-implemented impacts management approach can create a range of outcomes that enhance wildlife agency performance. Though modest, the benefits perceived by managers in this case suggest that impact management holds enough potential value to merit further investment and development.

5.6 Lessons Learned about Catalyzing AIM Implementation

Careful reflection led us to conclude that three key ingredients will be needed to catalyze adoption of AIM approaches within wildlife agencies.

One critical factor for success is having agency leaders establish a supportive climate for implementation in the wildlife agency. In this case, commitment of resources and other support from leadership allowed for extensive HDRU involvement to support the Bear Team. Agency support enabled HDRU to help agency staff develop planning documents, design and conduct stakeholder engagement pro-

cesses, and work with managers regularly to complete activities such as ends-means linking exercises. AIM implementation must have this level of administrative support to be successful. Administrative support structures should be in place before a management team proceeds with any AIM approach. Delaying an AIM initiative, or limiting the number of AIM initiatives by the agency is preferable to implementing an effort that does not have the level of support necessary to carry the effort to a successful conclusion. Extensive orientation experiences with agency leadership may be necessary to cultivate a supportive administrative climate for AIM pilot projects.

Another essential element for AIM implementation is staff capacity to implement and sustain AIM activities. Many potential impediments to AIM implementation might be reduced through efforts to train agency staff on AIM concepts and processes. Experiences in this case made it clear that adoption and continuation of AIM will depend on efforts of agencies and public scholars to develop and deliver in-service AIM training to mid-level staff within wildlife agencies.

A third ingredient for success demonstrated in this case was staff who can facilitate the extensive stakeholder engagement exercises associated with an AIM approach. Agency leaders must ensure that expertise of this kind is created and accessible to their management teams. Human dimensions expertise can be provided by staff within or external to the agency. The model for providing such expertise (i.e., via an internal human dimensions unit within your agency or via external consultants) varies widely across agencies. The key point is that management teams should plan to have an on-going capacity to provide mechanisms for transactional stakeholder engagement and deliberation over the life of their project.

5.7 Diffusion of AIM: Cautious Optimism, Lingering Questions

Findings reported in this chapter provide support for three linked assumptions underlying AIM:

- Enhancing mechanisms for stakeholder engagement can stimulate deliberation.

- Increasing deliberation among wildlife managers, and between managers and stakeholders, can lead to learning by both.

- Focusing on impacts and linking fundamental objectives to impacts, can encourage value-focused thinking.

While those results provide a basis for guarded optimism about wider adoption of AIM, other case study findings raise questions about the difficulties wildlife agencies face to implement AIM successfully. For example, this case demonstrates how difficult it is in a real-world setting to stimulate deep or broad stakeholder deliberation, the kind of deliberation that may be needed for thorough consideration of the fundamental objectives of wildlife management. The assumption that agencies can stimulate greater stakeholder deliberation and that greater deliberation will lead to change in decision frames is valid only to the extent adequate effort is expended.

Another impediment to AIM typified in the case of black bear management in New York is the lack of confidence managers have in quantitative models. Related to this is the inability to monitor impacts so that effects of management actions are fully understood. Without such understanding, the models and managers' confidence in them will not improve.

Important questions face those interested in applying AIM, including: how do we get more of the benefits that were achieved only to a modest degree in this case? How can agencies using AIM create more deliberation with and among stakeholders? How can agencies achieve the ideal of informed transactional engagement of stakeholders? Is application of impact management (not "adaptive") the more reasonable expectation in most instances? These are questions that additional applications of AIM will provide opportunities to answer as we learn and adapt AIM processes.

PART II

GETTING STARTED: DEVELOPING A MANAGER'S MODEL TO DESCRIBE YOUR MANAGEMENT SYSTEM

6 Introduction to Manager's Models

6.1 Overview

A big part of a wildlife manager's job today is to improve understanding of wildlife issues through analysis of wildlife management systems. This includes envisioning and articulating a preferred condition with respect to co-existence of humans and wildlife, describing current conditions, analyzing the gap between what is present and what is desired, and communicating to partners and stakeholders the new understanding of possible management needs that arises from such gap analyses. Then, in concert with partners and stakeholders, the wildlife manager identifies fundamental objectives, develops enabling objectives, and subsequently designs, implements and evaluates interventions to move the system toward the desired future condition.

In this part of the guide we describe how a management team can work through the process of developing a manager's model and create a concept map of a management system for a wildlife resource of interest. A manager's model is simply a description of the management system from the manager's perspective (an individual manager or a management team responsible for management of a wildlife resource). The process includes rich description of: management purpose, premise and context; stakeholders and the impacts of management they seek or experience; assumptions; relevant knowledge and knowledge gaps; possible management actions and their intended and unintended consequences. It is a first step toward more quantitative descriptions of the management system. The approach may be novel to some readers, yet it is basic in terms of its fundamentals. It's basically the systematic application of common sense.

The chapters in Part II guide you through the key considerations in the situation analysis activity a management team might engage in when initiating (or reviewing) a wildlife management program. We suggest a framework but not a prescription for practicing such thinking. Our objective is to point you toward a pathway to success as a practitioner of wildlife management.

A manager's model aids in developing understanding of a management system and then communicating about it. While the primary purpose of a manager's model is to improve understanding and communication among members of the management team, it also can be used to facilitate internal communication about the management system within the agency and external communication with partners and stakeholders.

A manager's model is not a plan, per se; it is more of a vision of desired conditions and portrait of actual conditions, as well as factors influencing such conditions and their relationship to one another. A manager's model also identifies kinds of considerations to be made before assigning responsibilities and implementing management actions. It is an approach to situation analysis that takes a broad view of the system within which management occurs to achieve desired outcomes with respect to a particular resource. A manager's model is not static; as one learns more about the management system, the model is modified in light of the new understanding achieved—it is adaptable.

Developing a manager's model involves a kind of thinking and discourse among members of a management team that few managers have been trained to use. Developing a manager's model requires explicit, analytical thinking, directed toward bringing discipline to the intellectual work of management and the management process itself. Unlike the normal process of science, however, in management thinking the affects of values are not guarded against and suppressed, but surfaced and identified explicitly, then incorporated into the management process.

A manager's model is:
  (a) a portrayal of desired conditions, actual conditions, factors that influence conditions, and considerations to be made before taking actions.

  (b) a broad view of the processes and components of a management system that may need to be managed to yield desired outcomes with respect to a particular resource.

  (c) adaptable in that as one learns more about the management system, the model should be modified.

A manager's model is not a plan, per se. It is a best estimate of a management system and how it might be influenced, based on situation analysis.

6.2 Phases for Developing Manager's Models

The following chapters describe the four phases for developing and using a manager's model.

- Manager's Model – Phase I: Describing the context and framing the management issue—where do you start? (Chapter 7)

- Manager's Model – Phase II: Understanding the management system—questions leading to system definition through identification of constraints, limits/capacity, and opportunities (Chapter 8)

- Manager's Model – Phase III: Anticipating the management response—questions to aid development of preliminary impressions about fundamental objectives, enabling objectives, actions, stakeholder reactions and mitigation (Chapter 9)

- Manager's Model – Phase IV: Creating, critiquing and using the preliminary manager's model/concept map (Chapter 10)

The process assumes that the initial effort to develop a first-generation manager's model is an *internal* management team activity. The inclusion of partners and stakeholders in the earliest stage of situation analysis can be attempted, but adds complexity to the interactions of participants that may not be desirable initially. This is a judgment call, but it is usually desirable to have managers pulling together their own initial thinking ("getting their house in order") as a team before broadening the envelope of participants. Stakeholders are nevertheless an essential part of this stage of the process insofar as managers have personal knowledge, general socioeconomic and demographic data sources, or specific study results about stakeholders available to inform model development. Formal partners, such as state and federal agencies or NGOs, may be invited to participate at this early stage, depending on the relationships that exist, formal protocols that have been adopted, and comfort level of the management team. Whether or not to include partners in this initial process of situation analysis is a context-specific decision.

The end results of developing a manager's model are improved understanding of the management system and a comprehensive description of the system in a schematic concept map (e.g., Cmap™), along with text files, spreadsheets and PowerPoint files, as appropriate (Fig. 6.1; refer to Appendix B for additional examples). Keep in mind that diagrams such as Figure 6.1 are summaries or road maps to the content and logic of the manager's models; they are

Unicorn Management System
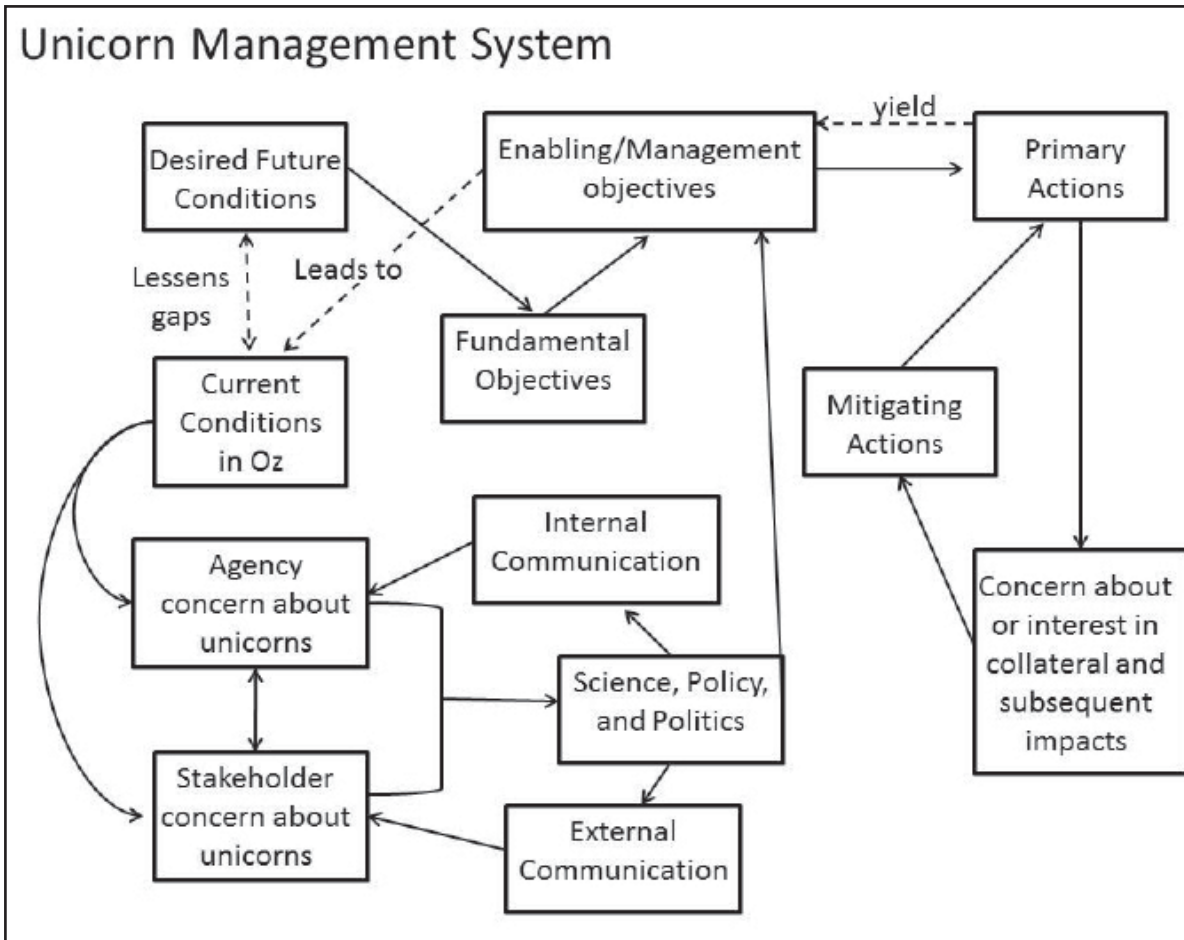
Figure 6.1. Concept map for Unicorn Management System

representations of the primary product, not the product itself. They have utility as communication devices, but *the purpose of developing a manager's model is not to produce a schematic, it is to improve understanding of a management system.*

6.3 Preparing to Develop a Manager's Model

6.3.1 Get Ready

Developing a manager's model seldom starts from scratch, although you may begin with a blank flip chart, clean white board or clear computer monitor at the outset. This can give the illusion that one is starting a thought process with a "clean slate." Though seldom put down in writing, conceptualizations of a management system, often quite rich and detailed, exist in the minds of the managers involved. You can be confident that most of the ingredients for a manager's model safely reside in the heads of managers. The process described in the chapters 7-10 is a means to

articulate these thoughts formally so they can be accessed, evaluated, and applied or elaborated on by others. The first step toward a productive process is to get the right set of people engaged in developing a manager's model.

What is the "right set" of players? That depends on the scale of the system you are describing—local management area (or park), in-state region, statewide or multi-state region (e.g., a flyway or regional network of parks, refuges and management areas). Consider including your agency's managers, biologists, researchers (ecological and human dimensions scientists), community-relations specialists law enforcement officers and education staff who have responsibility for the resource and geographic area being considered.

The management team (or supervisor with oversight for the team) needs to select someone to lead the effort. Experience has shown that a team leader for developing a manager's model can be most effective when working with two partners. One

assists in recording ideas on flip charts, allowing the leader to focus on the participants (team members) and process. In addition to the stand-up recorder, another individual captures the information and ideas associated with each section of discussion on a computer, enabling quick turn around of text products. Ideally, this person also is facile with a concept mapping software product, such as Cmap™ (available for free download at <http://Cmap™ .ihmc.us>), and attempts to build a draft diagram as the team discussion proceeds. Our experience indicates that this distribution of facilitating, recording and diagramming tasks allows smooth progress in the team discussion, efficient compilation of information produced by the team, and expeditious development of text files and a draft version of a concept map of the management system.

6.3.2 Get Set

Three activities can be valuable in readying a management team for development of a manager's model. The first is background reading,[3] the second is preparing an issue brief and the third is planning among process facilitators.

The issue brief should be no more than two pages long and contain the following:

- Brief title that describes the issue
- Species or natural resource of interest
- Management challenge or issue
- Management history
- Political history
- Policy history
- Research history and science available (ecological, biological and social sciences)
- Agency capacity vis-à-vis management of the resource

- Management team members with knowledge about this management system
- Names of those involved in preparing the brief

The brief is most useful if available at least two weeks prior to the first meeting of the team tasked with developing a manager's model.

Whether convening an existing program team or a new group formed specifically for purposes of developing a manager's model, someone needs to assume leadership for the model-development process. Experience has shown that it is highly advised to have an in-depth planning meeting facilitators and management team leader before starting the activity. The purpose of the meeting is to ensure common understanding of process steps and to identify potential obstacles that could distract the team.

The modeling team needs to be convened, whether for one intensive workshop over a few days or a set of meetings over a two-week period. If the multiple-meeting alternative is chosen, it is important not to stretch the process out over too long a time period -- no more than two weeks start to finish.

The team leader ensures unfettered participation by all members of the group. Participants should be willing to leave position within the agency's hierarchy or academic rank outside the door. Ground rules that support this should be agreed upon, and then group interactions must reinforce it.

Many agencies and organizations have established such ground rules for interaction of internal working groups and teams. Useful ground rules include:

- Every member of the group is equal for the purpose of model development,

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[3]Organ, Decker, Carpenter, Siemer and Riley. 2006. Thinking Like a Manager: Reflections on Wildlife Management. Wildlife Management Institute, Washington, DC. 106pp.

Articles *(recommended to read in order indicated)*:

Riley, Decker, Carpenter, Organ, Siemer, Mattfeld and Parsons. 2002. The essence of wildlife management. Wildlife Society Bulletin 30(2):585-593.

Riley, Siemer, Decker, Carpenter, Organ and Berchielli. 2003. Adaptive impact management: an integrative approach to wildlife management. Human Dimensions of Wildlife 8:81-95.

Enck, Decker, Riley, Organ, Carpenter and Siemer. 2006. Integrating ecological and human dimensions in adaptive management of wildlife-related impacts. Wildlife Society Bulletin 34(3):698-705.

irrespective of official rank in the agency or academic credentials.

- Group members will be civil and courteous in their interactions with one another—this is a professional undertaking where criticism and critique are useful insofar as it is constructively contributing to group learning, analysis and understanding.
- On occasion, it may be necessary for the team leader to contain or limit input from more enthusiastic members of the group to give others opportunity to contribute—sensitivity, patience and understanding of this need will be expected by all participants.
- In this model-development process, all information and insight are assumed to be potentially valuable. Experience is as valuable as scientific credentials of group members, and insight can come from many sources, including the naïve question of the least experienced member of the group.
- All suggestions are good ones, though they may not all be incorporated.
- Everyone's claims and suggestions are open to constructive critique, regardless of whose idea it is. No one should be privileged in this respect.
- The team leader for developing a manager's model is in control of the process, but not the content or outcome.

An agency may have additional cultural norms about teamwork to consider; incorporate those that will aid in ensuring an effective process. If some of the normative behaviors of your organization are counterproductive to effective teamwork, be clear about their inappropriateness for this process. Ground rules are shared up front, discussed as needed, and adhered to consistently.

6.3.2 Go! How to Get the Ball Rolling at your First Meeting—The "Art" of Asking Questions

One role of the team leader and engaged team members is to be continually inquiring—actively asking questions to reveal the assumptions, knowledge, biases and logic of management team members with respect to the issue at hand. Effective team leaders and members need to exercise the art of asking questions. Inquiring is essential to make progress. By being respectfully inquisitive with one another, a team more quickly can identify barriers and opportunities present in a management situation, as well as strengths of individuals on the team. This helps to:

- Identify individuals in a group who can facilitate group progress on a task, and those who might need extra attention to avoid creating delays.
- Identify individuals who have particular skills in a group so that they can be encouraged to put those to use for the task.
- Identify knowledge gaps that need to be filled as a prerequisite to progress.
- Gauge the diversity of abilities, knowledge, skills, experience and values that need to be orchestrated for a group to evolve into a team.
- Identify needed assets (expertise, legitimization, etc.) that will enable team development and task advancement.
- Identify barriers to communication (i.e., values inherent to different disciplines, specialized terminology of disciplines, variations in organization culture in a multi-agency group, etc.).

Inquiring also has to be approached with sensitivity to the individual, the group and the context to avoid awkwardness. Do individuals possess the self-confidence needed to respond? Is the situation in which a question is posed non-threatening? For example, avoid questions leading to technically "correct" or "incorrect" answers; instead surface observations and rationales for them. Often these kinds of responses can be finessed into contributions of insight more easily than questions leading to factual responses.

7 Describing the Context and Framing the Issue –Where do you Start? (Phase I)

7.1 Goals First? Probably Not...

The management team might be inclined to start development of a manager's model by referring to the existing goal for the management issue or referent resource, or by articulating a new one. This approach may have merit in some situations, but experience reveals that starting with an existing goal or creating a goal from scratch leads to constrained thinking or a focus on wordsmithing, respectively. We discuss how to start with either goals or "desired future condition", but our experience favors the description of desired future conditions over goals as a starting point. The team needs to use its judgment about which tack to take.

7.2 Goals

Despite our preference for starting the development of a manager's model with a discussion of desired future conditions, sometimes the timing is such that it may be prudent to start with review of a pre-established goal. Don't be surprised if discussion of a goal takes little time, but if the goal has not been well established beforehand or the relevancy of a long-standing goal has diminished, a great deal of time may be required. If preparatory work indicates that an existing goal is not broadly accepted or recognized, start at square one with desired future conditions (discussed below). If a goal has been identified beforehand, seek to clarify what it means to all team members and to gain assurance that the entire team is comfortable with it. The questions are easy:

- What is the goal for the referent resource?

Or, the team leader may ask...

- This is my understanding of the goal for "X" — is this your understanding?

When clarifying a goal, it is more important to surface the essential ideas than to have an eloquently crafted goal statement. Avoid lengthy group editing efforts because they can sidetrack you, but sometimes limited editing can reveal misunderstandings or differences in meanings that members of the team place on the words used. When people disagree about the appropriate word to use, it can signify semantic nuances or more fundamental differences in intent. The former is a minor inconvenience, whereas the latter can become a major issue if not dealt with satisfactorily. When the team has the essentials, depending on the words and phrases generated in goal articulation, it's ready to address follow-up questions, such as:

- What do we mean by perpetuate species X, improve habitat Y or avoid condition Z?
- What are we seeking when we say sustain species X, habitat Y or condition Z?
- What does it mean to manage for benefits associated with species X?
- What do we mean by providing benefits to people, society, citizens or stakeholders?
- Which people? All people? Formal, organized special interest groups? Stakeholders (people affected by species X, habitat Y or condition Z), whether organized or not? People who may not realize they have a stake?

An example of the line of questioning for a woodland caribou management system might be as follows: "What is the overall goal for caribou management?" The goal might be stated as "Long-term perpetuation of woodland caribou for the benefit of the species and enjoyment by people."

This might lead to the general follow-up questions, "What are the major components of that goal?" or "Let's deconstruct the goal and think carefully about what each key idea means in a practical or concrete sense." The specific follow-up questions to this end might be as follows:

1. What do we mean by "long-term perpetuation?"
2. What do we mean by "for the benefit of caribou?"
3. What do we mean by "for the enjoyment of people?"

All members of the team need adequate opportunity to state their views about desired outcomes of management or desired condition for the referent resource. A simple question, such as "What would successful management look like?" or "What would be a good outcome of management?," may be all that is necessary to stimulate a response. Whether answers flow easily or need prompting, such input from the team is needed to develop a model that depicts the manager's view of the system in which she or he works. (This input is feedstock for the identification of desired future conditions, discussed in the next subsection.) Clarity of communication is important here; words and their meanings matter. All team members should:

1. explain their use of terms,
2. understand terms being used by others,
3. use terminology in the same way, and
4. reveal important assumptions.

These clarifications are important for communication among team members, especially if they have different disciplinary backgrounds, and with partners and stakeholders.

Participants may speak of goals in terms that are not measurable, but for now that is acceptable. For example, it is fairly common for wildlife managers to envision desired outcomes of achieving the conservation goal for species X to be something like:

- Sustain species X as a component of the ecosystem and valued resource.
- Human-species X interactions on balance produce positive impacts (benefits) valued by residents and visitors.

The team can come back to add specifics later in the process when "fundamental objectives" and "enabling objectives" (sometimes interchangeable with "management objectives") are articulated. But first, after gaining concurrence about the goal of management of the referent resource, the management team describes the desired future condition they envision if the goal is met.

7.3 Desired Future Conditions

Even if a goal is generally known and accepted, discussion among managers addressing the question "what would the preferred future look like with respect to resource X" has proved effective in describing, largely in qualitative terms, what the team envisions as the desired future conditions (DFC) with respect to the wildlife resource. Such a description includes reference to the resource of interest, but also to the broader, typically coupled ecological and social components of the management system pertinent to that resource. Ecological and social components are all parts of the DFC. A team focused initially on exploring their ideas about desired future conditions keeps attention on "why" management is needed rather than "how" it will occur. In fact, for clarity when components of DFC are expressed, team members occasionally need to ask one another "why?" That is a powerful little question when it comes to understanding people's perspectives.

This approach—starting with team members envisioning the desired future conditions they'd like to see as a result of management—may end up reiterating a pre-established goal if one exists, but more often it results in embellishing the goal in

ways that contribute to an analysis of the gap between current conditions and the desired conditions (this gap idea is discussed later). We have found that describing DFC is a largely nonthreatening way to start eliciting managers' ideas about the context under consideration. Description of a desired future allows for longer, more colorful narratives than the typical one-liner goal statement managers have often been trained to write. A description of DFC is about more than the particular resource, it includes the coupled ecological and social components of the system in which the resource is situated (i.e., the context).

At minimum, a DFC statement usually describes habitat, wildlife populations and institutional changes, as well as human belief, attitudinal or behavioral conditions that managers want to achieve. General statements suffice as starting points for developing the DFC and, eventually, fundamental objectives (discussed later). With additional questioning and discussion, broad initial visions of the DFC can be sharpened as needed and framed in measurable terms.

7.4 Current Conditions

The management team turns next to describing the current conditions with respect to key elements or components of the DFC. Answer a question like:

> • What are the actual conditions existing on the ground at this time that will have greatest influence in achieving or maintaining the desired future conditions?

Responses elicited by this question take several forms. For example, a team might determine that the interactions between humans and a particular species of wildlife will have greatest effect on goal achievement for that species. But human-wildlife interactions have a variety of traits, so the team would need to dig a bit to reveal team members' understanding of the system. Using the human-wildlife interactions example, the team may identify several ways to describe interactions:

• Intended and unintended

• Direct and indirect
• Involve people, pets, property, motor vehicles, etc.

With probing, the team may learn it is not interactions with wildlife per se as much as the impacts people experience or otherwise perceive from their interactions that are the concern. Impacts to people that the team might identify can be:

• Positive and negative
• Tangible and emotional
• Different categories or types (e.g., health & safety, economic, aesthetic, psychological, ecological)

Impacts of human-wildlife interactions on people might result in:

• Behavior change (avoiding outdoors)
• Change in the way wildlife are valued
• Change in acceptability and preferences for management objectives and actions

Impacts of human-wildlife interactions on wildlife that the team has observed or anticipates may include:

• Behavior change in the presence of humans (e.g., habituation)
• Change in habitat use/home range/ movement patterns
• Mortality/population level effects

7.5 Assumptions and Operating Premise(s)

Often a useful exercise at this early stage is to elicit the team's operating assumptions and premise(s). Fortunately, as part of the process of articulating future conditions or outcomes desired, managers almost always state pragmatic limits and bounds, such as:

> *"Some negative impacts on humans will be an inevitable consequence of sustaining a viable population of species X. Therefore, identifying and achieving an acceptable mix of positive and negative impacts will significantly influence social support for the perpetuation of a viable population of species X."*

Such statements are revealing, because they inherently indicate assumptions, knowledge limitations, or biases. Probing for more detail and explanation helps

ensure team members are all working from the same assumptions and premises. For the example statement above, clarifying questions might include:

- Which negative impacts?
- Why is this an inevitable consequence?
- What mix will be acceptable?
- What will social support look like?
- How do we know this?

In practice, making explicit statements about one's premises is done infrequently. One way to facilitate this kind of thinking is to consider questions such as:

- What are the important beliefs that managers hold with respect to achieving conservation goals for the referent resource in the particular context?
- How confident are they in the underlying assumptions and knowledge foundation upon which their operating premises are based?

Here's an example of an operating premise described by one team of managers:

"The agency conservation goal for black bears inevitably relies on residents' positive regard or tolerance for bears, which is contingent on ensuring an acceptable mix of benefits versus costs of presence of bears."

Even when not stated as explicitly as in the example above, assumptions and premises often are revealed by the reasoning demonstrated in discussion. The astute team leader can infer assumptions and premises from team discussion, state these in his or her words, and then verify them with the team, seeking critique of his or her interpretation ("Now do I have this right?"). This approach is often more effective than the direct approach ("So, are you telling me…?"), which may more easily be construed as a challenge to the validity of an individual's perspective.

7.6 Synthesizing, and Summarizing, Checking and Reinforcing Understanding

This is a good place in the process to begin to emphasize the important role of synthesizing, summarizing and articulating the team's understanding of components of the manager's model as they are developed. For example, before moving on to the next activity of assessing gaps between what is present and what is desired, the team's collective input on the current conditions can be restated, preferably in summary fashion. This serves as an opportunity to reinforce information, concepts and aspirations the team has identified.

7.7 Perceptions of Needed Change—The "Gap" Between Current Conditions and DFC

The primary purpose of focusing on desired future conditions (or goals), current conditions, and the accompanying line of questioning is to encourage members of the management team to express why they are managing the species, habitat or natural resource condition of concern. After that purpose is established with some clarity and perhaps with consensus, the first broad question can be asked:

- What do you think needs to be different to achieve the desired future conditions or goal?

Or, put another way:

- What aspects of the current conditions need to change (or be maintained) to achieve the desired future conditions or goal?

Using both questions helps keep the discussion moving.

Put simply, the gap between "what is" and "what is desired" represents the management need. It is useful to flesh out and compare the current situation (or projections about the direction the current situation may be headed) to the desired future conditions. If these are disparate, the indication for management is apparent.

Current Conditions (e.g., actual status of wildlife population, human-wildlife interactions and impacts occurring)	Evaluated with respect to…	Desired Future Conditions (e.g., desired status of wildlife population, human-wildlife interactions, and impacts experienced)

Upon probing, the reasons for gaps between current conditions and DFC may be identified as being of ecological and/or anthropogenic origin. For example, in a wildlife management system gaps might be due to:

Natural conditions and processes affecting human-wildlife interactions

- Species population size/density
- Species home range/movements
- Predation
- Changes in stages of plant succession
- Climate
- Disease

Anthropogenic conditions and processes affecting human-wildlife interactions

- Predator control
- Habitat fragmentation/habitat change (development) and other landscape-level alterations (e.g., logging, agriculture, water diversion and impoundment)
- Habituation or co-tolerance of people and wildlife to one another
- Vehicle-caused mortality
- Intentional mortality, legal or illegal

The activity of "gap analysis" (i.e., comparison of the current condition to the DFC) often stimulates teams to express concerns. Less frequently, opportunities are revealed. The next chapter discusses this important phase of the manager's modeling process.

8 Defining Your Management System (Phase II)

8.1 System Definition Through Identification of Concerns and Opportunities

This phase of the process may in large part be a review of the team's discussion about current and future conditions and reasons for the gap between them. It is likely that a good deal of the content sought here has been recorded during previous discussion, but the team needs to be prepared to probe further to be thorough. Productive discussion that results in improving understanding of the management system typically requires considerable guidance and prodding to flesh out existing ideas, reveal new ideas, tie pieces of expressed thoughts together, separate fact from assumption or opinion, etc. In addition to asking probing and clarifying questions of one another that keep the team's discussion moving in a productive direction, reflection and verification are also helpful. The team leader needs to exploit opportunities that arise or create opportunities to pause discussion, provide summaries of group input, and allow the team to critique them. This is a low risk (to team members) technique to encourage reflection and analysis by the team. Using this technique, the team gradually refines how they describe their collective understanding of the management system in which they are operating.

The next subsections discuss concerns, constraints and limits/capacities. The ideas generated by the team about these traits of the management system are captured in projected computer images, tables or spreadsheets of the type found in Appendices E and F. These are useful aids for capturing ideas and building them out in a team process. Though "low tech," from experience we've found that flip charts are more flexible and have greater utility than computer projection for the work we describe below. Nevertheless, an assistant should be capturing ideas simultaneously on a computer. That practice leads to greater efficiency when compiling and synthesizing input later on.

8.2 Identifying Concerns Held by Managers and Other Stakeholders

The disparities revealed between desired and actual conditions typically lead to expression of concerns identified either by agency staff, partners (e.g., other agencies, local government officials, or NGOs), scientists not employed by the agency (e.g., academic researchers, consultants) or other stakeholders. Although this process produces useful material for creating a manager's model, sometimes managers skip careful "gap analysis" (i.e., systematically comparing actual versus desired conditions) and gravitate toward expressing their "concerns" or those that have been made known to them by other agencies, partners, NGOs, or individual stakeholders. This tendency can be used constructively to stimulate discussion helpful for generating grist for a manager's model. That is, after sufficiently discussing goals, DFC and current conditions, the team might address the general question:

> • What are your concerns with respect to achieving the goal or desired future conditions?

In most situations, this question gets the discussion rolling, often covering a great deal of ground and continuing under its

own momentum. This fills time, but is unlikely to be as productive as discussion facilitated by questions from the team leader. Even though an unaided discussion among some team members may be animated and sustained, all team members should have ample opportunity to participate and be encouraged to do so; one or two people shouldn't dominate the discussion.

Examples of the kind of concerns one might expect to surface from different perspectives can be illustrated by the following set of concerns about restoration of a large carnivore—Florida panther.

Agency concerns *(Florida panther example)*
- Maintain natural processes
- Significant anthropogenic effects on wildlife population, which can be either positive or negative, (e.g., land-use change)
- Increase to "overabundant" status: interpretation of impacts, implications of overabundance for social acceptability of panthers and expectations for management

Stakeholder concerns *(Florida panther example)*
- Homeowner costs (exclusionary fencing to protect pets from predation)
- Livelihood threat (small livestock producers)
- Predation on deer or hogs (i.e., species that are hunted)
- Increased "naturalness" of property—amenity value

Shared concerns *(Florida panther example)*
- Human safety (wildlife-vehicle collisions, disease transmission risk, collateral impacts from increased panther populations)
- Desire for wildlife viewing

Of course, the similarities in expression of concerns by professionals and stakeholders may be influencing one another as a result of communication between them. Conversely, differences in perceptions among and between agency professionals and stakeholders can create another kind of "gap" having potential to create tension and controversy. Analysis of the reasons for considerable differences in perceptions may be warranted.

Follow-up questions that help bring to light various aspects of concerns take several forms. Don't build off vague notions; seek clarity. Also judiciously insert the powerful three-letter question, "Why?" We suggest using questions such as:

- Are there conditions on the ground (in the field or office) that make you concerned about reaching the goal or desired future condition for "X"?

- Concerns about species X? Why?
- Concerns about habitat or area Y? Why?
- Concerns about people (individuals, grass-roots groups, NGOs, local governments, or state and federal agencies)? Why?

- Are you concerned about…

- The state of scientific understanding (biology, ecology or human dimensions)? Why?
- Public policy constraints or opportunities? Why?
- Political landscape with respect to the conservation goal? Why?
- Internal communication needs—do staff of the agency really understand the problems and constraints? Why?
- External communication—do stakeholders, commission members, elected officials, etc. really understand the problems and constraints? Why?

- Can you initiate or sustain management actions you think are important?

- Is cost an issue? Why?
- Is local community or broader social acceptability a likely impediment? Why?
- Do you anticipate people will try to stop you because of their concern about anticipated secondary (i.e., collateral and subsequent) impacts? Why?

A few additional questions that may help diagnose the situation and describe the management system include:

- Is the positive or negative concern (expressed as an impact) physical or emotional, widespread or isolated?
- Are stakeholder concerns widely disparate from agency concerns?
- Are stakeholder concerns widely disparate from one another?
- Who in agency or which stakeholders are concerned?
- What is the relationship between agency and stakeholders; i.e., who is influencing whom?
- What types of impacts need to be addressed?

An example of the line of questioning about needed change or concerns can be illustrated again with reference to management of Florida panthers. The general question might be: "What is it going to take to meet the goal or achieve the desired future condition?" Specific follow-ups to that question might be:

- What existing habitat conditions are you going to have to manage/change to meet the goal or achieve the desired future condition? Why?
- What existing panther population conditions are you going to have to manage/change to meet the goal or achieve the desired future condition? Why?
- What human beliefs, attitudes or behaviors do you have to manage/change to meet the goal or achieve the desired future condition? Why?

A guided discussion around the preceding questions produces a great deal of raw material, but often requires "processing" to get the most value and insight out of the discussion with respect to understanding the management system. Some simple tools to accomplish this include lists, figures and spread sheets that organize input.

8.3 Identify Relevant Science, Policy and Socio-Political Constraints

One might categorize constraints in many ways, but available science, existing policy and current socio-political considerations are common categories of constraints in management that often contribute to concerns expressed by managers and stakeholders. (Fig. 8.1). Incomplete and sometimes erroneous understanding of these components of the management system is fairly common for agency staff, partners and stakeholders. Frequently, some members of an agency management staff do not understand the politics of a situation and the ramifications of ignoring the socio-political context that agency leaders must consider. Lack of awareness and inaccurate interpretation of what is known in these three inter-related spheres can lead to misunderstanding and misperception of the management system, and possibly cause strife within the agency.

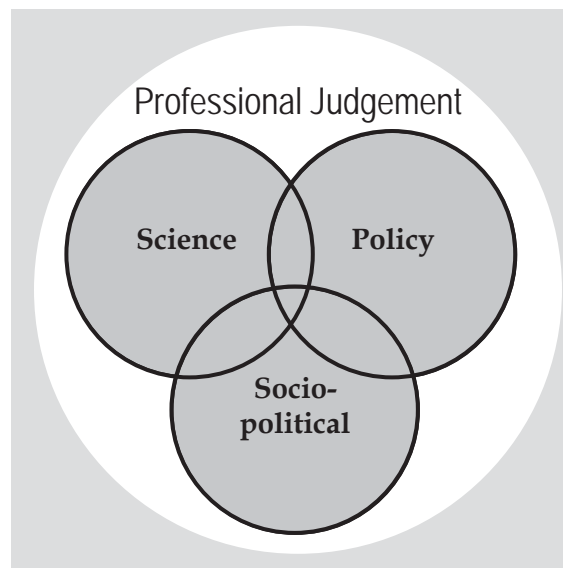**Figure 8.1.** Constraints and information sources

Managers' understanding of the three components—science, policy and socio-political considerations—is typically characterized by a great deal of uncertainty, as well as some missing parts. Key shortcomings will need to be filled in with more science, new or modified policy, improved political support or, quite often,

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by professional judgment of managers. Thus, it is important for the management team to evaluate their perception of the gap between actual resource conditions and desired future condition with respect to:

    a) policy vis-a-vis goal for referent resource,

    b) available science (biological and social),

    c) socio-political climate vis-a-vis agency and species acceptability,

    d) preponderance of professional judgment.

    The team should discuss why constraints it identified exist and how, specifically, they are constraining the system from operating in a way that is more conducive to effective conservation and management. What this analysis reveals may help the group move from identifying a situation to understanding it.

    Managers building a management system model address the following kinds of questions with respect to constraints on the system:

- Based on professional experience, what do we know about the biological and social components of the system?
- Is the information available to managers adequate to understand the need for agency intervention?
- Is our science information base adequate to evaluate effects of management decisions on wildlife, habitat or people? – identify gaps (biological and social)
- Are current policies adequate to attain desired conditions?
- Is the political climate supportive? Is it stable or likely to change?
- Do we need to establish partnerships or coalitions to support a management strategy or implement management actions?

    The result of such evaluative discussion focuses on topics and questions such as those outlined below with respect to a hypothetical large herbivore species with potential for severe plant impacts in a protected area and nearby human communities:

Needed scientific information (species X)

Biological
- Population density, predation, habitat quality, home range
- Species X population & habitat monitoring, assess health/reproduction
- Comparisons of conditions on public and private property
- Species X vehicle collision data
- Number of depredation permits authorized/successfully used

Sociological
- Demographic characteristics and motivations of natural area visitors
- Community demographics
- Attitudes of local residents regarding species X
- Numbers of people in community who support lethal control
- Tradeoffs regarding timing of management action and peak tourism season
- Attitudes of locals about the agency with respect to wildlife management

Needed policy information (species X)
- Policy of State regarding species X needs illumination
- Park policies regarding managing human-induced mortality of wildlife that's negatively affecting park resources—does State Park designation where species X is found preclude hunting in park? Are external pressures leading to species X using protected areas as refugia?
- Firearm discharge restrictions in adjacent town and village

Needed political information (species X)
- Regional vs. state level perspectives on importance of primary and potential collateral and subsequent impacts
- Level of agency staff engagement with local government or homeowner and community associations. Is it the agency's desire to work with the local community?
- Working relationships with community organizations
- NGOs—positions regarding regulated hunting/support of policy?

- How strongly does "Right to hunt" factor into decision in this geographical context (many areas open to hunting in the state—scale issue)?
- What do local residents think and feel about agency engagement? What is their perspective on agency-community relations?

A constraints discussion is likely to flow naturally into or reveal what managers regard as limits and capacities of the system. Although we discuss these concepts in the next section separately, in practice these often blend into the discussion of constraints.

8.4 Limits and Capacity

A team's descriptions of current condition and prospects for the future must be tempered by adequate analysis of the limits and capacities of the management system under consideration. This reality checking is essential for team members to grasp the challenges that the system's limits and capacity constraints present if they hope to overcome them.

The science, policy and socio-politics discussion contributes to limits and capacity revelation. But additional considerations to address include:

- What are current and projected staffing needs (numbers and kinds of expertise)?
- What external sources of expertise are readily available? Do we have relationships established with them and mechanisms in place or available to leverage them?
- Do we have the right partners?
- Do we have adequate stakeholder relations?
- Do we have effective stakeholder engagement processes?
- Are jurisdiction issues a limitation? If yes, can they be overcome?
- Do we have the institutional culture and will to make a difference in this issue at this time?
- In what areas do we have the capacity as an individual agency or in collaboration with others to really make a large and lasting difference?

8.5 Opportunities

During a management team's evaluation of the system, look for opportunities to be identified, even if the focus of discussion is ostensibly on constraints, limits and capacity. Capture the identified opportunities whenever they surface, to be discussed more fully at a later time if not immediately. The saying, "in every problem there is an opportunity" may be an exaggeration, but often there is some truth in it. For example, if a limitation in partnering with another agency or an NGO is identified, but this entity has interest in the issue, relevant expertise, or other assets of value to management of the referent resource, useful questions might be:

- How can you turn the current need for expertise (or other resources) into motivation for developing a lasting partnership?
- How do we capture the interest, build confidence and develop trust of people with a stake in this management issue who are novel to us?

8.6 Reality Check

At this point it is advisable to have a reality check. Pause to assess general management feasibility. A set of focusing questions may be of assistance:

- Which of the concerns can reasonably be expected to be influenced by management programs the agency might engage in? Which can't?
- What are the implications for rethinking agency involvement?

Depending on the answers to the foregoing questions, the team may reconsider the scale at which they are thinking about the management issue, particularly with respect to the scale they can operate within. Some management issues are simply too big from a jurisdiction, capacity, science or policy perspective. On the other hand, some big problems have embedded elements that might be meaningfully addressed, as long as expected impacts from the agency's program interventions are on

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a scale consistent with the constraints the agency must work within.

Part of a reality check will be assessing the effects and impacts that the team feels the agency should affect or create. These flow from the gap analysis between current conditions and desired future conditions identified earlier. The concerns expressed typically reflect some of the impacts of interest.

> - For the concerns that the agency feels it can address, what are the impacts desired from the management system?

Often a management team realizes that some aspects of the management system in need of improvement reflect knowledge or skill deficiencies in staff or others. The question to ask is:

> - Which concerns can be addressed through training, education and informative communication with agency staff, partners and collaborators, or various stakeholders?

With answers to this in hand, the next logical question is:

> - Who is best suited to provide such an intervention?

The answer to this question often surfaces frustration with the agency's limited capacity for strategic, effective education and informative communication. Focus discussion on the question of "who can" rather than "who hasn't" or "who can't" develop and implement an effective intervention.

> **Note:** If you cover topics in Phases I and II (i.e., Chapters 7 & 8) in one session, you have done well. Take a break! It's time to synthesize and organize the team's input thus far into a diagram with accompanying text files.

9 Anticipating the Management Response—Your Professional Impressions about Objectives, Actions, Reactions and Mitigation (Phase III)

9.1 Start with a Review of Your Partial Model

Assuming that a break has occurred—a day, a week or longer—since the management team worked on the first two phases of the manager's model, you can start Phase III by first reviewing the manager's model developed thus far. This process is aided by a diagrammed partial concept map (Figure 9.1). Following this review, the management team should turn to elaborating fundamental objectives.

9.2 Fundamental Objectives

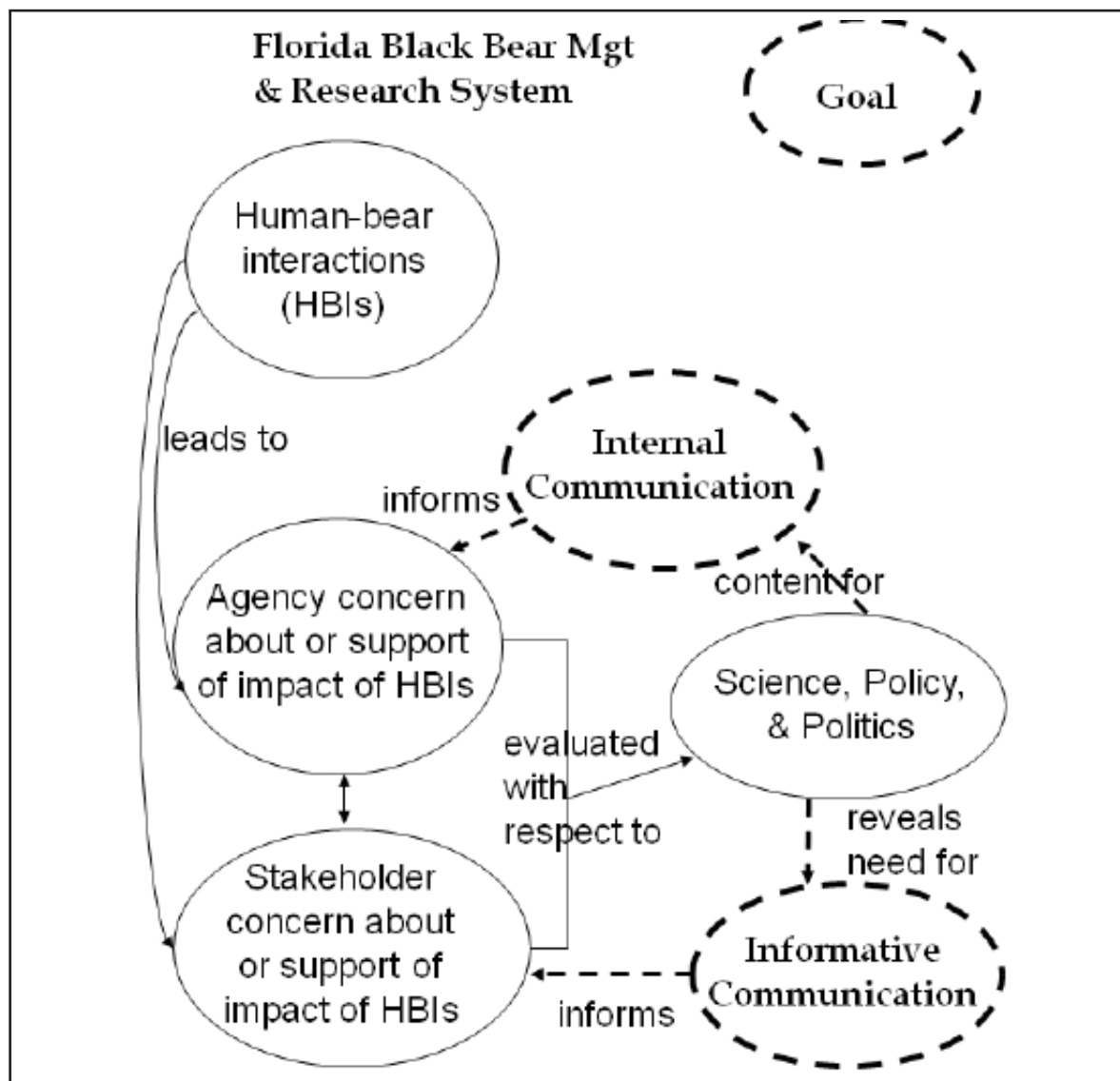Grist for articulating fundamental objectives may come from the discussion about

Figure 9.1. Partial concept map for manager's model of Florida Black Bear Management and Research System.

desired conditions versus existing conditions, stakeholder expectations, limits and capacities, etc. A fundamental objective is a statement about a condition the management team wants to reach or maintain. Though stated qualitatively initially, preferably a fundamental objective is quantifiable, with a timeframe identified for accomplishment. A fundamental objective is more specific than a goal or desired future condition. Accomplishing (or progress toward accomplishing) a fundamental objective or set of such objectives (often more than one fundamental objective is associated with a DFC, broad goal or mission) should contribute to achieving your DFC, broader program goal and agency's mission. These are nested constructs.

For example, using Florida panther management as a referent:

Goal: Long-term perpetuation of Florida panthers for the benefit of people, consistent with natural ecological processes.

Desired future conditions (for achieving panther conservation goal):

- Three geographically distinct, self-sustaining, healthy populations of Florida panthers, in protected habitat, widely appreciated by Floridians.

Fundamental objectives:

- Establish two additional, self-sustaining populations of Florida panthers within 5 years, for a total of three populations (i.e., 2 more in addition to the current population).
- Protect three areas of adequate, quality habitat for Florida panthers from net loss of area and quality, beginning 2008.
- Maintain acceptable impacts of Florida panthers on people, companion animals and livestock.
- Reduce anthropogenic sources of mortality on Florida panthers by 50%, from 30/year to 15/year.
- Balance benefits for people:
  o Increase interactions that result in positive impacts (e.g., viewing opportunities) and cultural value of Florida panthers (increase positive interactions, using 2008 baseline, at least 500% by 2012).
  o Decrease interactions that result in negative Florida panther-related impacts of various kinds (decrease negative interactions, using 2008 baseline, at least 50% by 2012).

Managers often do not see value in spending a great deal of time and effort refining measurable fundamental objectives. Nevertheless, this effort is an important prerequisite to describing enabling (management) objectives and subsequent actions. Lack of attention to fundamental objectives has led to time and money spent on activities having little positive effect on a DFC. Sometimes the process of developing enabling objectives, discussed next, helps to refine fundamental objectives. Taken together, work on objectives of both kinds is an iterative process.

9.3 Articulate Enabling or Management Objectives

Enabling objectives, sometimes called management objectives, describe the necessary condition changes or condition traits that enable achievement of a fundamental conservation objective (i.e., a significant component of desired future conditions). Enabling objectives give direction to specific actions and interventions that an agency and its partners might undertake. These are called "enabling objectives" because, if accomplished, they would create changes in current conditions that would move the management system closer to DFC. Put another way, achieving enabling objectives collectively enable achievement of fundamental objectives. Thus, enabling objectives cannot be developed without reflection about the fundamental objectives and the gap between "what is" and "what is desired," described earlier.

Enabling objectives vary in terms of focus, such as plant or animal population parameters, habitat characteristics, behavioral change of both people and wildlife, modification of risk perception, etc. It is common to identify a suite of several enabling objectives that are needed to achieve one or more fundamental objectives (see example

in Appendix F). Such objectives should be realistic with respect to available science and policy, as well as the political realities of the situation. Questions for a team to consider when developing enabling objectives include:

- What are the necessary conditions that contribute to achievement of the fundamental objective for the resource of concern (e.g., species X)?
- What is the current status of these conditions?
- How amenable are these to influence through management action/intervention?
- How well recognized are these conditions by agency and stakeholders?
- Which citizen input, involvement, and participation processes would contribute to developing socially acceptable enabling objectives?

Articulation of enabling objectives includes reference to specific outcomes that enable achievement of the fundamental conservation objective. Failing this connection, the enabling objectives are not appropriate avenues to achieve the fundamental objective, even if that conclusion flies in the face of agency tradition and professional convention. As mentioned earlier, often a suite of conditions need to be addressed, requiring multiple actions.

For example, management of double-crested cormorants in the eastern basin of Lake Ontario in New York State, where these birds congregate in great numbers and consume innumerable smallmouth bass has ecological, economic and cultural dimensions. One fundamental objective is to "promote the economic vitality of local communities in the basin." Enabling objectives include:

- maintain the recreational fishing base at acceptable levels (i.e., keep smallmouth bass anglers happy) by reducing the cormorant productivity
- develop interest in cormorant viewing, especially the large colony of cormorants on Little Galoo Island

9.4 Identify Set of Candidate Management Actions or Interventions with Potential to Contribute to Objective Attainment

Wildlife managers tend to be action oriented. They have a propensity for "doing something," an action bias usually directed at manipulation or regulation of habitat, wildlife populations, or human interactions with these components of the management system. Many wildlife managers are prone to jump to this step very quickly in management thinking, perhaps after only cursory attention to other aspects of the management system discussed thus far. That tendency must be resisted.

In addition to jumping to action, managers sometimes rely on favorite actions that they have used successfully in the past and are comfortable prescribing because of their familiarity. The practical warning credited to psychologist Abraham Maslow comes to mind here: "If the only tool you have is a hammer, every problem looks like a nail." Simple prescriptions tend to indicate lack of effort in describing the full complexity of an issue and the management system in which it is situated. In our experience, this tendency to jump too quickly to action (prescribing solutions to problems that have not been adequately analyzed) is minimized by encouraging the discussion we have outlined above *prior to considering actions*.

But in due course, management teams must turn attention to "doing something!" Management actions are the primary operational activities designed to achieve enabling objectives (refer to Appendix F for an example of linking enabling objectives and management actions). These actions, or "interventions," can draw from a broad stock of possibilities, including some novel or original additions. A simple conceptualization of management intervention possibilities has three types:

- *Active management:* Deliberately applying interventions (one or more actions) to influence the environment, species of interest, or humans in a particular, purposeful way, based on decision-making criteria.

- *Passive management:* Deliberately withholding from intervening in the system, based on explicit decision making criteria, because of evidence that a trend or pattern of existing influences on the environment, species of interest, or humans is moving the system in a way consistent with management objectives (*which might include "letting nature take its course"*) or satisfaction with current state of the system.
- *No management:* Exerting no influence on the management system, not because of any analysis and related decision-making criteria or process that indicates this is the best approach for objective achievement, but because of resource (funds, expertise, etc.) limitations, policy, political considerations or other reasons.

Examples of active and passive management of natural and social processes include:

Active management of:
- Natural system elements—mechanical and chemical removal of invasive species that could negatively affect species X habitat.
- Human system elements—educational and informative communication, regulations, incentives, physical barriers, etc.

Passive management of:
- Natural system elements—Allow natural fire events for restoration of habitat.
- Human system elements—Allow developing social stigma around particular forms of outdoor recreation to grow without comment.

Actions can be directed towards the following traits and more:
- stakeholder beliefs, knowledge, attitudes, risk perceptions
- stakeholder behavior
- local land-use policy
- species X population (size, distribution, location, genetic vigor, etc.)
- species X behavior
- species X habitat

Continuing the cormorant example, actions associated with the two enabling objectives might be:

E01: Reduce cormorant productivity
    Actions: a. cormorant egg oiling
            b. cormorant nest destruction

E02: Develop cormorant viewing opportunities
    Actions: a. install web cam in colony on Little Galoo Island
            b. develop ecotourism facilities and promote them

When thinking about management actions, one might ask the following questions:

- Which actions are currently being implemented?
- What is the history of actions (pros and cons)?
- What is acceptable or perhaps required given current policies?
- Is your agency or are other agencies, local governments, NGOs, private individuals, groups of stakeholders (e.g., landowner cooperatives) or the private for-profit sector in the best position to take action?
- What resources are available (staff, expertise, funds)?
- How effective and/or efficient are potential actions? Do they complement or contradict other regional efforts?
- What are the collateral and subsequent impacts of potential actions?
- What are the tradeoffs between benefits expected and collateral and subsequent impacts created?
- Do stakeholders and the agency understand the nature of these tradeoffs of actions?

Note: Experience has shown that this is another logical point to take a break because of the tendency to skim through the work described next. Consider whether it is better to pause and then come back fresh.

9.5 Develop Criteria for Action Evaluation

A topic often overlooked in creating a management system model is the set of formal or informal criteria that managers use to evaluate an action. Here we don't mean just progress in meeting an objective (i.e., effectiveness). Instead, we are talking about criteria that largely evaluate the assumptions made when selecting the actions, achieved with simple questions such as the following:

- Effectiveness?
- Efficacy?
- Difficulty for staff or contractor to implement, including hazards and technical challenges?
- Compatibility with other actions?
- Predictability of result?
- Durability and reliability of equipment or processes?
- Stakeholder acceptability?
- Cost?
- Humaneness?
- Type, magnitude and predictability of collateral and subsequent effects and impacts?

Thought should be given to what actions might be taken in the event interventions are not living up to expectations.

9.6 Nature and Extent of Likely Collateral and Subsequent Effects/ Impacts of Primary Actions

Management actions/interventions can have collateral and subsequent effects and impacts (e.g., economic, ecological, etc.), in addition to the primary impacts to which the actions are directed. In most cases, an intervention will have both collateral and subsequent effects. The distinction between collateral effects (occurring at same time) and subsequent effects (occurring after management objectives are achieved) is useful because they may require different timing of mitigating actions, different partners, and different communication to stakeholders, partners and internal agency staff.

Collateral and subsequent effects can be either positive or negative. The latter outcome, if significant to stakeholders (i.e., becomes an impact—an important effect of management concern), often requires mitigation to make the primary action socially, economically, and biologically acceptable. Consider these two questions:

- What are the anticipated collateral and subsequent effects/impacts of the primary actions?
- Can the collateral and subsequent effects/impacts be reasonably mitigated?

Collateral or subsequent impacts do not occur in a vacuum; someone needs to be affected for an impact to occur. As part of this exercise, affected stakeholders are identified. Managers need to evaluate the extent to which a new set of people are likely to become stakeholders in management as a result of management. By new, we mean people not affected by the impacts of primary management concern, but those affected as a consequence of the management actions. For example, in urban-proximate parks, wildlife managers may adopt a hazing program to disperse bears from campgrounds and picnic areas. This may effectively reduce negative interactions between the problem-causing bears and campers or other park visitors, but:

- if the hazing program upsets campers and other visitors who do not understand the reason for managers' actions and only see the effort as harassing the "poor bears," a *collateral impact* is created that needs to be mitigated; or
- if the bears move to raiding trash receptacles and invading homes in an adjacent community, a set of *subsequent impacts* is created by the action. And, a set of secondary stakeholders in that management action arises.

Thinking ahead about and articulating expectations for these sometimes cascading effects of management actions is a key element of a manager's model, and reveals some of the more challenging aspects of comprehensive management thinking.

9.7 Identify and Evaluate Mitigating Actions to Lessen Negative Collateral and Subsequent Impacts of Management Actions

As an exercise to support proactive program development, managers identify which secondary actions might be necessary and available to them to mitigate negative collateral and subsequent impacts from primary actions that may be used in a management program. The questions asked about mitigating actions are essentially the same as those asked with respect to the primary actions:

- Which mitigating actions are currently being implemented?
- What is the history of actions (pros and cons)?
- What is acceptable given current policies?
- Is your agency or are other agencies, local governments, NGOs, private individuals or collectives (e.g., landowners or landowner cooperatives) or the private for-profit sector in the best position to take action?
- What resources are available (staff, expertise, funds)?
- How effective and/or efficient are potential actions?
- What are the additional collateral and subsequent impacts of potential mitigating actions? (That is, be careful to identify the potential for cascading effects in the biological, ecological and social realm that can spin out of control.)
- What are the tradeoffs between benefits expected and additional impacts created?
- Do stakeholders and the agency understand the nature of these trade-offs of actions?

One can envision being caught up in a never-ending spiral of impacts → mitigating actions → additional impacts → etc. This is avoidable by the application of common sense. The trick is to have subsequent iterations of mitigating actions result in lessening additional negative effects, hopefully quickly reaching the point of "enough" mitigation. A key point is that the "best" primary actions cannot be determined without considering the collateral and subsequent impacts expected and the mitigation needed to make those impacts acceptable to the agency, partners and stakeholders. Is mitigation possible, and at what cost? Answers to these questions are part of describing the management system.

Note: Completing the discussion around topics and questions indicated above in Phase III marks another logical point for a break in the process of developing a manager's model.

10 Creating and Critiquing Your Preliminary Model (Phase IV)

10.1 Introduction

Creating a visual depiction of the manager's model is a combination of art and technique. A diagram, called a concept map, and the indexing of relevant files to each component of the concept map, have multiple benefits for communication purposes. Using computer software of some type (e.g., Cmap™ software[4]) can be an essential organizational and communication tool.

After a manager's model and accompanying concept map are drafted, the management team should review them and seek review by others (other agency colleagues, partners, selected stakeholders, etc.). The review occurs within a reasonable time period following development of the first-generation manager's model and is directed toward ensuring it is a consensus representation of the team's view of the management system. This usually means the concept map may not be "exactly right" for anyone on the team, but will be "right enough" for everyone to feel comfortable working from it.

We strongly recommend that the management team does this review together, in a face-to-face meeting. Our reason for this harkens back to one of the primary values of the concept map—to facilitate communication. A discussion among team members about the quality of their model and concept map is more beneficial than individual team members sending e-mail comments to one another. Pulling the group together for

this purpose may not be possible, no matter how desirable, but we encourage you to try.

10.2 Seek Internal Review of Your Model

After developing a draft manager's model and associated concept map that the team is reasonably satisfied with, it is advisable to seek review by individuals in the agency who were not involved in its development. This will mean one or more members of the team taking the time (about 1.5-2.0 hours) to explain the model to other people. Feedback and critique are sought in this process. Purposes of feedback minimally include the following:

- Reviewing the assumptions, premises and logic of the model.
- Reviewing the comprehensiveness and completeness of the model.
- Testing the value of the model in explaining the management system—is it an effective communication device?
- Developing one or more colleague's understanding of the system.

Results of the review are communicated back to the entire team (in the event some members are not present during review by others), and ideally a follow-up meeting with all the reviewers and team members is held to discuss how to incorporate the feedback received. This is helpful both for improving the management system model

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[4]Some people will not like the concept map approach; it's simply not the way they prefer to present or receive ideas. For those colleagues who don't like the chart as a tool for conceptualization, we have found utility in describing it as a "table of contents" for the various lists, narratives, illustrations, graphs and other materials that emerged from the discussions. In fact, the Cmap™ performs that function, by providing links to relevant files, organized by their relationship to components of the Cmap™ figure. The use of a PowerPoint presentation that has extensive narrative may be a good compromise.

and for widening the communication network about the management system, the program and the process of developing a manager's model.

10.3 Using the Manager's Model and Concept Map

The completed manager's model and concept map have several potential immediate uses: (a) identification of communication needs, (b) identification of information needs (including literature review, primary and secondary research, etc.), and (c) determining monitoring and evaluation needs.

10.3.1 Identify Need for Internal or External Communication

As noted earlier, frequently the basis of concern about a natural resource issue reflects lack of knowledge about some aspect of science, policy or politics. This can be true for staff within your agency as well as external partners and other stakeholders. One may encounter deficiencies in any of the following areas:

- Agency staff understanding of the management environment
- Stakeholder awareness of a concern
- Stakeholder knowledge about the management environment
- Stakeholder misperceptions (e.g., about species X ecology or agency mission/mandate)

The following diagnostic questions aid the team in evaluating the basis of concerns and also help in determining the need for informative communication:

- Does the assessment of the science, policy, and political climate need to be interpreted internally within your agency? Is consistency of interpretation a problem?
- Is stakeholder knowledge of agency mission/mandate adequate?
- Is stakeholder and agency knowledge of the status and ecology of the resource of concern adequate?
- Are the differences in agency and stakeholder perceptions of impacts known?

- Are learning characteristics, participation preferences, and relevant interests (stakes) of stakeholders known?

Internal Communication Needs (examples)

Some internal communication needs that may be uncovered and merit attention include:

- Staff possess broad range of knowledge and ideas about the ecology of species X, but they may need to understand variability of responses of species X to the different conditions that exist in an area of management focus.
- Knowledge of state and federal laws and regulations, as well as local ordinances, and how they affect management response.
- Understanding of jurisdiction vis-à-vis state, federal and local governments.
- Distinction between agency policy and personal opinion of professional management staff — implications for interagency and community relations.
- Importance of collaboration with other agencies, landowners, and communities to co-manage species X to enhance broader conservation goals.
- Tradeoffs of action vs. inaction with respect to costs (money, people, public relations/trust, short and long-term, natural resource integrity).

External Communication Needs (examples)

- Identify different groups of stakeholders for targeted communication strategies.
- Seek research on or insight about how to reach specific types of stakeholders, who is considered a credible source of information vis-à-vis management issue, learning styles/preferences of various segments of the public, etc.
- Develop and evaluate new outreach methods (conventional communication practices may not be most effective or efficient [cost effective] for effort).
- Helping stakeholders to understand the science available; i.e., how to

interpret complex ecological problems (level of uncertainty, spatial and temporal limits of data, scale of issue, capacities of agency, etc.).

- Has the resource "problem" or "opportunity" been fully articulated?
- Develop interest in collaboration.
- Attract scientists to the problem.
- Understanding overall agency mission and specific policy with respect to the resource.
- Relating overall agency goals and objectives to actual and perceived risks associated with the resource.

Note: The following describes an exercise for identifying information needs. We suggest exploring internal and external communication needs first, but this order can be altered if in your judgment the team would prefer doing otherwise.

10.3.2 *Review the Model to Identify Information Needs and Establish Priority for Inquiry*

After developing and refining a manager's model one immediate use of it is to identify information needs to serve decisions in various aspects of management. The team should go through the model methodically, using the concept map as an outline, asking questions such as:

- What are the biological, ecological, and human dimensions information needs associated with the various elements and relationships included in this model?
- What do we know already? What is the basis of this knowledge (research, experience, logic)?
- Is information currently available adequate to serve our management needs?
- What kinds of information and insight are most important?
- How confident are we in the validity of what we know with respect to the

species of interest, the people involved, or other aspects of the management environment?

- Does our confidence in information coincide with its relative importance?
- Is research underway that will improve our information base, or do we need to encourage needed research?
- Do we need site-specific information, or will insight from other contexts reasonably apply to ours?

With such questions answered by the group, one can then turn to assessing relative importance and urgency of additional inquiry to address the information needs. To avoid the information needs list becoming daunting and discouraging, it is essential to distinguish between what is "nice to know" and what is "critical to know" about the management system. Careful review of your manager's model should aid in this distinction.

10.3.3 *Identify Key Monitoring and Evaluation Needs for Impact Management*

No manager's model would be complete without inclusion of key monitoring and evaluation needs. Many agencies require this (e.g., Government Performance and Reporting Act (GPRA) requirements for federal agencies), but more important than a bureaucratic requirement is the professional expectation of evaluation of management program activity. Monitoring and evaluation are necessary to determine whether management actions achieve enabling objectives, and in turn, whether these enabling objectives achieve fundamental objectives. This is absolutely essential when operating in an adaptive management paradigm (i.e., AIM). Whether pursuing an active-adaptive (experimental management; i.e., AIM) or passive-adaptive (learning from outcomes; i.e., IM) approach to management, monitoring and evaluation are needed to test assumptions and mark progress toward anticipated goals, including identification of the need to change course, the reasons why, and the change in

outcomes expected by taking such actions. Monitoring and evaluation are needed just as urgently for passive management as they are for active management. Monitoring and evaluation are among the most crucial activities to ensure a vibrant learning environment for a thriving community of managers in your agency. Many approaches can be taken to evaluation, from quantitative modeling and experimentation, to refining models of system response, to pre-post evaluation of progress on specific objectives.

11 Manager's Models, Impact Management, Human Dimensions and More: How the Pieces Fit Together

11.1 Review

Manager's models have a particular role in the process of "thinking like a manager" (Organ et al. 2006). We briefly describe how we see some key features fitting together (Figure 11.1), and in so doing we hope to clarify the role of manager's models. The philosophy and terms we use in the following few paragraphs are described several published papers and books.[5]

The manager's model is grounded in the observation that the value of understanding stakeholder needs, interests, preferences, behaviors and expectations of management is widely recognized among professionals in public fish and wildlife management agencies. Increasing the content of the human dimensions component of the information base used to inform planning, policy and management decisions, and managers' confidence in that information, are pervasive needs of natural resource agencies across the country. Human dimensions contributions for management, developed through a combination of empirical data, social science theory, and stakeholder input, usually are necessary, but seldom are sufficient for planning and other decision making about management of a natural resource. Stakeholder engagement is valuable and often expected (sometimes legally required) to interpret the human dimensions information available, especially for identifying key impacts for management focus. If you subscribe to the idea that fish and wildlife management typically can best be executed by taking an impacts management approach (that is, by thinking of management outcomes in terms of impacts—the creation of benefits, minimization of costs, or finding an acceptable balance between these), then stakeholder-identified and stakeholder-weighted impacts become the focus of management; that is, the focus for developing fundamental and enabling objectives, and ultimately for evaluation of management success.

One of the large challenges that professional managers face, in part due to their education, training and experience, and in part due to the traditional conventions of management practice, is integrating human dimensions and biological dimensions (wildlife populations, habitats, etc.) of management. More and better human dimensions insight may be a necessary component of management, but such insight is not an assurance of management success, even if an impacts-management approach is adopted. Furthermore, it may be difficult to identify the human dimensions considerations needing attention in a management scenario. In general, managers find themselves ill prepared to enter into planning and decision-making processes where integration of human dimensions is critical.

The precepts of AIM/IM were developed in response to this situation, but we find that managers need a tool when attempting to describe a wildlife management situation comprehensively and apply the core aspects of "thinking like a manager" in the contemporary context where human dimensions considerations are paramount. We developed a systematic method

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[5]For example, Decker, D.J., W.F. Siemer, K.M. Leong, S.J. Riley, B.A. Rudolph and L. H. Carpenter. 2009. Conclusions: What is Wildlife Management. Chap. 23 (pages 315-327) in *Wildlife and Society: The Science of Human Dimensions*, Manfredo, M.J., J.J. Vaske, P.J. Brown, D.J. Decker and E.A. Duke, eds. Island Press, Washington, DC. 350pp.
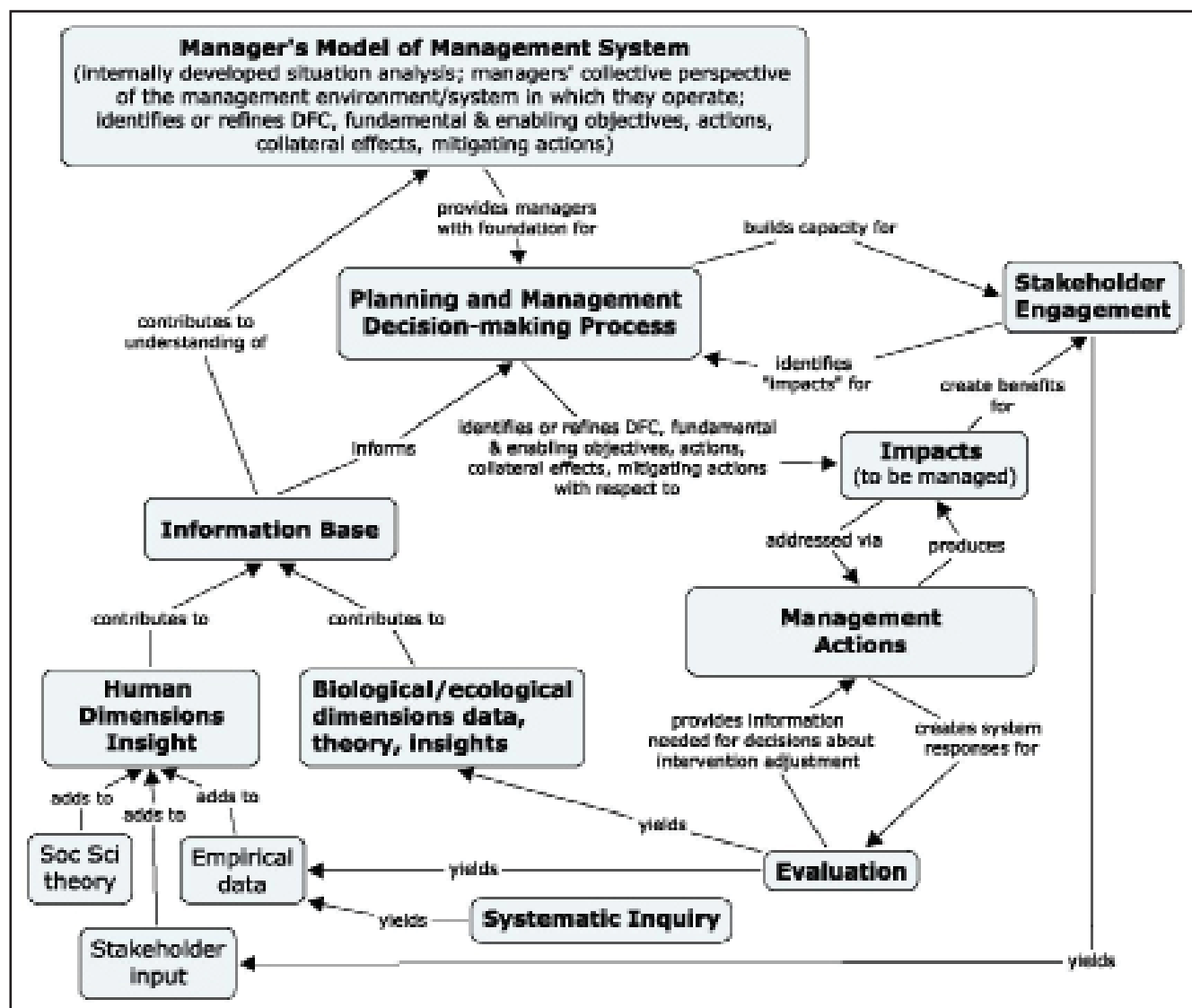
Figure 11.1: Place of manager's models in planning and management decision-making.

--manager's models-- for helping managers engage in a "rapid" situation analysis via a process to describe the management system in which they must operate. An emphasis of the process is being explicit and analytic in describing the management system (or management environment). The approach and "soft system" process elements were evaluated in pilot work with fish and wildlife agencies in New York, Florida and Arizona, and with the National Park Service. The tangible product of the process is often captured schematically in a concept map. The process of developing a manager's model typically clarifies where and how integration of human and biological/ecological dimensions should occur. The biological and ecological insights are critical to explaining what biological and ecological effects a resource can potentially produce (positive or negative), on what time frame and geographic scale, with what certainty or potential for variation, and how various management actions might affect the resource. Human dimensions insights contribute to the analysis of impacts desired or likely to be produced (e.g., thresholds of acceptable benefits and costs), policy constraints and social acceptability of (and therefore likely support for) technically possible actions.

The process of developing a manager's model is not intended to replace normal planning processes, but to facilitate managers getting their collective understanding of a management system revealed and analyzed internally prior to delving into a full-blown public planning process that

includes external partners and stakeholders, or into the quantitative mode of active-adaptive management. The rapid situation analysis that occurs in developing and critiquing a manager's model often reveals system components or relationships where little insight is available or where the importance of being more confident in existing assumptions is clarified; these discoveries point to research needs.

A manager's model is intended to be a perpetual work in progress—an ever-changing understanding of the management system that is updated as new insight is developed. This can be accomplished through careful, systematic evaluation in impact management (IM) mode or through experimental quantification in adaptive impact management (AIM) mode. Research is one way that insight is enhanced in either IM or AIM, but with an AIM approach the opportunity for testing managers' understanding (and assumptions) about the management system—the processes, components, their relationships, and the anticipated effects of management— presents itself.

In summary, impacts management or *adaptive* impacts management is the set of processes that lead to management objectives articulated in terms of stakeholder-identified impacts desired from management. The adaptive aspect occurs when assumptions are being tested via management actions implemented in an experimental design. Manager's models are products of teams of managers (and perhaps their close collaborators) who conduct a rapid situation analysis that describes their perception of the management system (or management environment) in which they operate to achieve management objectives. Manager's models reveal assumptions, information voids, uncertainties, needs for stakeholder input and collaboration, possibilities for interventions, anticipated collateral and subsequent effects from various action alternatives, etc. Manager's models tend to clarify where human dimensions insight applies. These aspects of manager's models generally (a) help managers communicate internally and externally about a management system, (b) aid in identifying priority information needs, (c) facilitate anticipation of management direction (and associated opportunities and challenges) and (d) provide managers with a firmer foundation to engage in planning and decision-making processes. Manager's models also represent the groundwork useful for implementing a more quantitative adaptive approach to impacts management.

11.2 Synopsis

A basic part of a wildlife manager's job is to engage in processes that improve understanding of wildlife issues through analysis of wildlife management systems. This includes working with colleagues, partners and stakeholders to imagine and describe a preferred condition with respect to co-existence of humans and wildlife. But describing a desirable future is just the start. A manager needs also to describe current conditions, analyze the gap between what is present and what is desired, communicate the issues to partners and stakeholders, and design an approach to improve the situation. Together with partners and stakeholders, the wildlife manager develops objectives and interventions to narrow the gap.

A manager's model is a tool to help perform a rapid situation analysis. Conducted internally, it is an initial sketch of desired conditions, actual conditions, factors that influence conditions, and considerations to be made before taking actions—a hypothesis later to be examined with partners and stakeholders. It also presents a broad view of what is being managed. Finally, it is adaptable because as one learns more about the management system the model can be modified.

If the process outlined for building a manager's model is successfully implemented, it will produce a roadmap for improving the management system. The manager's model and associated concept map are dynamic descriptions of the real world in which management occurs. The chapters that follow illustrate application of impact management. The examples cover an array of situations and degrees of management intensity.

PART III

AIM APPLICATIONS

AIM Applications

Introduction to Part III

Part III contains three hypothetical examples of impact management. They range from a very basic level of management that focuses on impacts as outcomes and evaluation of program in terms of impacts achieved, to what might be thought of as passive-adaptive impact management, where an experiment is put in place, but lacks the rigor associated with active-adaptive management (i.e., lacks multiple management treatments based on alternative models and a control). These examples are all place based (i.e., community based), so multiple management treatments are not feasible largely due to the operational scale of the issues presented. The names used for characters in the scenarios are fictional and not intended to be references to any particular individuals past or present.

We focus on cases with narrow geospatial scope because this is the situation most wildlife managers typically encounter. One can imagine that if multiple cases were to receive different management treatments, and one or two no treatment at all (controls), then as a set the criteria for an active-adaptive impact management experiment could be entertained. Even under this scenario, however, the inevitable variability in many environmental and human factors among the contexts would confound the interpretation of treatment effects.

The first case (chapter 12), *Getting Your Ducks (and Geese) in a Row*, is a familiar situation in urban areas across the US and Canada. Conditions created by urban green space and water features, whether golf courses or urban parks, that attract and hold ducks and Canada geese in large numbers. These birds are attractive to many people when they are novel or in low concentrations, but public response changes—and diverges—as the numbers of birds grows and the impacts of their presence are felt by more and more people. In this case, Kathy (an urban biologist) has long recognized the need for a coordinated approach to managing waterfowl in Central City, but has not had the backing needed to initiate such collaborative work. A dose of dead and dying ducks in a city park changes that overnight. She recognizes the opportunity for action presented and moves on it. This example describes a realistic prospect for impact management that may be hypothetical in its details, but very real in general.

The second example (chapter 13), *Cougars on the Edge of Town*, is situated in the intermountain west and deals with mountain cougars, but the case could just as easily be set in a community where concerns arise over black bear incursions along urban outskirts in New Jersey or coyotes living in urban areas of California. Susan, a state wildlife manager, has to deal with agency policy, professional conventions, community expectations and her own conflicting personal feelings about the presence of a large predator attracted by deer in an urban area, then becoming habituated to humans and their pets. This hypothetical case reflects real experiences of wildlife managers and will resonate with those who integrate the human and ecological aspects of managing a large, capable predator doing what such predators do, but doing it in and among communities of humans. Here the issue is all about safety impacts and tolerance of the presence of potentially dangerous wildlife. The impacts-management approach described has application to many like situations.

The third story is also about a pervasive problem facing wildlife managers nearly everywhere in the US and much of Canada—suburban deer management. Whether your deer are whitetails as in the case, mule deer, or "bigger" deer—elk and moose—you'll recognize some of the issues and concerns faced by managers Sarah and Earl in *Hang Together or be Hanged Separately* (chapter 14). Sarah is responsible for natural resource management in an urban proximate park, while Earl is the state deer manager in her region. Following a few years of an ill-fated deer management attempt via fertility control, they form a team to deal with the economic, ecological, and health and safety impacts of an abundant deer population. Taking a carefully planned approach, Sarah and Earl join forces to develop a community-based AIM "light" management scheme that is feasible for many such situations in North America. This case is based in the real experience of the authors.

12 Getting Your Ducks (and Geese) in a Row — *Applying IM to an Urban Waterfowl Issue*

12.1 Waterfowl Concentration in an Urban Area

Waterfowl management in urban areas is a growing concern for biologists, urban open-space managers, health officials and citizens. Elected officials find this topic to be thorny because of the disparate human values associated with it. Their constituencies are often in conflict. This is the case in Central City, a medium-sized regional urban center in the Midwest, blessed with extensive ponds, lakes, parks, and other open space that are a source of community pride. These areas also are heavily inhabited by several species of waterfowl, especially Canada geese. Over the years the goose population has become non-migratory and lives in the city year around.

The city has employed an urban biologist for some time. This individual, Kathy Jones, at one time was employed by the state and worked with Pat Smith, the state waterfowl biologist. One of Kathy's main issues in Central City is the overabundance of waterfowl and the associated impacts to the local community. Kathy and her city colleagues are developing a public information and interpretive campaign aimed at reducing feeding of waterfowl by visitors using city properties. Brochures, signs, public-service announcements in the local media and interpretive programs have been deployed, but with little apparent effect. Feeding ducks and geese is popular with families on picnics; bird viewing and photographing are extremely popular with lots of users. Kathy has learned that waterfowl have a strong symbolic value in the community because many regard the presence of these wildlife as a positive attribute of living in their community.

These positive values notwithstanding, Kathy also has been dealing with a series of on-going complaints from:
- Individual citizens
- District councilmen
- Mayor's office
- Golf course managers
- Chamber of Commerce
- Landscape companies
- Home owner associations
- Audubon Society and other environmental interests

Their concerns include:
- People do not appreciate the noise that Canada geese make near their residences, especially in early mornings.
- Feces on sidewalks, especially in front of businesses is an issue.
- Geese have exhibited aggressive behavior toward people entering the buildings.
- Feces and heavy grazing on lawns and greenways throughout the city.
- The three city golf courses have a long history of complaining about geese on the greens and fairways.
- Eutrophication of city ponds and lakes is a huge concern to city officials, and recently there have been some fish die-offs.
- People walking on the city trails with their pets have complained about feces and the problem of their pets being soiled by goose feces.
- City officials are concerned that the growing abundance of geese will lead to a greater incidence of predators in the city.

- In recent years the threat of wildlife diseases being transmitted to people, pets, and livestock has grown.

For some time, Kathy, Pat, and Jim Brown (USDA Animal and Plant Health Inspection Service—Wildlife Services biologist), and Linda Myers (US Fish & Wildlife Service) have been discussing the evolving waterfowl situation in the city and talking about the potential value of cooperatively developing a management plan. Synchronizing the different roles of each agency is important in coordinating authorities and responsibilities involved in a comprehensive waterfowl plan for the city. The biologists feel they lack the overall support of the community and the city government to carry out a stakeholder process that would lead to developing a plan.

This group of biologists is cautious because of the complex authority issue. They recognize there are other stakes such as public health, agriculture, and general animal health (veterinarians) interested in the issue.

12.2 An IM Process is Launched

The waterfowl issue suddenly becomes urgent when a maintenance crew discovers many dead and dying waterfowl in a city park lake. Things intensify quickly from that moment forward. The maintenance chief calls Kathy to report the dead birds and expresses concern about health threats to park staff and visitors. The crew has picked up the carcasses and asks Kathy what to do with them. The maintenance chief informs Kathy that a concerned citizen has notified a journalist working for the local paper.

Learning of these developments, Kathy calls a state conservation officer and arranges to meet him and the park crew at the city lake to process the carcasses and arrange for appropriate necropsies. Kathy immediately is thinking about connections to Avian Influenza. Kathy returns to her office after processing the carcasses and taking samples for lab tests. At her office she finds a message from her supervisor, Michelle Baron, the city Natural Resource Director, informing her that the local newspaper has called asking for details of the die-off and

to please advise ASAP.

Kathy returns the call to Michelle, informing her that "The carcasses have been properly collected and are on the way to the pathologists for a necropsy."

"What's the chance that these birds carried AI?" asks Michelle.

"That's highly unlikely given they are local birds and no suspected sources of AI have been reported," Kathy responds, perhaps sounding more confident than she really is.

"Well, I hope you are right. The mayor and city council will be expecting a plan of action and information soon," Michelle informs Kathy.

After hanging up the phone with Michelle, Kathy wonders whether this incident will provide the incentive to address the longstanding waterfowl issue in Central City.

Kathy next calls Pat to tell him what's happening. She suggests that perhaps this will trigger the management planning they have talked about.

"Maybe the city will see the need for a broad-based stakeholder approach to this issue," she suggests to Pat. Continuing she says, "Hopefully this will bring the financial and political support we've needed."

"Well, if this finally starts cooking, I think the state would support such an effort," Pat suggests reassuringly. "For sure, past complaints and history of the issue warrant development of a plan as a model for other communities in the state. I have ideas on how to proceed."

Thinking about the work ahead, Kathy says, "First thing I need to do is pull together a background report."

Pat replies that a situation analysis and a description of the management system would be very useful and further suggests that the broader group of relevant biologists should be contacted for their perspectives and inputs. He also reminds Kathy that before taking any further actions they need results of the tests on the dead birds.

Although it seems like an eternity when expectations of supervisors, partners and community members are running high, results from the pathologists are expected within 48 hours. During the first 24 hours

community speculation grows. The local paper's leading headline the day after the incident declares "Dead Birds at City Park—Has Bird Flu Arrived?" Kathy's phone starts to ring off the hook with calls coming from throughout the community. The same is occurring at city hall.

Thankfully, the pathology report comes in as negative to AI. The birds died from botulism, a disease found occasionally when waterfowl concentrate during hot seasons of the year. Everyone breathes a sigh of relief, but Kathy and her supervisor recognize they dodged a bullet and begin discussing what needs to happen to avoid future crises.

Kathy takes this opportunity to update Michelle on the on-going discussions that she and her colleagues are having about the steps needed to organize a broad-based community involvement process leading to development of a multi-agency management plan.

Michelle agrees to make a pitch for such a process to the city manager next week and asks Kathy for more details and a proposal.

Kathy starts calling the other agency biologists simply inquiring if they concur with Pat's and her analysis that this latest incident might be the catalyst to begin their long-anticipated planning process. Kathy receives general concurrence from her colleagues but several raise issues of funding and political support.

Kathy next prepares a one-page proposal highlighting key steps involved in developing the plan, including a time frame and estimated costs. She submits the proposal to Michelle, who in turn successfully gains approval from the city manager. Together they will work to secure resources and political support for the effort.

Kathy immediately calls Pat and says, "We have a green light, now the work begins."

Pat has been busy, too. He informs Kathy that he has received verbal commitment from state officials and they concurred that he should play a major role in this process. Pat's assignment reflects the state's recognition of its authority and responsibility in this issue.

"I think we need a retreat with other key biologists to kick off planning," Pat suggests.

"I have been told that if needed we can count on the help of one of our community relations specialists to facilitate a meeting," Kathy replies.

Kathy's work is just beginning. Additional information is needed to articulate agency roles, responsibilities, and authorities. Relevant research on urban waterfowl and waterfowl diseases, as well as pertinent wildlife, human and domestic animal health concerns must be reviewed.

The human dimensions considerations include compiling a stakeholder list, known impacts experienced from waterfowl (especially geese), existing management efforts (education, outreach, etc.), community experiences in collaborative processes (capacity), and agency experiences in collaborative processes (capacity).

During one of their many preparatory brainstorming conversations, Pat explains to Kathy that they need to decide whether to take an AIM or an IM approach. In this case, uncertainty about control over the intervention that may be deployed is in question because of the number of agencies and stakeholders, the urgency, and the concomitant political elements of the situation. An AIM approach requires commitment to extent and duration of treatments in an intervention. Thus, an AIM approach is not feasible. Though less powerful as a learning process, much can be learned from properly executing core elements of an IM approach. For instance, articulating stakeholder-identified impacts as objectives, systematically monitoring and evaluating change in impacts experienced, and modifying interventions as needed are all valuable and contribute to learning about the management situation.

Kathy lacks experience with either AIM or IM approaches and suggests to Pat that either sounds awfully complicated and wonders how to begin. Pat tries to reduce her anxiety by enumerating the key steps:

1. Establish a technical steering team (TST) representing the agencies involved in management of impacts of waterfowl in Central City.

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2. Form a citizen task force comprised of a diverse representation of stakeholder interests in the community.

3. Conduct a situation analysis, which Kathy has already done.

4. Avoid jumping into listing a set of management actions.

5. Develop a manager's model and concept map of the management system, work that may be performed by a broad-based steering team.

6. Establish objectives that express future conditions desired with respect to waterfowl management within the city. Identify primary impacts of concern and translate them into actionable objectives, i.e., enabling objectives. This activity requires considerable input from stakeholders because they are the appropriate source of insight about key impacts.

7. Identify possible management interventions. Stakeholders have a role in this step because ultimately they determine if the solutions are socially acceptable and therefore sustainable.

8. Identify likely collateral and subsequent effects needing mitigation.

9. Articulate how progress toward meeting stated objectives will be evaluated, including identification of monitoring needs and protocols and assigning responsibility for their implementation.

After hearing this list of needed work Kathy asks, "How do we get started?"

"An initial step is developing a manager's model of the management system," Pat explains. "This can be depicted as a concept map, which will help the technical people involved communicate with one another and help us describe what we are doing to our supervisors and the community."

Pat goes on to suggest that, "The group of biologists that have been interacting on this issue should become more formally organized. This group can be referred to as the technical steering team. One of the first jobs for this team is to develop a comprehensive articulation of the management system in play for this issue.

Kathy agrees to call the technical steering team (TST) members and find a suitable time and place to do this. She decides that the most productive approach would be a one-day retreat at the city open-space cabin. She offers to get to work on this right away.

At the retreat the following week the TST focuses on developing a manager's model and associated concept map describing their collective view of the management system for the city's waterfowl resources. After considerable discussion to describe a desired future condition, the group lays out the current situation and then quickly agrees on the fundamental objectives in broad terms. They differ on what the most important impacts are, so decide to identify a starter list for stakeholder consideration. The TST members also deliberate about the relevant authorities, policies, regulations, jurisdictions, etc. and come to agreement on a complementary package for eventual presentation to a citizen task force.

The TST recognizes there is a wide range of potential actions to be considered by the citizen task force. The TST anticipates that they will be called upon by the citizen task force to provide technical advice and explain efficacy of actions. They also recognize the importance of identifying collateral and subsequent effects of any actions considered. The TST anticipates that describing and analyzing necessary mitigation could be a time consuming activity. The TST also discuss appropriate monitoring and evaluation techniques and costs.

Armed with a mutually agreed upon managers model, the TST faces a decision about the level of sophistication of the stakeholder process needed to verify key impacts and establish fundamental and enabling objectives. To keep a stakeholder process on track they will need a clear link between fundamental and enabling objectives.

The TST discusses a range of considerations and settles on the following key criteria:

- Flexibility in sharing decision-making authority with stakeholders.
- Funding available for the stakeholder input process.

- Capacity of the community to participate effectively in the process (what is history of success of such processes in this community?).
- Timelines for completion of the management plan must be identified.
- Extent of community involvement in implementing, paying for, monitoring, and evaluating management interventions.

Kathy and Pat decide that the citizen task force will be comprised of a diverse representation of stakeholder interests in the community. They set the maximum number of participants at 12. The citizen task force will be engaged for up to 6 months. Long-term collaboration by the agencies and stakeholders will occur for elements of implementation. The city and state agree to share costs in the entire process.

Through a process of referrals and volunteering, a list of potential participants is created by Kathy and Pat for consideration by the TST. The TST immediately identifies the State Departments of Health and Agriculture as needing to send one ex-officio member each. Ten other names are selected from the list, representing a broad set of stakes in the waterfowl issue. Per usual, the TST endures some intense lobbying by established interest groups proposing "representatives" from their organizations. Nevertheless, decisions about membership are based less on political representation and more on diversity of impacts of interest and potential for effective involvement.

As expected, the citizen task force has a propensity to jump to proposing actions from the beginning but is effectively constrained by the process to first focus on identification of key impacts followed by transforming these into fundamental objectives for management intervention. The impacts identified reflect the full range of concerns in the community, but the citizen task force works hard to recommend which impacts should be the focus of management. With a set of consensus fundamental objectives in hand, the citizen task force turns to considering potential management objectives (enabling objectives) and actions, with considerable technical input by the TST. The TST brings knowledge of both proven and experimental techniques to the discussion. They also help explain relevant policy, laws, and regulations. Thus, the citizen task force contributes to identification of fundamental objectives and engages in an ends-means exercise.

Unexpectedly, one member of the citizen task force who adamantly refuses to consider a particular management technique advocated by other task force members resigns from the citizen task force. Media attention to this event is limited and a replacement member is quickly identified. A positive outcome of dealing promptly with a potentially disruptive resignation and replacement issue increases cohesiveness of the overall citizen task force.

While potential primary actions are identified fairly quickly, more work is required to identify and evaluate secondary actions needed to mitigate collateral effects. Key aspects of deliberation include discussing tradeoffs involving cost of mitigation vs. efficacy of identified actions. In addition, the citizen task force together with the agencies has to determine which is the most appropriate entity to implement and pay for various aspects of the intervention package. As it turns out, the state and city agencies carry the bulk of the work load. Some community organizations volunteer their services and limited funding for certain aspects; e.g., some of the community-based education programs organize "goose round ups."

After the set of management actions are agreed upon, attention is turned to monitoring and evaluation needs. Effects on waterfowl presence and human behavior are monitored. The monitoring activities are scrutinized to be sure they allow assessment of progress towards achieving stated objectives. Community members volunteer for training to serve as field technicians for several aspects for the management intervention.

The process of deliberation and decision making by the TST and the citizen task force runs its course over approximately a half year. A management plan is developed that both the TST and citizen task force find acceptable for meeting the needs of resource management and the community.

12.3 Forecast/Prediction of Future

The TST meets for a debriefing following the last official meeting of the citizen task force and the release of the draft management plan. TST members agree that a ½-day meeting back at the city-owned cabin would be appropriate and helpful. They also agree that both the TST and members of the task force will be invited to participate in the debriefing.

The debriefing first highlights key problems that were encountered. These include:

- o The public expression of discontent from two interest groups that did not feel they were represented in the process.
- o The time wasted at the outset in back tracking when the task force jumped into actions before objectives were developed.
- o Inconsistent attendance at meetings by a key task force member.
- o Initial suspicion of some task force members that the facilitator was not neutral because of her affiliation with the city.

While these problems caused some delays and required special efforts to overcome, none were fatal to completion of the management plan. In fact, challenges such as these were anticipated.

On the other hand, positive surprises that the TST recall include:

- o The endurance of the task force members.
- o The constructive problem-solving skills exhibited by the task force members.
- o The willingness of task force members to understand other view points and to seek common ground (civic mindedness vs. personal interest).
- o The cost was less than expected.
- o The TST worked together very well.
- o The dissention and criticism brought by one disgruntled elected official did not derail the process and was treated by the local media as an anomaly rather than evidence of a flaw in the process.

Retrospectively, perhaps these experiences should not have been surprising. The process followed and the general good will of the people involved led to these and other positive outcomes.

12.3.1 Best-case Scenario

Looking forward, each member of the initial group that committed to the process has expectations for the future. Some of these extend beyond the Central City situation, but are based on the experiences and lessons learned from it.

- o Pat Smith hopes that this experience, with improvements learned, will be transferred to other communities in the state having similar issues.
- o Jim Brown hopes that this collaboration will be extended to other issues of mutual interest and concerns.
- o Linda Myers hopes that the experience will transcend some other state-federal jurisdiction issues.
- o Kathy Brown feels the public acceptability of some management intervention over the long term will be helpful to other wildlife issues.
- o Kathy believes the management plan resulting from the process will be effective in maintaining human-goose interactions and impacts at a level acceptable to most citizens.
- o Kathy thinks that the reduced goose-human interactions will enhance the public views and attitudes towards the city's wildlife "citizens."

12.3.2 Keeping your Feet on the Ground: Lingering Issues Beyond the Scope of the Process

As with any process, the IM approach used in Central City is not a panacea. It helped move the wildlife management system for waterfowl to a better place—a management plan was developed with partners and stakeholders working together collaboratively. Nevertheless, the threat of Avian Influenza or other serious human-wildlife disease was not obviated. The scare that prompted this effort highlights the need for a more detailed and thorough scientific

analysis of risk reduction, which was not a challenge taken up by the citizens of Central City or the managers engaged in this issue. Kathy plans to use the experience to keep this issue before the various publics and hopes the outcomes help build trust and confidence in the collaborative nature of the TST and thereby reduce the amplification of risk perceived by the public in a future die-off. But she can anticipate that if a new threat surfaces, perceived or real, it will generate some level of public angst. The management plan and more importantly the relationships between key agencies and stakeholders that developed during the planning process can be rekindled to address the new concern. This will give her a new starting point. That will be an advantage for her and perhaps decrease her response time, and increase effectiveness.

13 Cougars on the Edge of Town —Applying IM to Address Human-Cougars Conflicts at the Wildland-Urban Interface

13.1 A Family Tragedy

Another beautiful spring morning. Alan rises from bed and glances out the window at the pre-dawn sky, clear with a hint of high clouds. "It's going to be another nice one." Jeannie rolls a bit in bed, partly acknowledging the statement and mostly trying to deny it's time to get up. Married for five years, the weekday morning begins as it usually does with Alan rising first, checking on 2-year old Brian, and then feeding Buster, their beloved 11-year old Golden Retriever. The old guy has been sleeping outside for the last three nights.

With only a week to go before the summer solstice, the temperatures have been unseasonably warm, and the cool nights outside have appealed to Buster. Buster's house sits against the four-foot high fence enclosing the back yard, an ample play area complete with toys for Brian and Buster. Beyond the back yard is a meadow with scattered spruce, sloping up into the foothills. The house borders a county-administered open-space area popular with hikers and mountain bikers. The entire area borders a National Forest. A piece of heaven at the edge of suburbia! As Alan walks to the back door, he notices the quiet. No scratching at the door. Buster won't bark – no need to as he has trained his family well to meet his mealtime expectations. Opening the door, he sees no sign of Buster, who typically is waiting, tail wagging, tongue dangling from the muzzle that's now mostly white. Walking over to Buster's abode, he notices something that sends a shock through his body. He sees tufts of Buster's hair, and looking closer he sees blood. Reeling, he notices tracks – large tracks, but different than Buster's. The blood drains from Alan's head and he feels his gut twisting as if it's being wrung like a wet towel. Anger, horror, sadness, shock – a suite of emotions races through Alan. He's aware that his anger feels different – he feels helpless, violated. In the minute or two it takes for all these emotions and sensations to boil over, another starts to creep in – guilt. Why didn't I pay attention to the reports; what made me think it wouldn't happen to us?

13.2 Getting "the Call"

"Wildlife Division, this is Susan." Susan's reflexive telephone answer carries only a hint of the annoyance she feels at the interruption. Susan is in the middle of preparing her annual performance report for her Pittman-Roberston Wildlife Restoration furbearer project, and as usual she has waited until the last minute. She's torn between simply reporting on progress made towards objectives versus elaborating on some of the findings. In particular, some trends appear to be emerging from the bowhunter survey now that a few years of data are in hand. Bowhunters enlisted for the survey annually report the species and numbers of carnivores they observe from treestands while hunting deer or elk. This is the first harvest-independent index of carnivores ever implemented in the state. Susan proposed this during her interview for the statewide furbearer biologist position 5 years ago, and she's worked hard to justify funding and develop greater support. Demonstrating some findings would be nice. Her attention is fixed squarely on her computer monitor and the data table illuminated on the screen as she half-listens to the voice on the other end of the receiver.

"Susan, this is Sam down at the station." Sam is a local police officer that Susan has

dealt with on a number of human-wildlife conflict cases, mostly with Sam as first responder notifying Susan of a citizen reporting a problem. "What's up Sam?" Sam informs Susan of the call he received that morning from Alan, reporting that Buster had been killed by a cougars. "Was it confirmed?" Susan asks. "That's why I'm calling you" Sam responds. He pointedly reminds Susan that there have been several reports of missing pets over the past couple of years, with cougars suspected as the culprits. "The photo in the paper last month of the cougar ready to pounce – that was taken in the county open space area, right near where today's incident occurred. You need to remove that cougar – it's a public safety emergency." Susan feels the pressure increase around her temples, as if somebody's hands are squeezing them. She saw the photo, and the caption read "Watch Out – You're Being Watched!" This annoyed Susan because the actual behavior of the cougars – whether or not it was focused on people – could not be determined from the photo alone, and this in her opinion was irresponsible, fomenting fear and concern in the community.

She tells Sam that the policy of the Wildlife Division is not to kill or remove wildlife unless a real – not perceived – threat to humans exists. She lectures him about how people had been given ample warning not to let their pets go unattended outdoors, and consequences are the responsibility of the owners, not the state. "You know Sam, people can't have their cake and eat it too. The community pressured the county to eliminate hunting and trapping in the open space area, and now you've got mule deer everywhere. You might as well hang an 'Eat At Joe's' sign out for cougars. I'm not surprised if there are cougars there – they've got food and people don't bother them. This is a classic situation where wild animals become habituated to humans and lose their fear, but again, is there a specific problem here that warrants a response? You've got unsubstantiated reports of cougars killing pets and a provocative photo – but no one has actually been threatened or attacked. If people take the necessary

precautions, as they have been advised, then cougars will leave them alone."

Susan holds her ground, but not before agreeing to contact Alan and Jeannie and investigate Buster's demise. Sam is frustrated, because he feels the burden of proof is too strict, and it will take somebody getting hurt before any real action is taken. He thinks the state should remove any animal that poses even a remote threat to humans. Susan, too, is frustrated. She doesn't feel good at all about the conversation she just had. She feels – impersonal – like a bureaucrat touting the company line. She's concerned that somebody will get hurt, but she knows that a knee-jerk reaction, killing a cougar, is not a lasting solution. She also is aware that the amount of time she can devote to a local situation is limited in her capacity as a statewide biologist. Her priorities have been set by the Division's Management Team – this, at least currently, is not one of them, although it could rapidly rise to the top of the list if someone gets hurt.

13.2.1 The Media gets Involved— Before You Do

Susan pulls her state pick-up into the driveway of the one-story brown ranch with green trim in the cul-de-sac. She parks next to a white van with "KMCC TV 14" emblazoned in large blue letters on the side. "Great" she mutters disgustedly, and ponders whether or not to slam the vehicle in reverse and head back to the office. Before she can seriously consider escape, the door in the breezeway between the garage and the house opens and a woman roughly in her late-twenties emerges, stepping around a tricycle lying on its side in the driveway. Susan shuts off the vehicle and steps out. The woman approaches her and says "Hi, I'm Jeannie, thank you so much for coming, this has been awful." Jeannie tells Susan the TV station contacted them within an hour of Alan contacting the police, and the police had told them and the TV station that the state would be contacted to come remove the cougars. "I expected more than one person – how will you catch it?" Susan, taking a deep breath, explains she has come

to investigate and confirm whether or not a cougars was responsible, and was not prepared for any further immediate response. Jeannie challenges her, expressing concern for her son and other kids in the neighborhood. Susan acknowledges her concern, and asks to look at the evidence.

They walk through the breezeway to the fenced backyard. Standing in the middle of the yard is Alan and a woman with a notepad in her hand. They are casually talking, and the woman is not taking notes. A man stands idly by, a shoulder-mounted camera at his feet. Jeannie introduces them, and then excuses herself to go back in the house and look after Brian. Susan is braced for the ensuing conversation and response from Alan and the reporter. She repeats what she told Jeannie, indicating the Division does not have the response capacity for dealing with pets killed by wildlife, and state policy prohibits it.

"That's not what the police told us this morning." Alan is clearly upset, but he is not being confrontational.

"We issued a report today on the 12:00 news that the state would be searching for the cougar and removing it," stated the reporter, with an expectant look.

"I'm sorry, but you were provided incorrect information. No one confirmed this with my office." Susan then immediately asks Alan to show her what happened.

Alan recounts the morning events and shocking discovery. Susan looks at the scene around Buster's hut, and nods her head. Cougars tracks are clear as a bell in the soft dirt, the 4 round toe pads and plantar pad easily distinguishable from Buster's classic canine track with claw marks and the telltale dog "X" pattern. Susan picks out a good track and places a ruler that opens up to have x and y axes with the x-axis along the bottom and y-axis to the right. She takes her camera out of her pouch and photographs the 4x4 inch track, and then steps back to photograph the scene.

There is little evidence of struggle – Buster probably didn't know what hit him, fortunately. Susan scans the area, and sees drag marks. Closer inspection shows cat tracks and swept ground, indicating something large was dragged to the fence. The top of the chain link fence has a bar, but ends of the links are exposed. More of Buster's hair is on two of the link ends. Susan looks out over the open area beyond the yard. "Classic muley habitat" she says out loud, to no one in particular as she looks out onto the meadow with its interspersion of brush and occasional spruces extending back to the foothills. "Classic cougar habitat" she thinks silently to herself, looking at the draws and ravines in the foothills opening onto the meadow.

13.3 Pet Safety is not the only Stakeholder Concern

"Hello." Susan is half expecting a telemarketer to be on the other end of the phone line, as they typically call during evening hours at home, but she rushes through the door to answer it anyway. Given the day's events and the media attention, she figures she better answer, just in case it is somebody from Division headquarters. She had stayed until dark at Alan and Jeannie's place and went right home – she realized she had left her cell phone at the office.

"Susan, this is Jan." Jan, a high school teacher and mother of a five-year-old girl, works out at the same health club as Susan. They have become friends, going on hikes together and occasionally going out for drinks and other social activities. Susan likes Jan – she is amazed at how she can balance a family with teaching and working out, while still finding the time to be independent and having a social life. On top of this, she is fun and would seem to be happy-go-lucky if you didn't know how well she balances the demands on her life.

"You must have seen the cougar story on the news today," Jan suggests.

Susan rolls her eyes, "No, but I was there. Poor dog, the family is really devastated."

"Dog? What the hell are you talking about?" Jan responds. Taken aback, Susan explained she had investigated Buster's killing and met with the family and the media.

"I'm not talking about some old dog, Susan; a cougar was in the playground at Julie's school today!" Jan excitedly informs Susan.

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At about the same moment, Susan notices the blinking light on her answering machine indicating she has six messages waiting for her. "I didn't know this Jan. I was investigating this other incident and was out of contact. What happened – was anyone hurt? Is Julie okay?" Jan explains that during afternoon recess a cougar was spotted crouched under a bush at the edge of the playground by one of the children. Police were called and the school went into lockdown. Parents were called and children were whisked away.

"Jan, let me call you right back. I bet I have a ton of messages on this." Susan replies.

Sure enough, Susan had messages from her office, the police, the school, the TV station, and a couple from parents. She calls Morty, her technician, who tells her he responded and confirmed a cougar had been at the school based on a sign he found there, but he couldn't confirm how it was behaving. In any event, the cat was nowhere to be found and he advised the school administrators to resume classes as normal but to make sure an adult is present during recess when the kids are outside. "The school year ends next week, Susan. That cat probably got spooked and they won't see it again."

Susan calls Jan back and explains what she learned, and assures her there's no reason to worry. "Aren't you going to find that animal and get rid of it?" Jan sounds desperate, not her happy-go-lucky self. Susan finds herself again giving Jan the party line, just as she had in her conversation with Sam. Jan's voice trembles as she says to Susan "I can't believe you. I thought you were my friend. You care more about these cats than my daughter? This isn't right Susan."

Susan's heart sinks. She assured Jan that she cares deeply about Julie and all the children at the school, but the likelihood of a child getting hurt is minimal. Nevertheless, she assures her, she will address the situation. It may not be what she expects, because going on a cougar chase is likely to be futile. However, given the spate of recent events, and the mounting community concern, she will bring this to the attention of Division management and seek permission to take action.

13.4 Making a Decision to Try a New Management Approach

To the left of the county road out the driver's side window, the hints of orange and purple on the eastern horizon are like a preview promising the coming sunrise will be a spectacular one. Susan slept little during the night, her mind racing with images of the shock on Jeannie's face, the anger in Jan's voice, the helplessness she felt at being unable to do something for them. Might as well get in the office early, she thinks, it will be a long day no matter what.

By the time Morty and others start to show up at the office Susan has pulled together her files and records of local cougar reports and incidents and other related information. She and Morty debrief each other on the previous day's events, and they discuss the overall scenario unfolding. "We've got to do something, Susan. We can't wait for somebody's kid to get killed."

"Yeah, but what can we do?" Susan responds. "You've got the perfect storm brewing here. There's no hunting in the open-space area and little pressure on Forest Service lands. The Animal Protection Alliance is all over us every time hunting is suggested, and they have an 'in' with the Governor – and an election year is coming up. Top it off, we know people are feeding deer. So, we have mule deer living essentially in people's back yards, with no control over them. This creates a magnet for cougars, who are brought in closer to people. Nobody's hunting cougars either, so they become habituated to people. Next step? Hmmm, wonder how those funny two-legged things taste. The problem isn't so much cougars – it's people's behavior." Susan shakes her head and slouches back in her chair as she lets Morty ponder the dilemma.

"Well, you've just nailed the problem," Morty declares. "We should put a briefing paper together and have a meeting with the town and county - we can show them what the problem is and how they can fix it."

Susan shakes her head. "The reality, Morty, is that coming from us, they won't

accept it. They think we have an agenda – promote deer hunting and protect cougars. Unless we work with them and build trust, they aren't going to see beyond that. The sad truth is, they are going to have to come to the same conclusions on their own, even though we are supposed to be the experts. That being said, we can be a catalyst for their discovery of the facts. We can bring the right parties together and have everyone work from the same set of facts. The important thing is for them to know they have a meaningful role in coming up with solutions. Who knows, if we can pull that off they may identify some things we'd never even think of."

Susan's phone rings. Doug, the Wildlife Division director, is on the line. Doug informs Susan he received a call first thing this morning from the Governor's office. Concerned citizens and town and county officials called in overnight expressing concerns and wanting action taken to protect citizens from cougars. The Governor's chief of staff made it clear that a "scorched earth approach" was not acceptable. Susan and Doug discuss the realities of the situation. Susan tells Doug their options are limited – what can they realistically do? Doug understands, but he wants action because the Governor expects action.

"Look, Doug. The people who are pressing the buttons are politically motivated. They want to be responsive to people's concerns and show they are part of the solution. Nothing wrong with that – that's what they're supposed to do. Problem is, they think the solution is removing the 'bad' cougar every time one misbehaves. That's not necessarily a wrong response – in some cases it could be absolutely necessary. Unfortunately, it can be like scooping sand out of the beach because they are not addressing the real problem."

"Susan, I'm not telling you to kow-tow to the politicos down there. I'm directing you to work with them and develop some management options they'll be satisfied with – as long as it doesn't fly in the face of our existing policies. You need help? – let me know. I can free up some folks here if need be."

"Tell you what Doug – I've got an idea that I'd like to pursue. Morty and I were

discussing the situation, and it struck me that we need a different approach for this case than we normally use. I need to contact some colleagues to flesh this out; once I do, I'll propose a process to you. In the meantime, I suggest we hire a houndsman and try to kill the cougar that is near the school. That will take some of the heat off for now, but as I said, it won't solve the problem. It buys us time to get the longer-term solution in place. Sound okay?"

"Well, I'm not sure," Doug responds hesitantly. "The devil will be in the details, but okay – get a proposal together. Be as specific as you can about agency staff time and resources, and any other costs. Make sure you take care of that cougar first – don't leave the county and town hanging. I'll give you some time as long as you can hold them at bay."

"Deal!" Susan says, and smiles as she hangs up the phone. Her smile quickly turns serious as she realizes she really doesn't know what she is getting herself into.

13.5 Pulling Together an IM Support Team

Before the morning is over, Susan has called town and county officials and the local police. She informs them that she is preparing to go after the cougar that approached the children, but wants their active participation in developing appropriate management solutions to the cougar issue. She expresses concern that a case-by-case reactive approach will only prolong the potential for someone to get hurt, and she wants their help in carving out a long-term solution. She will get back to them to set up an initial meeting.

"Wildlife Division, this is Susan."

"Hey Susan – how are ya?"

"Joe! Thanks so much for returning my call. I didn't expect you to get back to me so soon, but I'm sure glad you did."

Joe is a former Forest Service biologist who Susan got to know on a detail a couple of years back. Joe is currently a Refuge Manager for the U.S. Fish and Wildlife Service. While a biologist on a National Forest, Joe became involved in a black bear management controversy that Susan feels is

similar to her cougar scenario. Joe had used a relatively new technique called Adaptive Impact Management, or "AIM" to develop management options. Susan's recollection of the unique nature of AIM is that stakeholders define the problem and are active participants in developing objectives and management solutions. She thinks this could work in her current situation, but is sketchy on the details.

Joe gives Susan a primer on AIM, explaining many of the nuances, such as analyzing the situation and understanding the various scales involved, building the appropriate stakeholder group, describing the system at play, articulating stakeholder-identified impacts, describing a desired future condition, developing fundamental and enabling objectives and management interventions, and evaluating and adjusting as necessary. A key principle, Joe emphasizes, is the concept of "impacts" – the most important of the effects produced by the system as defined by the stakeholders. These are what become the focus of management. Lights start going off in Susan's head – she can see where number of cougars and mule deer may not be the focus at all. Rather, it could be having safe zones for people to live and recreate in. Joe warns Susan to not make the fatal flaw and presume what will be most important to stakeholders – let them determine that.

Susan cuts to the chase and asks Joe if he is willing to advise or consult with her on this, or suggest someone who could. Joe says he'd love to help her, but he's not really the best one to advise her, and he doubts he'd be able to get actively involved. He gives her the name of an Associate Professor at the land grant institution in the state he worked in where the bear issue erupted. "He'll be able to help you a lot more than I can, as he has skills and experience with things such as identifying stakeholders and facilitating their interactions. He also has both a wildlife management and social science background. Furthermore, he has been working on several actual applications of AIM and is refining the approach."

13.6 Deciding on IM vs. AIM

"Wildlife and Fisheries Conservation, this

is Steve." Steve worked as a district biologist and wildlife manager for a state fish and wildlife agency after he got his M.S. degree. After eight years of combat biology he decided to go back to school and get a Ph.D. What drove him were the experiences and observations he made on human-wildlife interactions and how management decisions were made. He felt important pieces were missing from the equation, but he wasn't sure just what they were. This compelled him to beef up his academic background in disciplines such as sociology, social psychology, resource economics, and policy. When Joe first contacted him on the bear issue he was looking for a good project for a graduate student – at the time he was a fairly new tenure-track Assistant Professor looking to carve out his niche. Bear issues would be a great focus of inquiry, he thought. Most of his field background had been with mammals. What he didn't realize was the niche would have to do less with bears and more with humans.

"Steve, my name is Susan – I'm a colleague of Joe who you worked with on a bear project a few years back. I was wondering if I could speak with you about a situation I have involving cougars?" Susan outlined the situation and the mounting pressures for action, and recapped her understanding of AIM and wondered if he thought it would be a good application in the cougar case.

"Well, I'm not sure a full-blown AIM would be appropriate – you have a discrete, somewhat localized situation, and you likely cannot conduct the number of independent management interventions needed to have an appropriate experimental design. Also, time is of the essence – you're dealing with a situation that is almost an emergency. However, this seems like a classic case for Impact Management, or IM."

"What's the difference between AIM and IM?"

"Frankly, IM's a smaller scale effort, kinda like 'AIM-lite.' It lacks the full experimental approach because you're limited in the number of interventions. You may only be able to implement one management action, so you can't compare treatments

as in a classical experiment. Nevertheless, the foundation – stakeholders visualizing the system and the effects produced, and identifying the impacts – is retained. They still are engaged in identifying fundamental and enabling objectives and appropriate management interventions. They are still key to monitoring the success of the actions as they relate to the desired impacts. Learning from your management interventions and plugging that learning back into the management model and revising your management actions are still part of IM."

Steve and Susan talk through the basics of an IM process, and discuss the potential application in the cougar scenario. Susan agrees that the situation is time-sensitive, but stresses to Steve the issue will not be solved by applying any particular discrete management action. This will be an enduring issue that will require management vigilance and persistence. Cougar conflicts will also likely increase in geographic scope and the agency will certainly not have the ability to initiate IM in every community experiencing cougar issues.

As Susan and Steve discuss the situation further, they adjust their thinking, coming to consensus that AIM may be more appropriate than IM given the broad application the findings are likely to be directed towards, and the potential for human cougar conflicts to be ongoing in the immediate community. Steve agrees to help Susan develop a proposal that outlines a process and desired outcome: achieving stakeholder defined impacts that are consistent with the public trust mandate of the Division. The challenge will be achieving a true AIM approach without competing independent experimental interventions.

13.7 An Initial Effort Falls Short— And the Issue Persists

"Susan, this is Doug. You've got the green light. The Division Management Team approved the proposal this morning. Frankly, folks feel like they're painted into a corner on this issue and don't see a solution, so I'm not so sure that this is a vote of confidence on their part or just an escape route that shows we're doing something—sort of an act of desperation. Anyway, the pres-

sure's on – keep me in the loop; we can't afford to drop the ball on this one. By the way, we haven't received any flak for killing that cougar – it seems to have satisfied the politicos as far as their stimulus-response mechanism goes. They've probably moved on to other things now – I hope!"

Susan lets Morty know and then calls Steve, who agrees to come out first thing the following week with a graduate research assistant who has been studying AIM and IM approaches. Susan and Steve agree on the materials and resources that Susan's shop needs to have together prior to the meeting. This involves compiling as much historical and current information as possible to develop a thorough situation analysis, and a 'global' list of potential stakeholders with a rationale that can be used in selecting the appropriate group.

Susan, Morty, Steve, and Brenda, the graduate research assistant, meet at Susan's office. Steve and Brenda present a primer on AIM and IM using case study examples, most of which are works in progress. Susan and Morty present a historical analysis of the situation. Concerns over cougars are not new here. Not long before Susan and Morty were hired into their current jobs, pressure had been put on the agency to address concerns over disappearing pets and potential human threats. A public participation process was initiated that apparently fizzled quickly. Morty found the original files that had a list of invitees and participants. Steve observes that the composition of the group appears to have been drawn primarily from traditional stakeholders – hunters and outfitters – without broader community representation. The meeting minutes show that the participants were concerned largely over the impact cougars were having on deer. This was apparently in response to a presentation by researchers who were studying deer-cougar interactions. The research recommendations were to not hunt cougars, but rather, allow mature cougars to maintain territories thereby preventing younger cougars from pioneering into the area, as these were the ones most likely to cause problems in the adjacent community. The meeting got pretty heated and any credibility the researchers

had prior to the interaction was rapidly lost.

This in turn led to a meeting between the hunters, houndsmen, outfitters and agency management and law enforcement representatives. This meeting got pretty heated as well, with reminders of who paid the bills. The result was a plan to work with the National Forest to increase access and hunting opportunities adjacent to the community to effect control on both deer and cougar numbers. Maintenance of hunting would also allow a control mechanism to be in place that could be focused on an individual problem animal if necessary. That initiative got bogged down when it became mingled with broader management planning by the Forest Service and came to a grinding halt over NEPA issues completely unrelated to the hunting proposal.

Fast forward to the present, and a situation has been allowed to fester for several years without any real action. Instead, conditions deteriorated as more human development occurred, more people were using the open-space area, and practices such as deer feeding were just making the situation worse.

The group starts to wrestle with how to address the situation. First of all, is some form of stakeholder engagement appropriate? The group's consensus, based on Steve's observation, is the initial effort had a fatal flaw because the stakeholder group was too narrow and represented only a subset of interests. They agree that all affected interests need to be engaged. Second, they revisit whether AIM or IM should be applied. The high-level attention this is receiving suggests as rigorous an approach as possible, but has it escalated to the point where responsiveness and timeliness are more important than the sophistication of the management plan? Would the expenses of a full-blown AIM be prohibitive? Who will cover the costs? Is the scope of the situation broad enough to justify AIM, and of enough interest to attract experts to contribute? Can AIM even be accomplished given the lack of a control and alternative experimental sites? Will an IM approach be sufficient to satisfy the needs for partner and community involvement that Susan

feels is necessary? Is enough known about the management situation/system to effectively launch IM? Can enough be learned through IM to address the challenges? In fleshing out these questions, they come to consensus that AIM is appropriate for the reasons Susan and Steve had discussed earlier.

Next they grapple with whether the community will be a player, and agree to take some responsibility for co-managing the situation. Does the community expect the state to deal with the problem? Are they willing to commit people and resources? Susan indicates the feedback she received from the county, the town, and the police was positive when she approached them about participating in developing a long-term solution. She feels the rapid response in removing the cougars that had been in the vicinity of the school helped, as it showed the state was acknowledging their concerns.

"So Susan, you feel you can take this on?" Steve asks.

"I don't know, Steve. I don't think I have a choice anyway. Since I don't really know what I'm getting into, what the heck – might as well go for it. I do want to be able to bounce ideas off of you and Brenda as we start to implement different stages of the process, so let's discuss what kind of an arrangement will work best for you."

"I think you'll do just fine, Susan. Brenda can certainly help, particularly with pulling the stakeholders together, facilitating their analysis and depiction of the system, and identification of impacts. We can work out a contract arrangement unless you have another mechanism such as temporary hire that you'd prefer. In any event, I'm pretty confident that you can do this – you sensed just what was needed without my help; we're just showing you how to use some of the tools."

13.8 Managers Outline an AIM Approach

Susan's proposal calls for first bringing an agency team together to develop a consensus perspective about the management situation they are dealing with. The team is comprised of Susan, Morty, Glen - the

District Wildlife Manager, Dale - the state ungulate biologist, and Carol - the Wildlife Law Enforcement Officer assigned to the district. Through the course of a noon-to-noon overnight meeting information is mined to sketch out the management situation and the management system relevant to the situation. Over the course of the next two weeks, a manager's model is developed. Out of that process, a concept map of the situation is created that describes the landscape, the human community and affected interests, the management history and status of cougars and mule deer, and the interactions of these key components of the system to be managed. The manager's model, illustrated via the concept map, is shared with the Division Management Team and others within the agency. Agreement is reached that with a few modifications this will be used as an initial communication tool when engaging with partners and other stakeholders.

Susan and the team initially identify a small core group of ten stakeholders. The group is comprised of a mix of traditional interests and those from the broader community. The group includes a representative from the sport hunting community, the local police community relations officer, a school official, county environmental planner, a houndsman, a homeowners' association representative, a local environmental group representative, an open space planner, an animal welfare organization member representing pet concerns, and the biologist for the National Forest.

Glen and Carol become involved as well, representing wildlife management and wildlife law enforcement. Susan hires Brenda on a part-time, temporary appointment to help facilitate the process.

The first meeting of the stakeholder group begins with Susan and Brenda outlining the ground-rules and expectations, and providing an overview of the process. Susan then presents a synopsis of the management situation, using the concept map of the management system as a visual and communication aid. Immediately, some stakeholders begin to interject and comment, clearly taking positions. They begin to cut to the chase making it clear that they

have preferred actions in mind, or prefer no action at all.

"Let's make sure we have a corpse before we commence with the funeral." Brenda's comment silenced the group and she immediately moved them away from the partisan positioning. "Let's look at the concept map, which illustrates a model of the management system. We need to make sure we concur with the basic outline and premises put forth here. Once we agree on what it is we're dealing with, then we can talk about the effects we are seeing."

Over the course of the next day the group refines the system model originally drafted by the agency team. The model depicts the human-wildland interface with protected lands juxtaposed against developed lands, the management regime and deer population response, the human demands for use, and the behavioral response of cougars.

After agreement is reached on the system, its components, and the likely nature of interactions among the components, the group starts to describe desired future conditions. This process reveals many differences among stakeholders, but also significant areas of common ground. The group then begins to define fundamental objectives. Stakeholders are asked to describe effects from cougars important to them and the interests they represent. The various effects are combined where appropriate, and the group ranks these effects as to their overall importance. The most important effects are identified as impacts that need to be managed. These are used to develop the fundamental objectives.

Again, positions begin to be exerted, but the tone is much more congenial than confrontational. The collaborative effort in refining the system model, identifying effects, and determining impacts got all stakeholders engaged, and the basic fact that their input was acknowledged and incorporated has helped in fostering their ownership in the process. Still, wide differences exist among stakeholders, with elimination of cougars to complete protection of cougars representing the extremes. Susan reminds the group that cougars management in this area is not without bounds,

and while the agency will let the stakeholders set the fundamental objectives, they must be within the limits of the public trust mandate responsibility of the State. The group settles on a fundamental objective of sustaining a population of cougars sufficient to meet reasonable public demands for viewing and hunting, and for minimal negative interactions between cougars and humans.

To achieve the fundamental objective a set of enabling objectives needs to be developed to direct management interventions. The group revisits the system model, and added to it now is the fundamental objective as the outcome. Components of the system that represent inputs are identified and refined, and their relative weight in influencing the output is debated. Management interventions (enabling objectives and associated actions) that could potentially affect inputs and lead towards achieving the fundamental objective are identified and discussed. Management interventions are inserted into the model, along with measurable outputs for each. Alternative interventions based on differing hypotheses of how the system functions are developed as well. The systems model now takes the form of alternative managers' models.

The discussions among the group yield consensus as to the key issues. Food availability, including deer and pets, is at the core. Exurban development has fostered this by making the area more attractive to deer (e.g., landscape plantings, no hunting), and by introducing domestic animals into the system. As long as deer are attracted, cougars will be attracted as well. Two underlying potential drivers, deer numbers and anthropogenic landscape effects are identified. Key interventions, both short term and long term, are identified:

- Monitoring of cougar sightings and a community communication alert network will be established. Percent of residents who received the communication is the measurable output, with 85% the target.
- Additional cougars and antlerless deer hunting permits will be allocated to the National Forest in and around the open space area. Percent reduction in cougar sightings is the measurable output, with 50% the target.
- Any new development will have to have landscaping plans approved according to guidance on plantings to avoid attracting deer. Deer damage to new plantings will be the measurable output, with 50% reduction from current conditions the target.
- Guidance and outreach to existing landowners will focus on how they can make their property less attractive to deer. Participation in applying the guidance will be the measurable output with 50% compliance the target.
- Deer and cougars will be captured and equipped with GPS collars and their movements evaluated. Data on use of new and existing residential properties will be used in conjunction with information derived from public surveys to evaluate efficacy of management interventions. The cougar sample will be robust enough to allow estimation of density, survival and other demographic parameters to allow assessment of where the population is relative to the fundamental objective of a sustainable population.
- Surveys will be conducted to assess public attitudes towards deer, cougars, the management program, participation in implementing landscape guidance, and deer damage to plantings. Results of the survey will be used to quantify the outputs for other management actions, as well as estimate whether public attitudes towards cougars and deer are improving, stable, or declining.

To address the dilemma of limited experimental treatment opportunities, not all interventions will be implemented the first year. The competing models differ in that one has deer numbers as the underlying system driver whereas the other has anthropogenic landscape effects and human behavior as the driver. Influencing human landscape effects and behavior will require time for implementation and further time to yield measurable results.

Deer population reduction can occur more rapidly, and the first two years will focus on interventions designed to reduce deer numbers in the community. Steps will be taken immediately to stop the deer feeding (i.e., community-focused outreach education, local ordinances and stepped up law enforcement). Landscape interventions will commence in two years after regulatory and outreach/technical assistance infrastructures are in place.

Annually, an assessment will occur after analysis of survey and biological data. A fundamental question will be whether or not any cougar conflicts occurred. If an event occurs, it will be evaluated to learn whether management interventions were in place and failed or had not been in effect relative to the incident. The results of interventions will be evaluated as to whether they achieved the desired effect, and whether and how those effects influenced the fundamental objective. If results are below target, the agency team and stakeholder group will reevaluate the intervention and determine whether modifications are needed or an entirely new action is warranted. Assessment of target measures will occur and they will be revised based on informed judgment, survey results and stakeholder input. Any changes implemented will be monitored. Subsequent annual assessments will be used to further modify the managers' models and management interventions. Over time, the importance of deer population management vs. elimination of deer feeding vs. landscape management in influencing the fundamental objective should be better understood and the level of management interventions can be reduced, with sufficient monitoring to assess whether the objective is being maintained.

14 Hang Together or be Hanged Separately — *Applying AIM to a Suburban Deer Management Issue*

14.1 A Familiar Beast in the Garden

Autumn colors are brilliant in the woodlot adjacent to the Botanical Garden. The clear, crisp air of an October morning seems to accentuate the captivating vista. Sarah has an unobstructed view of the naturally painted landscape from her office at the Park. She gazes out the window thinking about how fortunate she is to be working in a place with natural beauty yet set in a community with many cultural assets. Having grown up in more southern climate, she especially enjoys the diversity of the changing seasons. With four years under her belt at this job with the Park, she knows well that though the scene is beautiful, it is also ephemeral. The colorful woodlot and the falling leaves escaping the clutches of the ash trees lining the drive into Park headquarters are deceiving to the uninitiated.

The autumn scenery around Sarah is beautiful, certainly, but it also is a harbinger of the winter weather yet to come. And that season change, she thought with a bit of discouragement, would bring the pressure many plants would receive from the growing deer population of the area. She was asked already to speak to a grass roots group, calling itself the Neighborhood Deer Committee. It was formed by disgruntled citizens who wanted to work with the Park, Botanical Garden and wildlife agency to reduce deer in the community. They are well-meaning but have no authority and little knowledge of deer ecology and management. Furthermore, they are narrow in their motivations. They frame the deer management issue in the community as simply "too many deer."

Sarah is abruptly swept out of her daydreaming by a knock at her open door. It was Tina, one of her two technicians. She is there to inform Sarah that test results indicated indeed the tick bite she had received delivered Lyme disease. The doctor prescribed some serious doses of antibiotics, which might put her out of commission for a few days. Sarah offers the usual hopeful comments and understanding any sensitive supervisor would. A few days absence from work now is much preferred over the possibility of more serious illness and debilitating symptoms later. Tina thanked Sarah for her understanding and support, then left the office, obviously upset and not wanting to discuss the situation any further.

"That's it!", Sarah declared privately. Something has to be done about the deer. The ill-advised fertility control project cobbled up hastily by the Botanical Garden and Park three years ago is not working, as anyone could see. Damage to plants is worsening in the Botanical Garden and the Park, motor vehicle collisions are on the rise in the neighborhoods near the Park and Botanical Garden, and residents are complaining loudly about the damage to their ornamental plants. All these effects are occurring unabated while an expensive deer fertility diversion is wasting time and money. While Tina is the first member of the Park staff to be diagnosed with Lyme, the local newspaper carried a story not long ago about several other cases in the nearby community during the warm weather season and the county health department is ratcheting up its public education efforts, especially through the local schools and the Park visitor center. Two of those earlier cases were children. Sarah hopes that none of the dozen seasonal student assistants working for her division over the summer

will be the next reported case of Lyme.

With the season change underway, deer ticks will abate at least temporarily, but other effects can be anticipated, especially pressure on woody plants, whether rare species in the Botanical Garden, culturally important species in the Park or ornamental plants throughout the community. All are susceptible. The farmers adjacent to the community are really hurting, particularly those with orchards. Thankfully, those concerns don't get levied at the Park (though some farmers near the park believe deer find refuge from hunters on park lands). But she knows her friend Earl, regional deer manager for the state wildlife agency, will be hammered if deer damage to the orchards occurs at a level anywhere near that experienced last year. It is time to make a strong case for action to the Regional Director of Parks.

Sarah schedules a meeting with Jim, her regional director, the next week. She starts the meeting by relating the story of her tech and then goes on to share data on the deer damage to Park assets and the cost of plant replacement that the Park has incurred. She also lets Jim know that the Park neighbors are getting restless, and what originated as a discussion group about deer in their community is certainly going to flex its political influence. Jim has been paying attention to the papers and knows that citizens are seeking solutions to the deer problem. He is also acutely aware they are pointing the finger at the Botanical Garden and Park for being a "cause" for the problems they are finding increasingly intolerable. He listens intently, and then asks Sarah if she thinks she could work with the regional deer biologist if given the go-ahead. Sarah responds affirmatively. Jim then indicates that he regrets having agreed with the Botanical Garden director to put all their eggs in fertility control, and sees that it is time to prepare for another approach as they enter the last years of the fertility control project. Jim asks Sarah to hold off until he speaks with the Botanical Garden director, Kim, during a regularly scheduled meeting the end of the week. She concurs, and thanks Jim for his willingness to take action with the Botanical Garden.

14.2 Coming to Terms with a Failed Management Experiment

The meeting Jim referred to is a monthly "off line" get-together greased with cocktails. This is the same venue where 3 years earlier Kim had proposed the deer fertility project. They start their conversation on this particular afternoon as usual with small talk, but then Jim's tone becomes more circumspect. Jim lets Kim know that he is dissatisfied with the current approach to deer management for several reasons and is going to send Sarah to meet with Earl, in hopes they can launch a more comprehensive and effective approach. The Park is feeling too much negative public pressure and the plant damage is going on unabated. This is not acceptable, and no improvement is in sight given the current course of action. Will the Botanical Garden join in the new effort, or insist on continuing the fertility control project? Jim is unsure how Kim will take his assertive comments. After a few moments, obviously thinking seriously, Kim responds.

"Jim, you are absolutely right. This fertility control project has been an abomination. We are still experiencing heavy damage at the Botanical Garden—lost one irreplaceable plant last week, in fact. This is not acceptable to us, either. To top it off, my own board is starting to gripe about the deer, both in the Botanical Garden and around their homes and neighborhoods! It's time to cut our losses and change course. Clearly the Botanical Garden can't affect any change in the deer situation by ourselves. We need to work with you, but as you already recognize the Division of Wildlife involvement will be key to a lasting solution given the way these deer seem to move from areas of occupied habitat into any area where food is available, like it's a giant deer magnet. So this time I will follow your lead. Count us in."

Jim is relieved with Kim's response. He now has only one other senior administrator to approach, and that is Ben Stevens, the regional director of wildlife for the state. Ben is a peer within the state DNR, with an office in the same building as Jim. Despite these institutional and

spatial proximities, Ben and Jim have not been on the best terms since Jim threw in with the Botanical Garden on the fertility control project. Sparks flew between Ben and Jim over that move. Nevertheless, Jim knows he must have a discussion with Ben. Straight talking has always proved most effective in previous dealings with Ben, and Jim hopes that being honest and admitting that going ahead with the fertility control project without a more comprehensive set of interventions that included the wildlife division was a mistake.

The next morning Jim seeks an impromptu meeting with Ben, and is scheduled for a lunch meeting. Jim explains to Ben that he and Kim see that the fertility control effort is not working. He also sees that there is a public issue brewing that will involve the Botanical Garden, Park, community leaders and the Division of Wildlife. With only two years to go in the fertility control program, he hopes that the key players can start working together such that a more effective, collaborative program is in place by the end of the fertility control project. A planning effort is needed, and should get off the ground quickly.

Ben could have responded to Jim's overture in many ways. He chose the best Jim could hope for—he agreed that a collaborative approach would be needed, that all the entities Jim had identified are, indeed, in this together. At one point Ben remarked, "We can either hang together or all hang separately." Jim informs Ben that his natural resource chief for the Park, Sarah, never was in favor of the project, but was doing what she was told. In fact, she has been keeping in contact with Earl. Jim asserts that those two working together are a promising model for leadership in getting the deer issue under control. Ben concurs and commits to support Earl's involvement.

Jim calls Sarah later that day, leaving a message on her voice mail—"It's a go. Start talking with Earl. You can count on the Park, Wildlife Division and Botanical Garden leadership to be ready to entertain any reasonable plan for collaboration. Be sure the local community leaders are part of the process. Pull together a proposal for a process and get that to me asap. Good luck."

14.3 Ready for a Fresh Approach

Sarah reaches Earl on the first try—a rare event as he usually is in the field checking out deer damage complaints, speaking with stakeholder groups, or, on a nice fall day like this one, following Kate, his Brittany Spaniel, around the county's alder thickets and aspen groves looking for woodcock and grouse. But today, Earl is preoccupied with an assignment from the central office.

As Earl had predicted, deer numbers have not decreased as a result of the reproductive control demonstration project hatched by the Park and Botanical Garden directors. And while Earl got the commission to allow more hunting pressure on surrounding agricultural lands, that just moved deer onto the Park and Botanical Garden where they caused more damage during the fall hunting season, after which they dispersed to the surrounding communities and back to the orchards. Earl is aware that the people who provided money for the fertility control project are growing dissatisfied because the effort did not meet their expectations. By year 3 in a 5-year project the supporters are no longer thinking highly of fertility control as a solution to their deer problem. Animal rights groups have lowered the volume of their protestations. Other external groups concerned about detrimental impacts of deer have continued pressuring the Division of Wildlife and the Park. The pressure from the Farm Bureau has really intensified and with anxiety mounting about the coming winter being a repeat of last with respect to extensive deer damage, farmers are looking for relief. As if that isn't enough, he, like Sarah, has been watching the rising foment from the residential neighborhoods situated between the Park and the rural farm country. The Neighborhood Deer Committee (NDC) is making its presence known with local and state elected officials, who in turn were expecting Earl to work with them to address their concerns. Like Sarah, Earl also had been approached by the NDC to speak at an open community forum on "living with deer."

"Central Region Wildlife Office. This is Earl." The business-like tone of Earl's voice is familiar to Sarah. They have had periodic discussions as they watched the deer problems worsen. They have been meeting occasionally over the last few years, mending fences between the Park and regional Wildlife office. Relations between the Park and Wildlife Division have been strained at the top, but in addition to maintaining communication, Sarah and Earl have not personally undermined one another during difficult times, and still value each other's role in dealing with the deer problem.

"Earl, this is Sarah," is all Sarah had to say.

Immediately upon hearing Sarah's voice Earl softens and responds in a more friendly tone. His first words pick up on a familiar, friendly chiding line he adopted some time ago. "So, how is the queen of fertility control doing today?"

Sarah is ready for him this time. She snaps back, "Ready to do some serious deer management rather than paying off farmers to keep them from complaining to their state legislators!"

At first, Earl is not sure what to make of Sarah's comment. She seems excited, so rather than keep the bantering going, Earl asks, "What's up?"

Sarah fills Earl in on the recent discussions and the opportunity that is presented. On the one hand, he is very pleased by these developments, and on the other he knows well that they have a lot of work ahead of them, and expectations of their supervisors and many stakeholders will be running high. But, at least they have a fighting chance to turn things around. The current approach is doomed to failure. A new approach could do no worse and perhaps much, much better.

After some discussion, Earl and Sarah decide on their first steps. As a condition of the permit for the fertility control project, it has an evaluation built into it. After year three, the progress in deer population reduction using fertility control alone is to be assessed. Deer numbers have been monitored all along, so the assessment will be easy to pull off. Earl and Sarah already

know the outcome—no effect. The plan approved by the Wildlife Division includes a provision that if the finding of "no effect" is reached, then a new round of planning for deer management will be initiated, leading to a second phase of management.

With over a year to develop phase two of a deer management plan, rather than a couple months like they had the first time, Sarah and Earl are ready to launch a more robust and comprehensive planning process. They understand what that means for resources and effort, as well as outcome potential. The first thing they need to do is get their staffs on board. The curator for the Botanical Garden will need to be involved as well.

Prior to the first joint staff meeting, Sarah and Earl decide that they need to avoid a finger-pointing session that might serve to harden feelings between employees of the Botanical Garden, Park and Division of Wildlife. The fertility control project is not working. That's obvious to most staff. So, rather than spend time hashing over the obvious, they decide to allow the group to decompress by discussing the positives and negatives of the program. It will be better to describe lessons learned than beat up on the Botanical Garden or Park, or "administrators."

A joint staff meeting is convened. Earl began by informing the group that the fertility control project will be terminated. He tells them they are tasked with designing a planning process that will result in a deer management plan their respective organizations and the community could support. They have a year to do this. The first work for the group is to discuss what they have learned from the last several years.

A member of the Park staff piped up, "We sure learned that reproductive control didn't work. We need to get some sharpshooters in to do the job right." Sarah tries to stop this line of discussion in its tracks by replying, "Right. Fertility control by itself did not work given the scale of the problem we are dealing with here. Now that we have established that, let's see what else we have learned."

"Well, that is a good question—what

have we learned?" Earl asks with emphasis. "Many of us were so certain that a fertility control program wouldn't work that we did not put time or effort into setting up the program as a field experiment or management experiment from which we really could learn what the effects of the activity would be."

"What else is there to learn?" one Division of Wildlife staff member asks. "Like most of us expected, the fertility control program didn't reduce the deer problem, period. Isn't that all we need to know?"

"We did not set up the fertility control program as an experiment, so we don't know that it didn't reduce the problem from what it would have been without the program," Earl cautions. He adds, "We can see that deer damage to plants in the Botanical Garden and Park has continued, car collisions still occur at an unacceptable rate around the Botanical Garden and Park, homeowners are complaining unabated about their tulips and shrubs, but we do not know that the fertility control effort didn't help keep the situation from being worse than it was. We had no controls, let alone alternative treatments to measure differences. Whatever we decide to do next time, we need to get more sophisticated in our approach to learning from the experience. This issue will be with us for decades to come, if not forever, and it's time we start being more scientific to back up our claims of engaging in science-based management."

"Are you talking about taking an adaptive resource management approach to our deer management dilemma?" one Division of Wildlife biologist asks.

"Actually, I'm thinking of a variant, adaptive impact management," Earl responds. "That approach places the emphasis on stakeholder-identified or community-derived impacts as the objectives, not deer population performance. We all know that deer numbers are important but the overriding issue isn't deer numbers per se; it's the effects created by the combination of deer behavior and human activities—like driving cars and creating botanical gardens and parks. We need to focus management

on the important effects, as our stakeholders and partners see them. We can anticipate that we'll have competing ideas about how to fix the problems, how to reduce the impacts, so we can also anticipate that we will need to parse out the contributions that various elements of an intervention will have on problem reduction."

"What you are suggesting, Earl, sounds very intriguing and potentially very useful in the long run," the biologist responds, adding, "but it may be more than we can handle."

"We'll need to take this in steps over the next year," Earl confesses, "to see what makes sense given the situation we have, but I want to set our sights high initially, and adjust as we need to, rather than the other way around."

"Haven't we learned quite a bit from our experience of the last several years?" asks the curator. "Do we have no confidence in our professional observations?"

"Right, we should make an assessment of what we think we know from these last years of effort," Sarah chimes in, sensing unease among the group. Looking across the table at Earl, she asks, "Can we start there?"

"Certainly, what positive developments have occurred with respect to moving forward with a new approach to deer management?" Earl asks the group. Over the course of a half hour the group enumerates and discusses briefly some of the positive outcomes of the last few years. More stakeholders are interested in deer management. Some community leaders are more interested in listening now and working toward lasting solutions. The group even found that they learned some things from the fertility control project, key among them are insights about scale of the issue (e.g., the impacts of deer and their management go well beyond the Botanical Garden and the Park; deer effectively use protected areas to avoid hunters, etc.). The Botanical Garden and Park learned some things about their limits and capacity. Some positive relationships with local media have developed and can be used to help communicate about what the collaborators want to do next.

"Perhaps we have a better informed community now," one staff member observes.

"And what were the negatives? What should we do differently with whatever approach we take and how do we incorporate that into our next planning process?" Sarah asks the joint staffs.

"We didn't really think hard about all the full range of effects occurring from interactions with deer or how stakeholders translate those into impacts," remarks a Park planner. "We didn't carefully model or critically evaluate what we could reasonably expect as effects of the fertility control program that we had the wherewithal to implement. We were using general ideas applied loosely to our situation, and what we got was a lack of desired effect on specific problems. We should put more time and resources into modeling and predicting how alternative actions will individually and collectively move us toward our objectives."

The curator for the Botanical Garden observes, "We didn't engage stakeholders in a comprehensive way. We didn't clearly articulate objectives. We didn't really link all community impacts from deer well to actions taken." Pausing for a moment, he adds, "So now we have a more polarized set of stakeholders; we created new stakeholders with new concerns that we hadn't anticipated."

"These are good points," the Park planner comments. "And any modeling we do should be focused on objectives that are couched in terms of stakeholder-defined impacts, and involve some stakeholders in modeling so they understand how the system we are dealing with works and how our ideas for influencing that originate, as well as how much effect we can reasonably expect."

These comments give rise to a good discussion about the importance of being clear about objectives—why management is occurring—and connecting actions to objectives. More comments about the benefits and challenges of stakeholder engagement surface during the discussion, but after about an hour the discussion wanes. A "bio break" is declared. When the group

reconvenes, Earl first turns to Sarah and asks, "Would you like to add anything else before we start discussing the future?"

"Well, I think we can safely say that we have learned relying solely on fertility control didn't work. But no approach that hinges on another single technique is going to address all the problems we are hearing about either. As we discussed before the break, this time we really need to think more comprehensively about impacts before we discuss actions. We need to engage stakeholders better and we need to raise the sophistication of our analysis to include modeling. Accepting that we are going to be involved in this management issue for many years to come, we also need to place more emphasis on learning from our experience, in a more rigorous way than is typical of the Park and perhaps the other agencies present. Fortunately, we have the opportunity to do so. That is why Earl and I would like to propose an AIM approach this time around."

As Sarah pauses to take a breath, a Park staff member looks at Sarah and Earl quizzically and asks the inevitable question, "Folks, what the heck is an AIM approach?"

"I can address that question," Earl interjects. "AIM is shorthand for Adaptive Impact Management, which is simply an approach that focuses management on effects of human-wildlife interaction of greatest importance to stakeholders. Those most important effects we refer to as impacts. AIM judges management success based on the extent to which impacts are changed in the direction planned during a pre-defined period of management activity. If we are seeking more occurrences of positive impacts, such as deer viewing opportunities for visitors to the Park, then we judge success on that. If we are seeking to reduce or eliminate deer damage to valuable plants on the Botanical Garden or Park, then that is what we judge our success on. Because we typically need to trade off some expectations for more positive and fewer negative impacts, we use stakeholder input and involvement to determine where the tradeoff points are. Thus, AIM seeks high quality stakeholder input and involvement

to identify both impacts of concern and acceptability of management actions taken to achieve impact changes desired."

14.4 Considering Adaptive Impact Management (AIM)

"I don't want to be a jerk about this, Earl, but how is another process going to help?" asks Art, a long-time wildlife biologist on Earl's staff. "It seems like we periodically try some new management fad just for the sake of it, and I'm tired of that. How is this Adaptive Impact Management approach different than what we did before? How is it going to help? It just sounds like a pile of new work to get to the same place we always try to be. How much more stakeholder involvement can we stand?"

"It will take some work to implement a good AIM approach, no doubt about that," Earl replies. "But these problems aren't going away. As we discussed earlier in the retreat, things are getting worse. And with some work, Sarah and I are convinced the Park, the Botanical Garden, and our wildlife agency can really make progress working with our various stakeholders toward some common objectives. We need to make a good effort at identifying all the impacts of concern in this community, from gardeners to hunters. And then we need their help in the next step—deciding what the inevitable tradeoffs are going to be that will result in acceptable impacts across the suite of stakeholders affected by deer and deer management."

"The point isn't to simply do more stakeholder involvement," Sarah adds. "It's to do smarter and higher quality stakeholder engagement. You all know that we have typically done as little stakeholder involvement as possible—just enough to claim we did it with a straight face. This time, we need to do it because we really want to learn from it and we want stakeholders to learn from us and each other. That isn't doing the same old thing, is it?"

"No, that would be different," Art responds. "But, it will also raise the stakes for us, as we will be raising expectations of those stakeholders we involve and the people they represent in the community."

"That's a good point, Art," Earl remarks, "but we will have one ace up our sleeve—the people involved will bear and share some responsibility for the objectives established, the timeline and the methods we employ. That means we will be acting as a collaborative community, if we can develop a solid foundation for an AIM approach over the next year or so."

After crossing the bridge of doubt among the staff, Sarah and Earl tell staff about the steps in an AIM process. They point out that the first step includes a situation analysis and a decision about whether to go with an AIM or an IM-plus approach. They explain that the difference is in degree of stakeholder engagement. Sarah and Earl make it obvious that they are leaning heavily toward the IM-plus side of the continuum because they want to sustain stakeholder engagement from start to finish. That decision does not need to be made yet, but the seed is planted with the joint staffs.

The joint staffs agree to become a collaborative deer management team. They decide to meet again soon to start the situation analysis phase of the project. That step focuses on development of a concept map and involves just them, for starters at least. Earl assures the group they aren't going to limit situation analysis to staff only, but they will do it internally first, then expand to include review and input from a select number of people who can reflect key stakes existing in the community with respect to deer management.

Following the joint staff meeting, Earl contacts Pat, a colleague from another state wildlife agency who is a skillful facilitator of teams of managers in the process of creating concept maps of management systems. Pat also knows how to use a software program called Cmap™ to organize and present ideas as a neat concept map. Thus, Pat has a few prized skills to offer Earl and Sarah as they embark on their first AIM approach.

Earl explains the deer management situation to Pat and asks if he'd be interested in helping out with the concept mapping work for the collaborative management

team. It would involve some preparatory work, attendance at a retreat, and then a little follow up to clean up the concept map. Pat is intrigued, but needs to check work schedule and seek an OK from his boss. He promises to get back to Earl by the end of the week. Earl receives a call from Pat within a few days and the answer is "Yes."

14.5 Situation Analysis through Manager's Model and Concept Mapping

With a little coaching ahead of the retreat to build enthusiasm, the deer management team dives into their assignment to create a manager's model and illustrative concept map. They meet over 2 days in a pleasant and comfortable retreat atmosphere, away from e-mails, telephones and other interruptions. Pat is introduced to the management team at the retreat. Though one of the youngest people in the group, he soon earns the confidence of others as he quickly proves to be very bright, knowledgeable, and skilled in concept mapping.

Earl and Pat team up to define and describe what a manager's model is and why it is useful. They present examples of manager's models from other states and situations, including a community-based deer management case, and in so doing demonstrate the general architecture and utility of concept maps. The deer team learns that a concept map is basically a visual depiction of relationships between key elements of the management system *as they see it*, including social, political and biological aspects. Describing the process of developing a manager's model, Pat lets the team know they would be discussing a number of things that would move them through a three-stage process: framing concerns, system definition (including identification of constraints, limits/capacity, and opportunities) and articulation of likely actions, reactions, and mitigation. He assures them that there is no such thing as a manager's model that was perfect or an observation or a suggestion that was not worth considering. Not all ideas will be included in the final manager's model and concept map, but all will be considered. He emphasizes

that the discussion is as important as the model produced.

After answering a few questions, Pat kicks the session off with a few key questions to get the discussion rolling. It is not difficult to ignite the conversation. Controlling discussion and keeping it on task is a challenge, but one that Pat handles skillfully. At the close of the first day, the team is exhausted, and has nothing much that looks like a model or concept map on the dozen sheets of flip chart paper that adorn the walls. They cover a great many topics, including describing the current condition in the community from a variety of perspectives, describing the future conditions they and the community would prefer to see, biological and sociological information gaps, policy constraints (limitations imposed by current policy and need for additional policy to aid deer management), politics of the situation, stakeholder education needs, and more.

The second morning starts with Earl and Sarah tag-teaming a review of the pieces of the concept map that Pat synthesized from the discussion of the day before. To the group's amazement, Pat has a draft manager's model, or at least a portion of one (covering framing concerns and system definition) literally mapped out, using the software package Cmap™ . He projects the map on a screen and hands out printed copies to each of the team members. Team members who were wondering where Pat, Sarah and Earl had disappeared to the evening before while they were relaxing with a few beers and sharing war stories now have their answer. They were still working!

Referring to the Cmap™ illustration (a computer-projected figure), Earl and Sarah lead discussion while Pat works the technology and takes notes for future refinement of the concept map. With the concept map taking shape, and making sense, the deer team is visibly excited that they are making as much progress as they have in the little time they spent thus far. This seems to motivate and animate their discussion during the second day of their retreat.

The management team continues discussion that contributes to articulation of

a manager's model and Pat keeps up with the Cmap™ additions by not taking lunch. In this fashion the team completes its first draft of a manager's model and the concept map for their deer management system by mid afternoon. In the process of developing their model, the team reveals quite vividly for themselves the difference between the existing condition and the condition they want to achieve. The concept map captures the major relationships and key details for further refinement and communication purposes. The management team is quick to see the value in the exercise and the product. As one points out, "We now have a common understanding of the system, some challenges we face, and a way to talk about it that will improve communication among ourselves and with others."

They know that their work with the concept map is not done yet. With Pat's assistance after the retreat, the concept map of the management system will be developed in greater detail. The management team does not know how to resolve their deer issue yet, but they have a more thorough idea of the situation and what they are facing than ever before.

Ideally stakeholders and partners need to be engaged to refine and confirm aspects of the manager's model. The model should be "calibrated" against the beliefs of stakeholders. But for the time being, the team has a joint product representing a collective perception of the system in which they are operating and a vision of the future they think would benefit the community and its various interests. They understand that essentially what they have, however, is a hypothesis. Their model, like any system model, is a lie that helps them see the truth, but it is not the truth per se. They also know that every action they take from here forward has the potential to change the system they just described—hopefully for the better. With attention to such changes through systematic monitoring and periodic evaluation, they will learn how to influence the system more effectively and perhaps even predictably.

With a concept map in hand, during the closing hour of the retreat the management team turns to Sarah and Earl with the inevitable question of "what do we do next?"

With this cue, Earl indicates that they have to decide on an overall approach to reveal and set priorities for impacts that are important across the affected neighborhoods and stakeholders. At this point team members start suggesting ideas that range from creating an advisory group to holding "focus groups" to conducting surveys.

Sarah reacts by explaining, "These all have merit in identifying impacts and we are going to have to decide which ones will serve us best or whether we can do them all in a complementary fashion." She also indicates that each of the suggestions have different strengths for different purposes and given that we have some time, developing an approach that incorporates many of these suggestions is possible and may make sense.

Earl points out that an <u>advisory committee</u> might be set up for the duration of the program from planning through implementation, and evaluation. Additionally, ad hoc <u>stakeholder input groups (SIGs)</u>, perhaps one in each of the four neighborhoods near the Park and Botanical Garden would be valuable for getting suggestions initially about impacts, fundamental objectives and enabling objectives. These same SIGs might meet a second time, after the stakeholder input is aggregated and the managers have created what seem like reasonable stakeholder-derived, impact-based objectives. Purposes of a second meeting would be verifying the objectives and identifying actions that would be acceptable for meeting enabling objectives.

One team member points out that the roles and responsibilities of the advisory committee and the SIGs will need to be spelled out. Earl agrees, indicating the advisory committee likely will have some authority in selecting objectives and actions, whereas the SIGs will be the source of input and a sounding board for reacting to alternatives before decisions are finalized.

One member of the management team observes that the development and implementation of a well-done community

survey would be a great aid not only to the team but also to the advisory committee and the SIGs in the overall attempt to understand the extent and nature of experiences that citizens are having with deer, the effects they are recognizing, and the impacts that they want managed. Another team member relates an experience where the data from a scientific survey was critical to help demonstrate the validity of the premises upon which they were basing a management program.

Discussion of the pros and cons, timing, costs, and complementary aspects of these stakeholder input and involvement methods leads to a consensus that the approach they were going to propose would include all three aspects. The team feels that the triangulation benefits offered by this multifaceted stakeholder approach outweigh the costs involved to accomplish it. The team recognizes that down the road the advisory committee would have a special and important role in evaluation of effectiveness of actions taken and decisions about modifications in the program (i.e., they recognize a need to adapt their approach based on what they learn during program implementation).

14.6 Will it Fly?

Sarah and Earl take their proposal for program planning and implementation to their supervisors. They explain the management system (likely impacts of concerns, limits and capacities expected) to Kim and Jim. With the aid of the concept map as a communication device and the compelling argument for high quality stakeholder involvement, they gain approval to proceed.

With the green light from their supervisors, Sarah and Earl set the plan in motion. First, they engage in a process to identify members of the advisory committee. They seek nominations of people from the community who reflect various stakes but who do not represent any organized interest groups. They hope this ensures that the diversity of impacts from deer are revealed without "baggage" from previously established positions. They settle on an eight-person committee with State Park, Division of Wildlife, and Botanical Garden ex-officio

representation. Sarah volunteers to serve as secretary of the group. One of the first activities with the advisory committee is for Sarah and Earl to share the concept map of the system with the committee primarily as a catalyst for discussion. The advisory committee is asked to help refine the system model.

The second order of business is explaining the purpose and value of a community survey and then soliciting advisory committee willingness to participate in developing the survey instrument. The advisory committee agrees. The third action is for the advisory committee to be the "sponsor" of the SIG meetings.

Next the Division of Wildlife contracts with the state university to work with the deer team and advisory committee to design and implement a survey of citizens. A formal expectation is that the principal investigator (PI) will work with the advisory committee as she considers the method and develops the instrument. All agree the best method will be a telephone survey. After considerable discussion as to whether the survey should come before or after the SIG meetings, the PI and advisory committee decide the survey could run simultaneously with the meetings.

With the help of community leaders, potential SIG members are identified for each of the four neighborhoods. Asking community leaders to assist in this way serves both to engage them and to improve credibility with them when "their" nominees to the SIGs make suggestions. Participation is solicited from these nominees in early winter, a time when deer-car collisions rise and therefore the deer "problem" is apparent within the community. The first SIG meetings focus on identifying impacts and drafting fundamental objectives. These present a logistical chore; meeting arrangements and communication with each SIG (each had eight members) required time and attention. Fortunately, the local Cooperative Extension educator volunteers to help organize and facilitate the SIG meetings. A second meeting of each neighborhood SIG focuses on identifying enabling objectives needed to achieve fundamental objectives they identified during their first meeting.

They also discuss a variety of management actions that might achieve enabling objectives. The primary input desired from SIGs with respect to management actions is their contribution to the assessment of social acceptability of action alternatives.

14.7 Impacts to be Managed

Collectively the various stakeholder groups begin identifying their concerns. From this exercise, events and interactions between community member and deer are articulated, as are effects and impacts. This is the grist needed to start developing fundamental objectives.

The list of impacts is diverse:
- diminished value of Botanical Garden plants for research and education, compromised cultural and historical plant assets in the state park,
- Botanical Garden and park staff and visitor health (Lyme disease),
- community resident's health (Lyme disease) and safety (deer-auto collisions),
- aesthetic quality of residential landscaping,
- cost incurred by farm families from deer damage,
- health and safety of farm families,
- enjoyment of recreational hunting, and
- enjoyment of deer viewing.

The deer team presents this list to the advisory committee for discussion. It is important to inform and receive input from the advisory committee on the impacts because these ultimately drive the management interventions in the Impact Management approach they are taking. A critical task is making sure the advisory committee is mindful of the limitations of the deer team, so the team first identifies the recognized impacts that they have authority to manage. For instance, management of human-tick interactions might more appropriately fall to the public health department and deer-auto collisions to the transportation department. The deer team accepts the fact that the number and distribution of deer may affect ticks and collisions, but other actions by the health and

transportation departments will be needed. The advisory committee suggests that these additional public agencies be contacted, which the deer team agrees to do.

This results in a reduced list of impacts for further consideration: diminished value of Botanical Garden plants for research and education, compromised cultural and historical plant assets in the state park, aesthetic quality of residential landscaping, cost incurred by farm families from deer crop damage, enjoyment of recreational hunting, and deer viewing. In further discussions the group decides that deer viewing would not be treated as a separate objective, because no matter what the management interventions might be there would still be deer for viewing.

Next the management team meets to work on articulating fundamental and enabling objectives in terms of these key impacts. The first hour of the meeting is dedicated to a preliminary report from the community survey. As one would hope, the survey pretty much confirms the input from SIGs with respect to the kinds of impacts being experienced in the four neighborhoods. But the survey also holds a couple surprises. First, unlike the impression one might have formed from the SIGs, deer-car collisions are not the major concern of the neighborhoods. Instead, plant damage tops the list, by a wide margin. Second, the university folks who worked on the survey were able to use GIS to spatially reference degree of problems experienced by respondents. As expected, one area of heavy impact is a band of residences near the Park periphery. But another band is revealed on the urban-rural interface—that is, immediately adjacent to the agricultural lands on the outskirts of town. This is not expected. Furthermore, those respondents are more inclined to accept recreational hunting as a remedy than are those who are close neighbors to the Park. These data are just the ticket for fueling some excellent and creative discussion.

The ensuing discussion leads the deer team to realize that at a fundamental level the concerns of the Botanical Garden, Park, and many home owners are similar. Simply stated, they desire <u>complete protec-</u>

tion of the most valuable plants on their property and <u>reasonable protection</u> for the vast majority of other plants. The concerns of the agricultural stakeholders are more related to enterprise economics than aesthetics or irreplaceable values, but plant protection is still at the base of their concerns. Likely prompted by the geo-spatial aspects of the community survey analysis, the deer team starts to identify what might be a two-zone strategy to attack the deer problem. The first zone is at the core of the area under consideration. It includes the Botanical Garden, Park, and residential areas adjacent to the Park. The second zone is the agricultural area and the outer ring of adjacent residential neighborhoods on the urban-rural interface. This partitioning of the area geographically is discussed at length. By crossing jurisdictional boundaries it has pros and cons. On the downside, more than one set of decision makers (trustees, Park administration and elected officials from local community) needs to be in agreement to implement actions. But the up-side is that it is treating the system more like the way the deer are affecting it, based on deer behaviors and movement patterns as well as the various forms of stakeholder input received by the deer team. The team decides the pros exceed the cons and they turn their attention to developing fundamental objectives for the two zones.

Using the input from SIGs and the preliminary findings reported for the community survey, fundamental objectives are identified for <u>Zone 1</u> for the next 5 years:

- No loss of the research and education value for rare plants.
  - o Enabling objective: eliminate all damage to rare plants
- Reduce damage to replaceable plants (used as specimens at Botanical Garden, in agriculture at Park and part of ornamental landscaping around homes) to an acceptable economic level.
  - o Enabling objective: reduce damage to replaceable plants by 75%.

Fundamental objectives identified for <u>Zone 2</u> for the next 5 years are:

- Achieve crop damage at a level acceptable to farmers.
  - o Enabling objective: reduce by 20% the cost to farm families from deer crop damage.
- Expand recreational hunting opportunities in the agricultural areas.
  - o Enabling objective: make available 20% more deer permits in the agricultural areas.

Next, the deer team takes these draft fundamental objectives to the advisory committee for review. The committee is comfortable with them, except for those referring to agricultural damage. They ask that the targets indicated in the objectives be verified with some group representative of the farmers. Earl volunteers to do that by discussing the situation with the local farm bureau at their next monthly meeting, scheduled for two weeks hence.

Earl is a familiar visitor at farm bureau meetings because the group regularly seeks information on deer population status, projections of hunter harvest, actual results of harvest, access issues, etc. Usually they feel that the Division of Wildlife is dealing with their concerns inadequately and certainly not without political pressure. They are surprised when Earl announces that he is there to seek input on the degree of deer damage they can tolerate, and what they think is reasonable in exchange for the presence of deer (which he knows the farmers appreciate a great deal). The farm representatives present had never thought of specifying a reduction level in terms of percent change. They always just want fewer. Lack of data about the economic translation of damage levels currently experienced hinders informed discussion, but they try in earnest to weigh the pros and cons of various levels of change. They also know well that the Division has only so many tools at their disposal to effect a change. In the end, they ask Earl to change the reduction amount from 20% to 30%. They also ask that a study be hastily put together to get a baseline estimate of the current level of agricultural damage, and offer to allocate some funds for that purpose, if the state can

match them. Earl agrees that this is a good idea and promises the additional funds. He will get the university researchers on this inquiry as soon as possible. He asks if a few farm bureau members are willing to work with members of the deer team as a steering committee for the inquiry. They agree and three people volunteer on the spot.

14.8 Management Interventions— Finally!

14.8.1 Interventions Described

After multiple meetings and discussions with staff members and university researchers the overall management experiment begins to take shape. Logistical considerations such as two management zones, limited study area sizes, disparate stakeholder perspectives, and the complexities of the urban-rural interface complicate decision making on how best to structure the management experiment.

They agree that in Zone 1 individual small exclosures will be installed to protect all of the most valuable, very rare, and irreplaceable plants. The reason for the deer-proof exclosures is to ensure survival of these plants regardless of the outcome of the management experiment examining effects of deer density reduction and repellent effectiveness.

For other plants in the Botanical Garden and Park that are classified as rare or irreplaceable, a highly-touted deer repellent, recently developed by the University Agricultural Experiment Station, will be tried. The repellent will be applied to 50% of these plants, leaving 50% untreated.

Culling of deer using various techniques including sharp shooters, archery hunting, and trapping plus euthanasia will be used in Zone 1. In Zone 2, deer removal will include expanded antlerless hunting harvest during the normal hunting season, coupled with post-season special culling hunts and targeted killing of deer that tend to congregate in private orchards. In addition, local bow hunting clubs agree to volunteer at least 1000 man hours to provide the effort needed to achieve the targeted harvest rates.

Numerous discussions and debates lead to setting deer reduction goals. It is agreed that the targeted harvest rates for Zone 1 will be set to achieve a reduction in deer numbers of 40% over a 5-year period. It is acknowledged that considerable effort and tenacity will be needed to achieve this objective.

In Zone 2 the goal is to increase antlerless deer harvest significantly in year 1 to achieve a population reduction of 20%. Additional reductions over the next 4 years will be set to achieve a total reduction of 30% by year 5.

University researchers serving as advisors to the management team are clear that if the goal is to identify a level of deer reduction where repellents are most beneficial, then a key aspect of this experiment has to be focused on learning about specific interactions between deer densities, effect of repellents, and level of herbivory on rare and valuable plants. The researchers point out that it will require the development of specific models with competing hypothesis tested to ferret out this information.

Together, the management team and the researchers create a first-order model of the deer-repellent-plant damage interactions. Using some data from the literature and reasoning to fill in approximations where data are lacking, they develop hypotheses for how this system operates.

Data gathering will be intensive. Monitoring of the deer populations in both Zone 1 and Zone 2 is paramount. It is acknowledged that there will be movement and interchange of deer between the two zones. The population estimate will be done consistently at the same time of year over the 5 years and the point estimate for each zone will be the estimate. This point estimate is needed to calculate the number of deer to be removed each year. Thankfully, an on-going mark-recapture effort has been in place for the past few years that greatly aids the effort.

Concomitant measures of hunter participation, success, and satisfaction will be taken. These systems are generally in place and done annually by the Division of Wildlife, but will be supplemented by specific hunter reporting requests.

To monitor rare and endangered plant responses the standard and on-going method of determining plant viability utilized by the Botanical Garden will be employed. In addition, other measures of plant herbivory such as intensity of browsing on ornamental plants in residential areas will be recorded.

Standard information that is routinely collected on impacts important to the various stakeholders will also be part of the evaluation. These include number of deer-car collisions, deer damage claims from farmers, incidence of Lyme disease among residents in both zones, and measures of key stakeholder satisfactions.

Earl and Sarah convene the deer management team to discuss the next step in planning an AIM approach—deciding on action alternatives. Prior to the meeting, they discuss how in previous management efforts, they often would start with the actions assumed and work backwards to gain approval for them. This time they have input already from stakeholders who have made their preferences known via the community survey or the SIG meetings. Despite the data available, the decisions to be made "will not be any easier, but perhaps much better" as one deer team member put it.

Zone 1. A management action identified to accomplish the enabling objective of "no loss of rare or highly valuable plants" is to construct exclosures. The alternative is to fence the entire Botanical Garden and Park, which would come at a high cost and great resistance from community members wanting free access to the facilities, so the group opts for the individual exclosures. This leaves open the reality that plants not enclosed will still be subject to deer damage, perhaps even greater damage if no other actions are taken to provide relief from browsing. Nevertheless, the team feels this action will allow for an acceptable degree of damage and cost.

A management action to reduce damage to replaceable plants is the use of chemical repellents. Park managers do not see how repellents will work for them because of the expansive nature of the heritage

agricultural operation. Homeowners will not be enamored with exclosures around their ornamental plantings, but likely will consider them for the period from late fall through early spring when their plants are most susceptible to deer damage. They also will consider repellents. Moreover, they are willing to consider alternative plants that have demonstrated resistance to deer browsing. The deer team is unable to identify any significant collateral impacts from these proposed management actions.

Clearly some reduction of deer is essential. Some form of culling (perhaps removal by sharpshooters, archery hunting, trapping plus euthanasia) is needed in the Botanical Garden and Park especially. These remedies have identified collateral effects, such as concerns about safety, secondary contamination, venison consumption, cost, and hunters fear of a non-hunting precedent for deer management. Based on an assessment of the collateral effects and cost/difficulty of mitigation of these, it is decided to proceed with a significant culling operation in year one, followed thereafter by the combination of archery hunting (where feasible) and trapping plus euthanasia to achieve harvest rates when archery hunting alone does not do so.

The deer team identifies collateral effects associated with this course of action. Some organized resistance from animal rights interests is anticipated against the culling, whichever means is employed, and bow hunting. The community survey shows that some people (20% +/- 5%) will be opposed to killing deer regardless of method and some will be opposed to the archery hunt in residential areas because of safety concerns (15% +/-5%). Fewer are concerned about trapping plus euthanasia, but the team envisions this as a limited activity, not useful for the larger number of animals they want culled by archers. The only mitigating measures the team can identify are getting out a great deal of information indicating general community support for the measures recommended and publicizing the progress made and safety record of the culling by archers. They hope that over time these actions together with success

in reducing impacts from deer will lessen the fears of many. The team feels it simply has to accept the fact that not everyone will be satisfied with the suite of actions they identify.

Zone 2. On the agricultural lands of Zone 2, the group decides to rely heavily on expanding hunting harvest during the normal season, coupled with post-season special culling hunts and removal of deer that congregate in orchards in late winter. To reduce effects on adjacent residential properties where gun hunting is not considered a safe alternative by anyone, an unprecedented 120-day archery hunting season is proposed, running from November through February. Local bow hunting clubs agree to volunteer 1000 hunting hours for this civic purpose and suburban-rural interface landowners are largely in favor of allowing archers on their land to provide this culling service. Deer carcasses will be processed for the meat and distributed to various outlets in the community.

Collateral effects anticipated are of two types—(a) resistance from hunters who do not want does killed, especially not in large numbers as will be proposed, and (b) resistance from animal rights groups who will protest the archery hunt in suburban areas. To mitigate the concerns of hunters, the Division of Wildlife staff will try to convince them that a rare opportunity is being presented for the hunting community to demonstrate its real potential as an instrument for management of deer for the greater public good. They can demonstrate a civic purpose for hunting, adding value to the cultural and recreational benefits typically associated with the activity. The team is less successful in identifying any mitigating actions to reduce the protests of animal rights advocates, other than trying to explain why the actions are being taken and reaching out to those interests to be participants in addressing the public issue that deer management has become.

On behalf of the deer team, Earl and Sarah present the Adaptive Impact Management action plan first to their supervisors, who blessed it, and then to the advisory committee, who also blessed it. Now, with the formal approvals behind them, the deer team can proceed. The process takes eight months.

14.9 Adaptive Impact Management Pilot is Launched

It is late spring now. From Sarah's office window she can see the fresh green leaves cloaking the trees of the Park's woodlot. The early perennial plants around the old farmhouse are blooming, having sprung up overnight following a warm spring rain. She can see several deer feeding on the sprouts of new growth outside the exclosures that protected the heritage plantings. All of the mature does in the group are obviously carrying fawns that in a month or so will add to the growing deer population, attesting to the ineffectiveness of fertility control project. The coming year is supposed to be the last year of fertility control, but everyone is convinced it has failed miserably and that the Adaptive Impact Management plan resulting from the collaborative effort of the deer management team is far superior, so fertility control is cancelled a year early. Soon the AIM implementation will start in earnest. Actually, the Park and the Botanical Garden already erected exclosures for their most valuable plants. Earl has approvals from the wildlife commission for increasing hunting permits, deer removal permits, and lengthening archery seasons per the Adaptive Impact Management plan. And, the Cooperative Extension educator who works with the SIGs is doing a great job informing homeowners about how to make attractive and effective exclosures for use in their yards and which plants might be deer resistant replacements when exclosures are not desired.

While these pieces of the plan are falling into place, the culling measures needed in the Park and Botanical Garden have run into a snag. Some people, clearly a minority, are not yet ready to accept the idea of just killing deer by sharp shooting, trapping plus euthanasia or poisoning. These seem less palatable than normal hunting for many citizens, yet they do not feel that such hunting is safe in their situation. This log-jam needs to be broken because much of the rest of the action plan depends on knocking back the number of deer in one

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effective pulse prior to the other measures being implemented. A law suit results in an injunction, but the state Attorney General for the Park system assures Sarah that because of the exhaustive, indeed unprecedented public input effort used to arrive at the strategy, this law suit will be settled quickly, resulting in a minor delay at most, and perhaps no delay at all.

Earl is working to get the farmers and hunters talking on a regular basis, and that results in hunters softening their resistance to the added deer permits. They understand farmers' concerns a little better. And, farmers understand that part of hunters' concerns is lack of access to good hunting land, so the more deer the better chances of hunting success on the marginal lands open to the public. The farmers themselves help to mitigate this collateral effect by offering more access on their farms in the area. This unanticipated gesture has Earl grinning from ear to ear.

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Appendix A: Glossary of Terms

Actions: the primary operational activities designed to achieve enabling objectives.

Assumptions: beliefs held to be true or accepted for purposes of developing a program; conventions from which to build understanding of a system and how it operates, including responses to management interventions.

Capacity(ies): the magnitude, comprehensiveness or volume of resources (people, money, skills, knowledge, will) available for a purpose.

Collateral impacts: unintended impacts that occur simultaneously with the implementation of primary management actions; typically the focus of mitigating actions.

Cmap™: a particular version of a concept map, created using the Cmap™ software.

Concept map: schematic depictions of managers' models. Such depictions are summaries or road maps to the content of the manager's models

Concerns: disparities revealed between desired and actual conditions, held either by management agency staff, partners (e.g., other agencies, municipalities, or NGOs), scientists not employed by the agency (e.g., academic researchers, consultants) or by one or more kinds of stakeholders.

Constraints: various kinds of limits and capacity issues that restrict management aspirations and activities.

Current conditions: actual state of the system with respect to biological, physical and socio-political subsystems or components.

Desired future conditions: describes, often largely in qualitative terms, what the world would be like if conservation and management of resource X were achieved.

Effects: the results of events or interactions of wildlife, habitat and people as perceived by various actors in a management system

Enabling objectives (management objectives): define the necessary conditions that <u>enable</u> achievement of a fundamental conservation objective (desired condition); provide direction to actions and interventions an agency and its partners might undertake; enable achievement of fundamental objectives that in turn result in maintaining or creating a desired condition.

Fundamental objectives: a statement about a condition the management team wants to reach or maintain; at first stated as a goal, but eventually refined to being measurable with a timeframe identified for accomplishment. Not as specific as an enabling objective.

Goal: the large, long-term objectives and outcomes desired, resulting in and from the desired future condition toward which management is directed.

Impacts: the most significant effects (see definition) that are important enough to stakeholders to warrant management attention.

Interventions: an alternative label of reactions, but often used to represent the suite of actions taken. The primary operational activities designed to achieve enabling objectives.

Limits: the outer bounds of knowledge, skill, resources, and such that can be applied to a situation; sometimes absolute (as in scientific knowledge available), but often determined by priorities.

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Management objectives (enabling objectives): the necessary conditions that <u>enable</u> achievement of a fundamental conservation objective (desired condition); provide precise direction to actions and interventions an agency and its partners might undertake; enable achievement of fundamental objectives that in turn result in maintaining or creating a desired condition.

Management system: the coupled biological, ecological, cultural, and institutional components of the management environment and their interactions that create the constraints, limitations, barriers and opportunities resulting in positive and negative impacts warranting management attention.

Manager's model: a description of the management system from the perspective of a manager or, in most cases, a management team responsible for management of a resource.

Mitigation: reduction of negative effects and impacts through ancillary actions.

Mitigating actions: ancillary or secondary management actions taken for purposes of reducing negative consequences (impacts) of the primary management actions.

NGOs: nongovernmental organizations.

Opportunities: existing or potentially creatable means for expansion of limits and capacities.

Policy: legal or formal (statutory and agency directive) and informal (professional convention, institutional rules and protocols) guidance to individual, group, community and organizational behavior.

Professional judgment: the expression of a particular perspective on a situation rendered by a professional in the subject, based on that person's cumulative knowledge and synthesis of both scientific and experiential knowledge, tempered by reason and logic; often relied upon to fill the gaps in science-based knowledge available to apply to a management situation.

Science: used here generally to indicate knowledge revealed through various forms of systematic inquiry—experimentation, field studies, qualitative research, surveys, modeling, etc.

Scale: various levels of temporal, geographic, political (jurisdictional) scope and effect, including extent of community (of place or of interest).

Socio-political: systems and system components that focus on the human dimensions of management; involve human processes, such as formal (laws, policy) and informal (norms) bounds on behavior of individuals and organizations; individual and group beliefs, attitudes and behaviors; etc.

Stakeholders: anyone who is affected by or affects the resource or the management thereof.

Subsequent impacts: unintended impacts that occur as a result of accomplishing primary management objectives; potentially cascading if left unmitigated.

Appendix B: Examples of manager's models schematic diagrams.
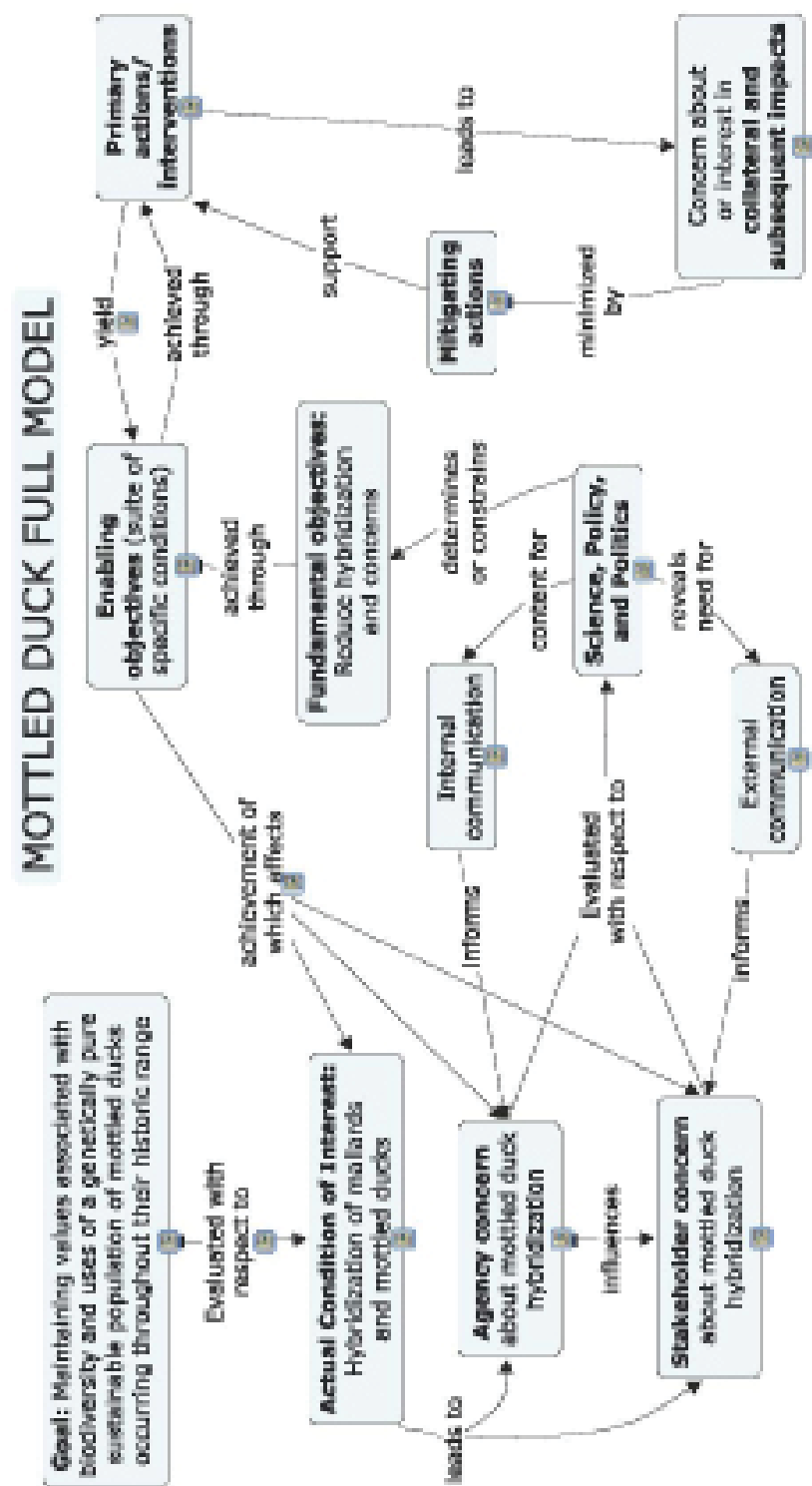
Figure B1. Example manager's model schematic created by a team of managers focused on management of mottled duck in Florida.
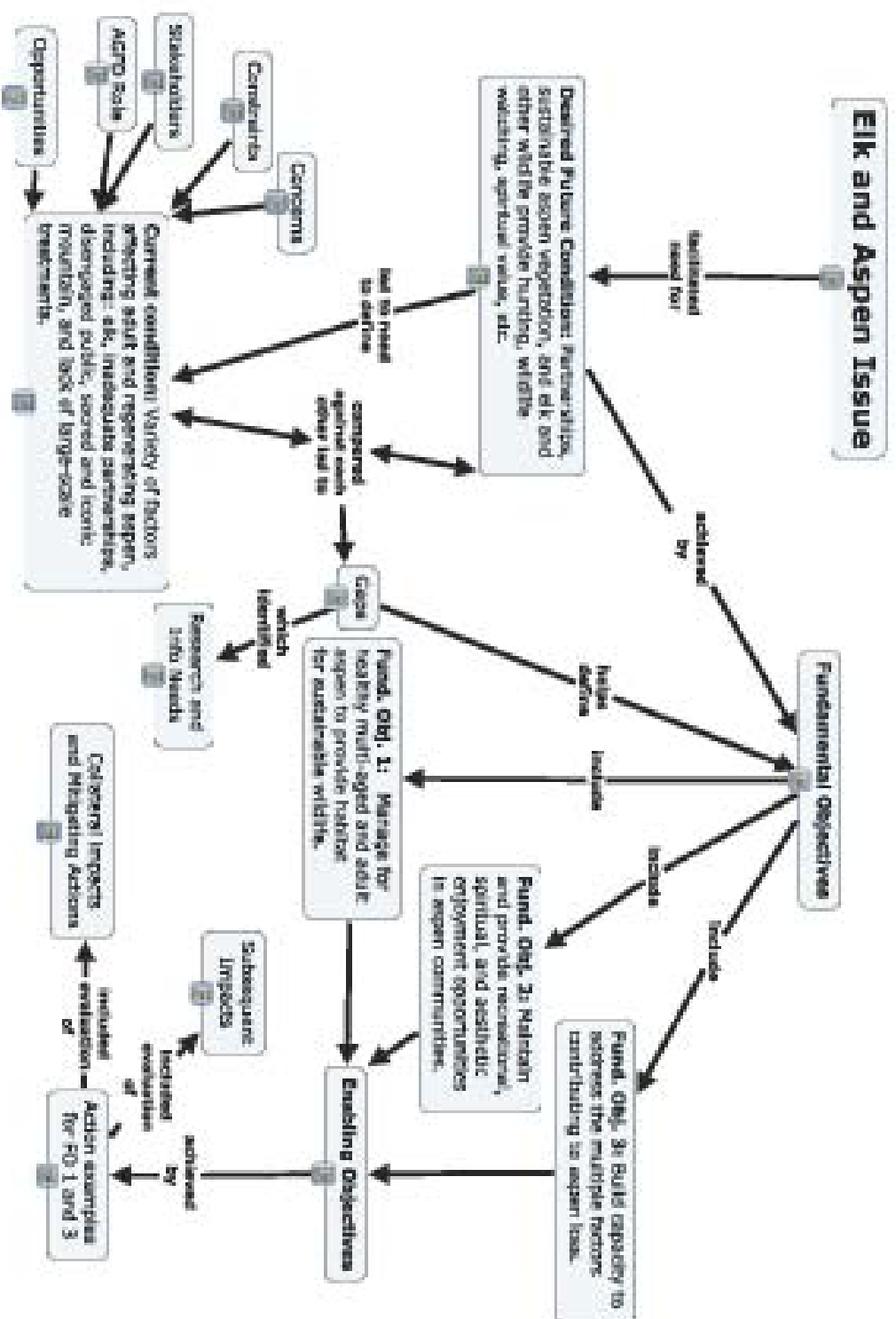
Figure B2. Example manager's model schematic created by a team of managers focused on management of elk and aspen in Arizona.

Appendix C: Suggested readings

Book:

Organ, Decker, Carpenter, Siemer and Riley. 2006. **Thinking Like a Manager: Reflections on Wildlife Management.** Wildlife Management Institute, Washington, DC. 106pp.

Decker, D.J., S.J. Riley, W.F. Siemer (Eds.). 2012. Human Dimensions of Wildlife Management. Second edition. The Johns Hopkins University Press. Baltimore, MD. 286pp

Articles (recommended to read in order indicated):

Riley, Decker, Carpenter, Organ, Siemer, Mattfeld and Parsons. 2002. **The essence of wildlife management.** Wildlife Society Bulletin 30(2):585-593.

Riley, Siemer, Decker, Carpenter, Organ and Berchielli. 2003. **Adaptive impact management: an integrative approach to wildlife management.** Human Dimensions of Wildlife 8:81-95.

Enck, Decker, Riley, Organ, Carpenter and Siemer. 2006. **Integrating ecological and human dimensions in adaptive management of wildlife-related impacts.** Wildlife Society Bulletin 34(3):698-705.

Decker, Wild, Riley, Siemer, Miller, Leong, Powers and Rhyan. 2006. **Wildlife disease management: a manager's model.** Human Dimensions of Wildlife 11:151-158.

Decker, D.J., S.J. Riley, W.F. Siemer. 2013. Human Dimensions of Wildlife Management. Pages 34 - 50 (chapter 4) in P. Krausman and J. Cain (Eds.) Wildlife management and conservation: contemporary principles and practices. The Johns Hopkins University Press. Baltimore, MD. 342pp.

Appendix D: Instructions for pre-workshop preparation of issue briefs

A. Title: Name the management system of interest (6 words or less)

B. Species or natural resource of interest: What is/are the natural resource(s) of concern? A wildlife species, a fishery, a habitat, etc.? Describe the context for the resource—how is it situated with respect to landscape traits? (200 words max.)

C. Management challenge or issue: Briefly describe the management challenge or issue. Is it new or long-standing, current or emerging? Is the issue entirely "owned" by your agency, or shared with other agencies (e.g., Florida Panther—FWC, USFWS, NPS, etc.). Who are the key stakeholders and what are their stakes in the issue? Is this issue at a crisis stage or is it in need of on-going attention? Etc. (300 words max.)

D. Management history: Describe status of management. Does a plan exist? Is it up to date? Has it been followed? What primary actions are indicated in the plan or have been taken? Has it been evaluated? (100 words max.)

E. Political history: Is this issue a political hot button? At what scale—local, in-state region, statewide, multi-state? Who is mad at (agency) and who is happy with (agency) in this manage-ment system? (100 words max.)

F. Policy history: Has the issue been the subject of special policy or does it present concern about setting precedent? Are there jurisdictional issues—what other entities have a role? (100 words max.)

G. Research history and science available (ecological, biological and social sciences): What is the general status of research-based knowledge with respect to the management system? What is underway at the moment? (100 words max.)

H. Agency capacity: What is the agency's capacity to deal with this management system? Are there current or potential partners (research institutions, other state and federal agencies, NGOs, etc.)? (100 words max.)

I. Does the management team have 2 or more people with some reasonable level of knowledge about this management system?

K. Who was involved in preparing this brief? List names of individuals involved in preparing this proposal. Indicate a contact person and provide e-mail and office telephone number so that we may reach that person if we have any questions.

Prepare a 2-page brief using 12 font or larger, and submit electronically to (leader), at <e-mail >, no later than (due date—2 weeks prior to first meeting).

Appendix E: Tips for Eliciting, Recording and Organizing Output of Manager's Model Discussion

| Key components of a managers' model	Activities to elicit information for the concept map
Desired future conditions (DFC) • Not a philosophical discussion, but concrete expression of the habitat, wildlife population, policy and human belief, attitude or behavior conditions managers want to achieve. • Identifying specific desired conditions will be the basis for crafting fundamental objectives.	• This is primarily a listing exercise. Use flip charts to capture ideas in bulleted form. Encourage brainstorming—open and free flow of ideas. These can be combined and critiqued (edited) afterward. • Try to capture the qualitative aspects of manager's aspirations—richness of description of desired future conditions is desirable.
Current conditions • Events and interactions create the current condition. • Constraints: capacities and limits.	• List key events and interactions (which lead to effects, impacts) that regularly occur. • Classify key events and interactions into impact categories (make sure that this exercise prompts the team to consider all major categories of effects). • Have separate flip chart ready to capture constraints that inevitably will be described—try to sort into limits and capacity categories, but that is not essential.
Gap analysis	• Compare the DFC description and the actual conditions description for major changes that will need to be met in order to create the DFC. • Have separate flip chart ready to capture constraints that inevitably will be described—try to sort into limits and capacity categories, but that is not essential.
Concerns (agency, partners, stakeholders) • Coach uses probing questions to elicit agency and stakeholder concerns recognized by the management team.	• As information on concerns accumulates, the recorder works with the management team to craft a spreadsheet of concerns by stakeholder group category (primary or collateral, etc.).
Constraints and limits/capacity, opportunities	• Policy, science, socio-political, agency resources, institutional or individual capacity, partnerships. • Policy: Does it restrict you? Is it silent on important questions? Any policies that unintentionally impede you?

Key components of a managers' model	Activities to elicit information for the concept map
Stakeholder identification	• Exercises to identify stakeholders (those affected by primary impacts; those affected by subsequent or collateral impacts). What is this information based on (e.g., systematic inquiry, special interest group mailing lists, professional judgment)? • Identify and define stakeholders and partners (e.g., for each key stakeholder or partner identified by the management team, clarify Which stakeholders hold particular concerns? How many people are there in a given stakeholder group, etc.?
Fundamental objective(s) • Discuss gaps identified between desired conditions and actual conditions, and reasons why these exist. • Fundamental objectives are essentially clarifications of desired future conditions, focusing on specific changes needed.	• Analyze the DFC description and the actual condition description for the few large objectives that will need to be met in order to create the DFC • Key impacts to create, avoid or modify should be identified and listed. These should be keyed to particular fundamental objectives.
Management/enabling objectives	• Linking spreadsheet: on flip charts and computer spreadsheet, link impacts related to fundamental objectives to enabling objectives and eventually to actions (see example spreadsheet below).
Collateral and subsequent effects/impacts	• Charting exercises to get primary and expected subsequent or collateral effects listed. • Identify how the wildlife agency believes people are affected by the species or issue (i.e., make an explicit list of what managers recognize as effects and impacts by stakeholder group; make sure the team gives some thought to all major categories of effects).
Management actions/interventions (primary actions and mitigating actions)	• List management teams' preliminary ideas on possible primary and mitigating actions. • Coach clarifies that discussion of agency actions is intended for group learning by the management team. Coach leads reflexive or iterative discussion that stimulates team members to clarify how they believe each potential action relates to achievement of enabling or fundamental objectives.

Appendix F: Example of a table that a wildlife management team could create to explicitly link fundamental objectives to specific enabling objectives and actions.[a]

Categories of impacts for fundamental objectives	Enabling objectives (outcomes needed to meet fundamental objs)	Actions to achieve enabling objectives
Stakeholder impacts (perceived by hunters, birdwatchers, conservation interests)	Improve understanding of stakeholder attitudes, beliefs, motivations	• Enhance stakeholder engagement • Sponsor/conduct social science research
	To develop general support for mottled duck mgt among stakeholders	• Increase external communication • Develop external partnerships
Agency impacts about credibility or effectiveness regarding ability to control exotics and loss of biodiversity	Develop resources and capacity to implement hybridization mgt strategy Create informed employees about hybridization problem	• Explore means to obtain external dollars • Increase state duck stamp dollars • Develop internal communication strategy
Ecological impacts (e.g., loss of biodiversity)	Increase scientific understanding of duck ecology in this setting	• Research on population dynamics • Research in genetic and monitoring • Develop phenotypic key
	Reduce hybridization of mottled ducks and mallards	• Reduce mallard population • Prohibit possession of mallards • Reduce federal restrictions on mallard removal • Clarify options for genetic trajectories

[a]This example uses mottled duck management in Florida. Creating a table, such as this, helps distinguish between fundamental and enabling objectives and links actions to enabling objectives.
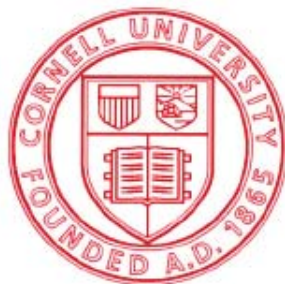
Cornell University
Department of Natural Resources
Human Dimensions Research Unit
Cornell Cooperative Extension