A PRACTITIONERS' GUIDE

WORKING THROUGH

# Black Bear Management Issues

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NORTHEAST WDM COOPERATIVE

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# People, Bears and Conflict

TRUDY NICHOLSON

Eight living species of bears roam the globe today. Most are imperiled and experts believe some bear species may be teetering on the verge of extinction (Servheen et al. 1999). The American black bear (Ursus americanus) is one exception in the trend toward scarcity. Resilient and adaptable, the black bear has not only survived across much of its historic range, it has thrived in an environment increasingly altered and dominated by human use. Even as its ursine cousins continue to decline in distribution, the North American black bear has repopulated areas once thought too fragmented and densely populated with people to support such a large carnivore.

When black bears and people live in close proximity, conflicts often occur. Perhaps the best known example of such conflicts comes from the state of New Jersey. Black bears were nearly extirpated from New Jersey by 1900, through a combination of habitat loss and unregulated exploitation (New Jersey DEP 1997). The black bear was given status as a game animal in 1953. Fewer than 50 bears were taken by hunters between 1958 and 1970. Based on data gathered from regulated hunting seasons the New Jersey Fish and Game Council closed the black bear hunting season in 1971 (Lund 1980).

Habitat improvement and legal protection created conditions for bear population recovery in New Jersey over the last half of the twentieth century. Problem interactions between bears and people increased dramatically during the 1990's, as both the human and bear populations increased in the four counties comprising core bear habitat (reported human-bear conflicts rose from 285 in 1995 to over 3,000 by 2003 [Carr and Burguess 2004]). By the late 1990's, wildlife officials in New Jersey found themselves embroiled in a bitter and divisive controversy over black bear management, especially conflict over agency proposals to control the size of the bear population through regulated hunting.

The conflicts over bear management that unfolded in New Jersey during the following years received widespread media coverage and are now well known to wildlife management professionals. However, New Jersey's experience is only one example in a long list of bear management controversies that have emerged in North America in recent years. From Ontario in the north to Florida in the south, from Virginia in the east to British Columbia in the west, communities are wrestling with their own bear management issues. Some communities face challenges associated with large, expanding bear populations. Others face challenges associated with small or isolated bear populations. Yet, at the heart of all these controversies one finds wildlife managers and

stakeholders struggling with the same central dilemma — how best to manage a public trust resource in an environment of uncertainty and disagreement about the root causes of problems and how society should respond to those problems. In this guide, we describe a framework to characterize bear management issues as resolvable public policy issues. We then offer a simulation that wildlife managers and others can use to begin working through one of the more common bear management issues in the Northeastern United States.

## Organization of the Guide

We divided this guide into two parts. In Part I, we describe human-bear conflicts as public policy issues. We suggest that public issues education can be a valuable tool when working through bear management issues. Part I of the guide discusses partnering to achieve your organizations' issue-education objectives and provides an overview of general tools and techniques for issue education in the context of black bear management. We include a few examples and case studies of issue education in a bear management context, to give readers an appreciation for the human resources needed and the processes that government agencies, nongovernmental organizations or communities can employ to deliver an effective issues education program.

Our purpose in Part II is more specific. We present a software application called "Responding to Problems with Bears: A Management Simulator." The management simulator is easy to use and creates opportunities for wildlife managers and stakeholders to have directed discussions about managing problem interactions between humans and bears in residential areas. We offer Part II of the guide as an outreach resource you can use to achieve a specific set of issue education objectives, for a very common bear management issue. We include detailed instructions and support materials necessary to use the simulation as the focus of an issue education event with bear management stakeholders.

**Hunters and anti-hunters confront one another during a protest of New Jersey's first black bear hunt in three decades. Public issues education will not eliminate such conflicts, but could help wildlife agencies reduce the likelihood of disruptive issues that divide and polarize wildlife management stakeholders.**


JOE PAULIN

### *Our intended audiences*

Working through bear management issues requires the talents and teamwork of many people, in many different roles, who are called upon to organize or contribute to a bear management issue education program. We developed this guide for four groups of professionals who can contribute to bear management issue education.

Our primary audience is wildlife agency staff. This work was sponsored by wildlife agency administrators, who expect more bear management issues to emerge in the Northeastern U.S. and want to prepare their staffs to manage those issues effectively.

Other intended audiences for this guide include community leaders, Cooperative Extension professionals, and nongovernmental organizations. We offer this guide to community leaders who recognize their vested interest in raising community capacity to engage in deliberations about wildlife management at the community level. We offer the guide to those extension educators who want to play a role in bringing wildlife professionals and community members together through productive stakeholder engagement processes. Finally, we offer the guide to representatives of nongovernmental organizations who want to lend their expertise and voice to bear management decisions.

PART I

# Responding to Human-Black Bear Conflicts as Public Policy Issues

Our purpose in Part I is to give you a broader context within which to think about human-bear conflicts. This part of the guide will frame bear management conflicts as public policy issues. We review the steps of a policy making process and the ways that you can productively work through bear management issues by implementing a comprehensive public issue education (PIE) program.

## Public trust, public issues, and public policy

Black bears are a public trust resource in the United States. They are held in trust by the state and are managed by wildlife agencies for the benefit of all citizens. Decisions about bear management are an expression of public policy and, in generic terms, bear management issues are actually public policy issues.

Public issues are simply issues of widespread public concern (Dale and Hahn 1994, Patton and Blaine 2001). Like any public issue, bear management issues take form as struggles among stakeholders, who individually or collectively compete to frame problems and champion public policies they believe will successfully address the problems they perceive. Public issues become public policy issues when one or more groups successfully frame the issue as a social problem that demands a policy solution (Frameworks Institute 2002).

Wildlife and extension professionals can facilitate good governance when they use public policy education to help stakeholders form productive frames to conceptualize bear management issues and discuss bear management policies.


TRUDY NICHOLSON

## Classifying your issue

Public issues come in different shapes and sizes. Taking some time to characterize the type of issue you face will help you determine how your organization can effectively work through the issue.

Patton and Blaine (2001) developed an issue typology that can help you better understand and characterize your specific situation. They group issues into three broad categories (Table 1.1).

Type I issues might be described as tame issues, because they have a clear underlying problem. As an illustration, consider the following case. The High Peaks region of New York State's Adirondack Park is a popular destination for hikers. The area is core black bear habitat where problems have occurred between hikers and bears for decades. Each year, some hikers on overnight trips would lose their food to bears and be forced to cut their trip short. Others would encounter bears on trails or in back-country campgrounds in situations they considered threatening. As the frequency of problem encounters increased during the 1990's, hiker safety and trip dissatisfaction emerged as a public issue. Research and monitoring documented that poor food and garbage storage by trail users was the root source of most problem interactions. Recent evaluation suggests that hikers and wildlife managers generally agree that bear-resistant food storage containers offer an effective and affordable solution to this very specific bear management issue (Zoe Smith, Wildlife Conservation Society, in press). A new regulation requiring all trail users in the eastern High Peaks area to use bear-proof storage containers for food and garbage, coupled with trailhead education and local availability of storage containers for purchase or rental, seems to have markedly reduced problem interactions and concerns about hiker safety and satisfaction (Zoe Smith, Wild-

**Table 1.1** **Types of black bear management issues.***

| | **Type I** (TAME PROBLEMS) | **Type II** (TOUGH CHOICES) | **Type III** (WICKED PROBLEMS) |
|---|---|---|---|
| **Example** | Human-bear interactions in High Peaks area of Adirondack State Park (New York) | Threatened bear population (e.g., Florida) | Human-bear interactions near homes in Catskill region communities (New York) |
| **What is the public issue?** | Safety and quality of recreational experience of all high peaks trails users | State listing of black bear as a threatened species | Multiple (public safety, relief from problems, welfare of individual bears, etc.) |
| **Underlying problem** | CLEAR<br>Food or food waste handling behavior of individual hikers creates food-conditioned bears, which threatens the collective experiences of all hikers using high peaks trails | CLEAR<br>Expanding human population and associated development isolates bear populations in "islands" of habitat | UNCLEAR<br>Experts have identified multiple contributing factors, but interrelationships between factors not completely understood |
| **Solution to problem** | CLEAR<br>Regulation requiring all hikers to use food canisters; regulation enforcement; trailhead education; local availability of canisters | UNCLEAR<br>Several alternatives, all having significant economic consequences | TO BE DISCOVERED<br>Requires careful, creative, group decisions which recognize that any solution may cause additional problems |

* *Figure adapted from: Patton, D. B. and T. W. Blaine. 2001. Public issues education: exploring extension's role. Journal of Extension [On-line] 39(4). Available: www.joe.org/joe/2001august/a2.html.*

life Conservation Society, in press). Type I issues such as this include relatively little conflict between stakeholders because people are in general agreement about the underlying problem and the best way to manage that problem.

For Type II issues, the problem also is clear, but there are competing possible solutions on which stakeholders disagree. A useful label for Type II issues would be "tough choices." As an example, consider the Chassahowitzka population of black bears in Central Florida. This population of fewer than 20 bears is located north of Tampa, on a thin strip of coastal land that is bordered by a major highway and isolated from other bear populations by human development (Larkin et al. 2004). Florida residents may generally agree that the Chassahowitzka bear population is imperiled by habitat isolation. However, Florida residents probably do not agree about the best solution to this problem, due to different beliefs about the social and economic impacts associated with creating corridors of habitat that reconnect bear populations.

What's needed for a Type II issue is a process that brings stakeholders together to discuss and deliberate about preferred management actions to address the underlying problem(s).

Sometimes, the distinction between a Type II and a Type III issue is simply a matter of scale. For instance, on a state or regional scale, bear population endangerment could easily take on the earmarks of a Type III issue.

In Type III public issues, stakeholders can't even come to consensus on the underlying problem or problems. Because they cannot come to consensus on the underlying problems, they also can't come to consensus about actions to resolve the issue. The most disruptive black bear management issues are of this third type, which might aptly be described as wicked problems (Rittel and Webber 1973).

An increasing level of human-bear encounters in a residential area can easily develop into a Type III public issue. In residential situations, some stakeholders will perceive a significant public safety issue exists, while others will deny that bears present any threat to people. Some people will define the underlying problem as "too many bears." Others will define different underlying problems (e.g., "too many people," "too much development," "irresponsible human behavior," and so on). These different problem and solution frames are picked up and communicated by mass media (Siemer et al., 2007), where they offer competing arguments about the values and alternatives to consider in a bear management policy or program.

Type III issues are a daunting challenge. Wildlife and extension professionals facing a Type III issue may not even know where to begin a public dialogue on such issues. Yet, there are ways to bring order to this seemingly chaotic situation. Experience shows that thinking of your issue as an evolving public process, and determining where you are in the life of that process, is one useful way to get started.

## Stages in the evolution of bear management issues

The specific traits of public issues vary from case to case. But predictable stages emerge as agencies, organizations, and stakeholders seek resolution of the problems underlying their issue. Policy analysts have proposed several models of that process that help agencies and organizations understand how they might effectively intervene at each stage. We find the model depicted in Figure 1.1 to be particularly useful. We employed it in the first two practitioners' guides in this series, as a framework to discuss stakeholder engagement in wildlife conflict management generally (Decker et al. 2002) and community-based deer management specifically (Decker et al. 2004).

The public policy education process model (Figure 1.1) was developed by House (1988) and promoted by Hahn (1990) as a tool to plan, implement, and evaluate public-issue oriented policy education. If you're in an organization interested in resolving bear management issues, we think you'll find this model to be a useful diagnostic tool. It will help you get started, by answering key questions, such as:

- Where can my organization usefully intervene as a team of researchers, managers, and educators (where are we in the public or political life of this bear management issue)?

- Has my organization fully identified and discussed the public concerns that generated this issue (have we helped our stakeholders define the issue with a clear and useful problem statement)?
- What does my organization need to do to ensure that all our stakeholders have the information and skills they need to contribute to effective, lasting management decisions (what can we do to build individual, institutional, and community capacity to resolve our bear management issue)?

Using the model as a guide, stages in the evolution of a bear management issue can be identified. The following subsections describe the model stages as they might be expressed in a bear management context.

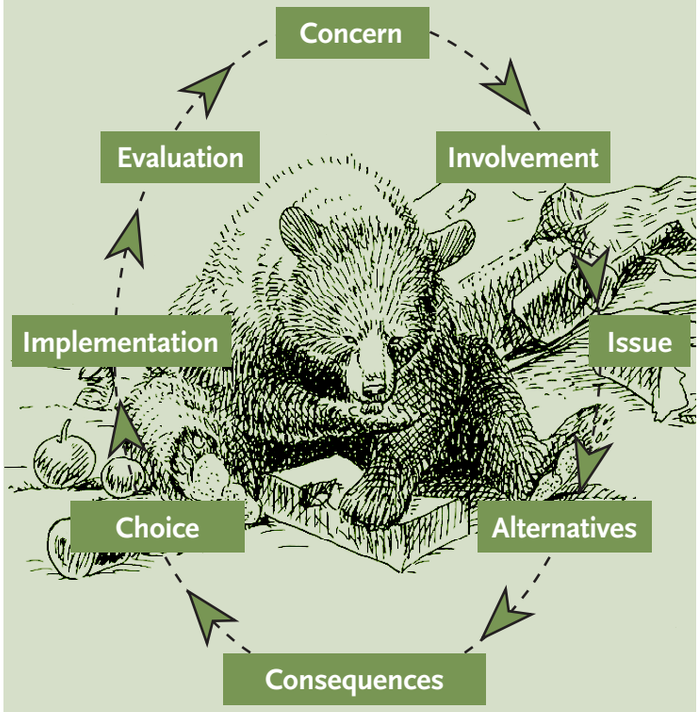
**Concern** — During the concern stage, individuals or groups of stakeholders begin to perceive undesirable impacts of bears. As friends and neighbors talk with one another, they come to recognize that they are not alone; others are experiencing similar problems and share the same concerns about bears.

**Involvement** — In the involvement stage, some people with concerns about bears seek support from one another and inform officials of their concerns. Groups of people may meet to assess the extent and nature of their problems with bears. Wildlife managers and elected officials start receiving complaints. Letters to the editor may show up in the local newspaper as the concern becomes increasingly public. At this early stage, differing views about the nature of the concerns and even possible remedies are voiced. The potential for controversy starts to become apparent. Involvement also leads to the realization that a quick fix does not exist and sets the stage for issue definition, which is the next stage in the process.

**Issue** — In the issue stage, a critical mass of stakeholders reaches general agreement about the nature of the primary impacts of bears in their community or region. This does not mean that all members of the community or region agree with the prevailing perspective. Agreement about the existence and nature of the bear problem must be sufficient to propel the issue toward resolution. If interest in the problem is not widespread or is held by those with little public voice, the issue may dissipate, regardless of whether the actual impacts of concern are mitigated. Education and informative communication can be critical at this stage to minimize the probability of a rift among stakeholder groups. The value of common goals — which are essential for focusing discussion, analysis, and decisions — also becomes evident at this early stage.

**Alternatives** — In any wildlife issue, some people quickly jump to suggesting different actions (for bear issues, some stakeholders may call for actions such as more hunting, problem prevention education, bear relocation, or permits to kill problem bears) based on their experiences or preferences, perhaps before objectives are agreed upon. Advocacy coalitions (Sabatier 1988) form to promote their preferred policy or management action alternatives. Each proposed alternative will typically have both

**Figure 1.1** **Public policy education process model.**




*(House 1988, Hahn 1990)*

ILLUSTRATION: NYS DEPT. OF ENVIRONMENTAL CONSERVATION

proponents and opponents, making the alternatives stage of issue evolution one of the more contentious, and therefore challenging, for anyone seeking solutions to bear problems. If goals have not been established previously, their absence will become a barrier to progress in this stage. Education and communication can have an important positive effect at this point, helping people to understand the efficacy and feasibility of various policies or actions. It's important that the information is perceived by recipients as coming from unbiased sources.

**Consequences** — All proposed alternative policies or actions have consequences that should be considered carefully from multiple perspectives. Initially, alternatives should be assessed for efficacy in addressing the impacts of concern, with both effectiveness and cost taken into consideration. Then, identification of who benefits and who suffers from each alternative (including who pays to take action) needs to be evaluated. You can expect different stakeholders to arrive at different conclusions about benefits and costs of alternative courses of action.

**Choice** — In this stage, stakeholders deliberate about which alternatives to adopt for their community, or they deliberate about the acceptability of alternatives proposed by a wildlife management agency. Even after analysis of consequences, individuals or groups may find it difficult to come to agreement. Wildlife agencies have the authority to take a decide-announce-defend approach to bear management decisions. However, experience has shown that if stakeholders are involved in decision-making processes, resulting decisions tend to be more sustainable. Certainly, community-based decisions (e.g., establishing a municipal ordinance for use of bear-resistant trash containers) are likely to be more durable if based on community input and deliberations.

**Implementation** — In the implementation stage, a management program—usually a set of management actions to achieve identified policy objectives—is put into place. Responsibility for implementing these actions may fall to a wildlife agency or land manager. Alternatively, responsibility could be distributed among a number of entities in a partnership. Empowering communities to implement actions can be a means to direct more resources into a management program and to lead to local, community ownership of management programs.

**Evaluation** — The impacts of broad policies or specific management actions are assessed during the evaluation stage. Evaluation should not come as an afterthought for wildlife managers. Because it represents the key to learning about and adjusting management actions, evaluation should be a pre-planned, integral component of management program delivery. It's useful to involve stakeholders in evaluation and in any subsequent decisions about modifying or even continuing the management program. Stakeholder involvement should include agreement on acceptable metrics for assessing progress in terms of managing impacts associated with bears. Baseline levels of impacts should be established prior to management in order to assess progress. Wildlife managers can expect advocacy coalitions to offer their own evaluations, in the form of protests, newspaper editorials, or lawsuits. Management programs will change and evolve as a result of both internal evaluations and pressure from advocacy coalitions.

The stage-to-stage progression of public issues depicted in Figure 1.1 does not reflect precisely the way in which many public issues actually emerge and grow. Real-world issues aren't as neat and tidy as a concept model. Yet, models like the one in Figure 1.1 help us recognize and deal with the following general truths:

- Bear management issues tend to go through developmental stages. The rate of development may vary greatly. This has implications for timing of interventions and the amount of attention to give a particular issue.
- Not every member of a community will be at the same place in understanding an issue at a given moment. This presents both a challenge and an opportunity to anyone trying to guide a process to seek resolution of a bear management issue. The challenge is in slowing the rush for decisions among some people, while accelerating engagement and knowledge of the issue among others. The

opportunity lies in the readiness of stakeholders to learn more about the relevant biological and socioeconomic dimensions of their issue.

- Capacity to deal with an issue varies from case to case, but typically a skillful intervention by some party can help build the capacity necessary to resolve public issues. Education, informative communication, and deliberation that promote different types of learning (i.e., technical, conceptual, and social learning) can be used as tools to build community capacity.

In a nutshell, wildlife agencies often need to work with others to address bear management issues and that work often includes a comprehensive public issue education (PIE) program. To be productive, participants in decision processes need to understand the issue in which they find themselves. By delivering issue education, wildlife agencies, extension educators, and community leaders can strengthen stakeholders' capacity to participate in bear management and to work through their conflicts. The structural components of PIE are outlined in the following sections.

### Objectives for public issue education (PIE)

The primary goal of PIE is to help citizens engage in public issues and contribute to sound public choices amid uncertainty and conflict. In 1992, the Cooperative Extension Service (USDA) formally defined issue education as "education programs that have the objective of enhancing society's capacity to understand and address issues of widespread concern" (ECOP 1992).

Cooperative Extension specialists across the United States have been developing and implementing PIE approaches for nearly two decades. The objectives, principles and core values for PIE are laid out in a document produced by the Public Issues Education Competencies Task Force (see Table 1.2).

Increasing citizen's knowledge about issues is probably the most common PIE objective. Most wildlife agencies have developed products that help stakeholders understand black bear natural history and bear problem prevention techniques. Fewer organizations have developed products to help stakeholders understand one another with respect to bear management issues. Issue education to address that objective is illustrated in Box 1.1.

As a wildlife issue emerges, heightened media attention to the issue presents wildlife agencies with a communication opportunity. For example, when a bear injures a human, the incident generates considerable media attention (Gore et al. 2005). When public attention to bears is heightened, wildlife agencies can provide a public service by presenting information about bear behavior, human-bear interactions, public concerns, or conflicts among stakeholders.

In the context of black bear management, PIE objective 2 is arguably the most neglected. Creating new structures for decision making is always a politically-charged endeavor, because it brings up issues of power and power sharing. However, it is a challenge wildlife agencies can expect to face more frequently as bear management issues emerge on the rural-urban interface, and new advocacy coalitions create external pressure for change.

PIE objective 3 will be familiar to anyone who has tried to implement the steps in a typical planning process. PIE is intended to involve stakeholders in developing, implementing and

**Table 1.2** **Objectives of Public Issues Education.**

1. Increase citizens' knowledge about issues.
2. Assist citizens in determining appropriate and effective strategies for public decision making.
3. Help citizens craft, evaluate and implement alternative solutions.
4. Build skills and provide opportunities to enhance citizens' effective participation in public decision-making processes.

SOURCE: *Public Issues Education: Increasing Competence, Enabling Communities. National Public Policy Education Committee, Cooperative Extension (USDA), Public Issues Education Competencies Task Force. 2002. www.publicissueseducationnet/pie_values_roles_definitions/ index.php*

**Box 1.1**

## An effort to increase citizen's knowledge about issues in Maine.

Nongovernmental organizations can make contributions to public understanding of bear management issues. A good example comes from the state of Maine. In the November, 2004 presidential election, the ballot in Maine included a referendum that would have made it illegal to hunt bears with bait, traps or dogs, except to protect public safety or for research. Debate over the referendum quickly polarized groups supporting the ban (Maine Citizens for Fair Bear Hunting, Humane Society of the United States, Hunters for Fair Bear Hunting) and groups opposing the ban (Sportsman's Alliance of Maine, Maine Department of Inland Fisheries and Wildlife, Maine Professional Guides Association).

In the months leading up to the vote, an independent nonprofit group called the Maine Environmental Policy Institute (MEEPI, www.meepi.org) commissioned a report (Gore 2004) on baiting and hounding and featured the report on its website as part of a voter guide on the referendum. The report and voter guide were in keeping with MEEPI's goal to provide nonpartisan information to Maine residents and policy makers. The MEEPI-commissioned report offered an overview of bear baiting and hunting with hounds, reviewed the status of both practices across the United States, and summarized the experiences of states where voters had been presented with similar referenda. The report did not include arguments in support or opposition to the referenda.

The report was posted online and advertised in the mass media so that voters could increase their understanding about the issue and make an informed decision on Election Day. MEEPI also posted links to the language of the ballot initiative and to websites of those supporting and opposing the referendum. Newspapers, public radio, and local news stations used information from the report as content for stories about the ballot initiative. In many instances, the media referenced the report to its audiences as a source of additional information. In using issue education about the referendum, MEEPI helped voters make a more informed decision about bear baiting and hounding on Election Day. Maine voters rejected a referendum by a 53% to 47% margin.

**Box 1.2**

## Helping Virginia residents craft, evaluate, and implement alternative solutions.

When the Virginia Department of Inland Fisheries and Wildlife embarked on formulating a black bear management plan in 1999, four issues related to increasing human and black bear populations were of interest: bear hunting; nuisance bear management; bear conservation and education; and illegal sale of bear parts. Key to resolving these issues was seeking input about citizens' beliefs, attitudes, and opinions about bear management. Thus, a public involvement process was implemented. A Stakeholder Advisory Committee (SAC) was formed; 17 individuals representing diverse interests in black bear management (homeowners, sportsmen, organizations with non-consumptive interests, agricultural producers, the commercial timber industry, and resource management agencies) met six times in one year. Five focus groups were held to gain in-depth information about issues important to stakeholders early in the planning process; SAC members used focus group insights to articulate key issues and concerns. Questionnaires were distributed to professionals involved with bear management and to members of three constituent groups represented on the SAC to expand input about key management issues, and help SAC members further articulate the concerns of their constituents. Five regional input meetings were held where individuals could offer opinions about regional bear populations, actively discuss draft plan goals and associated local bear management issues, or provide anonymous input. Finally, broad public review of a draft management plan completed the suite of stakeholder involvement activities. The plan was endorsed on June 4, 2001 by the Stakeholder Advisory Committee and delivered in October 2001 to the Virginia Department of Inland Fisheries and Wildlife Board of Directors for approval. The plan was approved and has been implemented successfully.

evaluating alternative management actions. A recent strategic planning process in Virginia illustrates how wildlife agencies can incorporate PIE objective 3 into their bear management program (Box 1.2). An example from Louisiana (Box 1.3) illustrates how multi-party partnerships can help stakeholders understand issues and craft and implement alternative solutions.

If you have worked with stakeholders, you probably know from experience that people are quite willing to suggest solutions. We've facilitated processes where people began offering solutions as they introduced themselves and well before problems and objectives were fully articulated. One of the key challenges of an issue education program is slowing down the discussion, clarifying underlying problems, and eventually discussing potential solutions in reference to a recognized problem or set of problems. Tools to achieve objective 3 are offered in Part II of this guide.

Bear management issues are often rooted in multiple underlying problems. You can expect different stakeholders to focus on different underlying problems. In cases where no process is used to define and characterize specific problems, it comes as no surprise that public officials have difficulty resolving bear management issues. PIE can help stakeholders and wildlife professionals establish clear problem statements, an essential first step toward effective problem management.

PIE objective 4 relates to building stakeholder capacity to contribute to policy-making processes (see Decker et al. 2004 for more discussion on capacity development). Every activity you offer as part of a PIE process is an opportunity to increase stakeholder capacity to contribute to wildlife management decision-making processes. This year, you may be working intensively on a local black bear management issue. Next year, your emphasis may switch to deer or some other concern in the same locality. Over time, however, your investment in a given community will lay the foundation for future success, regardless of the specific issue that demands your attention.

### Technical, conceptual, and social learning

Learning is the unifying theme that runs through a comprehensive PIE program. By creating opportunities for reflection and interaction with others, a successful PIE program provides conditions for three specific kinds of policy-oriented learning. Each type of learning is described here briefly (more information on

**Box 1.3**

**Using partnerships to help Louisiana landowners understand issues and implement alternative solutions.**

The Black Bear Conservation Committee (BBCC, www.bbcc.org) was created in 1990 to help restore the Louisiana black bear, a threatened species. As a coalition of over 60 groups, the BBCC has diverse membership, including the forest industry, conservation organizations, government, private landowners, researchers, and interested citizens. Key to accomplishing the BBCC mission of bear restoration is partnerships among stakeholders; the BBCC believes proactive, inclusive, and cooperative efforts will increase the probability of successful restoration of the Louisiana black bear. The BBCC developed a Landowner Assistance Program (LAP) in 2003 to encourage landowner involvement in forest restoration programs.

LAP promotes awareness and understanding of the many incentive programs available to private landowners for restoration black bear habitat. LAP workshops held in bear recovery zones feature a summary of assistance programs offered by state and federal agencies and private organizations. In addition to building landowner capacity to aid in habitat recovery, LAP fosters communication networks among landowners with parcels that border on public lands. The BBCC also works with the Louisiana Department of Wildlife and Fisheries, the United States Fish and Wildlife Service, and the United States Department of Agriculture's Wildlife Services unit to manage human-black bear conflict.

these learning categories can be found in Glasbergen [1996] and Fiorino [2001]).

Technical learning enables groups to do a better job of achieving existing objectives. Conceptual learning enables groups to reconsider and perhaps redefine their concepts of underlying problems and appropriate solutions. Social learning refers to learning about social processes and their influence on public policy. All three types of policy learning are interrelated, and all three play a role in issue resolution.

## Strategies for working through the toughest stages of your issue

The middle stages — from considering alternative actions to choosing a set of actions — are probably the most contentious part of issue evolution for wildlife agencies. Many different stakeholder engagement formats can be employed to work through those stages of issue evolution, from information collection techniques (e.g., mail surveys, focus groups), to small group processes (e.g., advisory committees, input groups, etc.). The format you select should match the objectives you want to achieve in your specific case. Other resources are available with guidance on how and when to apply those specific methods, so we won't do so here. What we will offer are a few techniques or strategies that you can apply to help you work through the most challenging stages of issue evolution. We note how each strategy addresses policy learning.

### *Develop partnerships for program delivery*

Multiple professional roles are called for in the course of a comprehensive PIE program (some key content and process roles are identified in Table 1.3). Given the need for a range of talents and skills, it is usually necessary to take a team approach. Partnering across agencies or organizations may be the best way to build an effective PIE team. Working in partnerships is also a great way to stimulate the kind of social learning you will need to resolve your issue.

At the outset, you will need team members who can assess the key characteristics of the issue and design a comprehensive PIE program. Some parts of your program will call for staff

**Table 1.3** **Professional roles that can be fulfilled in a public issue education (PIE) program.**

| | |
|---|---|
| **CONTENT:** | |
| Information provider | A person who provides objective information to PIE participants. |
| Technical advisor | A person with content expertise who explains and/or interprets technical information for participants in PIE. |
| Policy analyst | Analyzes policy alternatives and their likely consequences. |
| Issue researcher | Conducts applied research that can be used to understand some dimension of the issue. |
| **PROCESS:** | |
| Process designer | Recognizes a bear management issue, analyzes the situation and stakeholder needs, designs and helps implement PIE. |
| Convenor | Identifies key stakeholders and involves stakeholders in PIE. |
| Facilitator | Guides stakeholders through a structured PIE program. |
| Networker | Links process participants to information, services, and other social groups in order to develop issue understanding and capacity to give informed input or contribute to bear management decisions. |
| Trainer | Provides instructional experiences to develop knowledge or skills that stakeholders need to participate in decisions or implement management actions. |

SOURCES: *Public Issues Education: Increasing Competence, Enabling Communities. National Public Policy Education Committee, Cooperative Extension (USDA), Public Issues Education Competencies Task Force. www.publicissueseducationnet/pie_values_roles_definitions/index.php Ohio State University. 2003. Public issues education. Ohio State University Extension. Available: http://www.ag.ohio-state.edu/~pie/.*

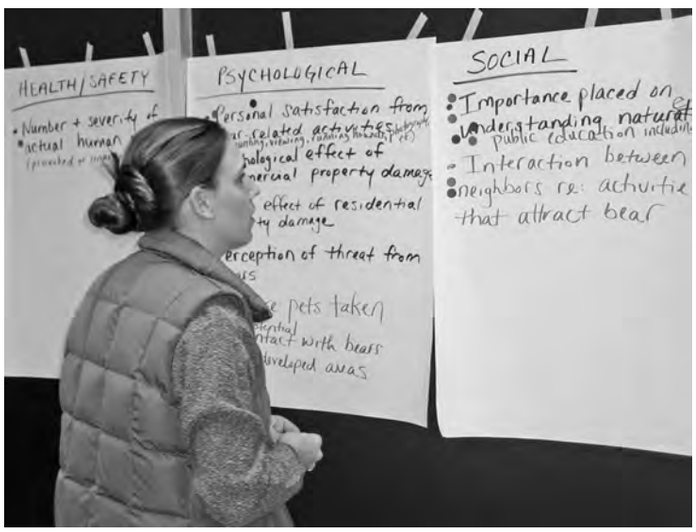
who can convene and facilitate small group processes. Over the course of a PIE program a range of information needs will arise, and your team will need to include people with specialized content knowledge to address those information needs.

Wildlife agencies have ample incentive to take a leadership role in issue education, given their statutory authority and responsibility to manage bears. However, there is no reason why wildlife agencies should go it alone. Many individuals and organizations can contribute to a successful PIE program. For example, many Cooperative Extension professionals are well trained to handle many process and content roles; there may be an extension educator in your area who is willing and able to serve as a facilitator or trainer. Nongovernmental organizations and local government agencies may be able to contribute as information providers, technical advisors, or issue researchers.

### *Focus on impacts*

People interact with bears in many ways, and those interactions produce many effects. The term "impacts" refers to a subset of the effects that stakeholders care about most. Impacts should be the central focus of wildlife management programs (Riley et al. 2002, 2003).

**An input group member participates in an exercise to identify bear-related impacts in her region. Impact identification can be achieved through a variety of involvement techniques.**

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PIE should include efforts to identify what stakeholders in a given area perceive as impacts. Wildlife managers can help stakeholders identify effects, and determine which effects are of most importance to a community, a region, or state.

Processes focusing on impacts are valuable in a PIE program because they can encourage conceptual learning among individuals and advocacy coalitions. Natural resource management professionals (scientists, managers or educators) cannot tell stakeholders which effects to label as impacts. It is ultimately stakeholders who interpret the relative importance of effects based on their values (Riley et al. 2002, Lackey 2006). However, management professionals can help people recognize and understand effects, especially those not apparent to a casual observer. Identifying the less obvious effects (perhaps revealed only through research) may change people's concept of the problems they face. With new problem frames, advocacy groups may revise their beliefs about bear management policies or how best to carry out those policies. Focusing on impacts may thus break an impasse that created the bear manage issue you are facing.

Fortunately, working with stakeholders to identify which effects they regard as impacts is not as difficult as you might imagine. Bear managers in New York have found that they can work with stakeholders to identify a manageable list of impacts that should be the focus of management attention (see Table 1.4) (for an example of impact assessment, see Siemer and Decker 2006).

### *Create space for deliberation*

Bear management issues involve conflict between people with different perspectives on the nature of the events taking place, the problems and opportunities associated with those events, and the degree to which action alternatives will address their key concerns. Differences in perspective lead individuals, groups, and organizations (including wildlife agencies) to emphasize particular aspects of an issue over others (Loker and Decker 1995). Advocacy coalitions often express their perspectives through mass

media outlets and compete with one another to frame the issue and focus public debate in ways that support their policy preferences.

In their rush to judgment, stakeholders may fall into a common decision-making trap — creating an inappropriately narrow definition of their decision problem (Keeney 1992). Opportunities for deliberation within a PIE program may help you and your stakeholders create broader, more productive problem definitions.

Different frames of reference among stakeholders can be a barrier to communication and learning. Carefully facilitated opportunities for face-to-face deliberation can lower those barriers, increasing the likelihood that your stakeholders will think about bear issues from a different perspective. Offering small group processes that allow space for deliberation is one of the only ways in which wildlife managers can encourage stakeholders to reflect on and perhaps change their beliefs. That's an important step in working through a bear management issue.

In essence, deliberative processes create opportunities for social learning. Social learning in a policy arena involves learning how to improve relationships, interaction, and dialogue within and among advocacy groups. A recent study (Lauber and Brown 2006) found that social learning provided the foundation for both conceptual and technical learning in

**Table 1.4** **General categories of impacts and examples of specific impacts relating to bears identified by wildlife managers and stakeholders in New York.**

| EFFECTS CATEGORIES | SPECIFIC EFFECTS OF GREATEST CONCERN IN 2003 (IMPACTS) |
|---|---|
| **Ecological Effects:** Effects on wildlife, wildlife habitats, and ecological systems that result from interactions between wildlife, people, and the land. | Long-term population viability of black bears in the state. |
| **Economic Effects:** Monetary effects produced by interactions among people, related to black bears. | Costs of bear-related damage to commercial property.<br>Cost of bear-related damage to residential property.<br>Economic activity associated with bear-related recreation (hunting, viewing, photography). |
| **Health/Safety Effects:** Effects on human safety or health. | Number and severity of actual human injuries caused by black bears. |
| **Psychological Effects:** Enhancement or diminishment of psychological well being for individuals, stakeholder groups, or society overall. | Personal satisfaction associated with bear-related activities (hunting, viewing, photography).<br>Personal/psychological effect of commercial property damage.<br>Personal/psychological effect of residential property damage.<br>Perception of threat from black bears. |
| **Management Effects:** Effects associated with bear management actions. | Reaction to active management or intervention.<br>Importance placed on having a wildlife management agency that has the knowledge and expertise to conduct black bear management. |

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**Stakeholders with divergent beliefs and attitudes have opportunities for a civil exchange of ideas in a PIE program. Such exchanges facilitate learning and progress toward issue resolution.**

community-based deer management cases. Communities need to acquire a social learning skill set in order to address local wildlife management issues. Wildlife and extension professionals can help communities build that skill set, by involving those communities in the design and delivery of deliberative input processes.

### *Link ends to means*

It seems to be human nature to focus on how we want to get things done before we carefully establish the ultimate ends we have in mind. This tendency has important practical implications when it comes to wildlife management policies and programs.

Perhaps more often than wildlife professionals would like to admit, the fundamental objectives of a given wildlife management program are ill defined or weakly tied to management actions. In many cases the specific policy statements that guide wildlife management programs focus instead on the intermediate steps one has to take to make progress toward a goal or desired future condition. In other words, communication from wildlife management agencies tends to focus on actions — how some end should be achieved — rather than specifying the desired end state managers hope to attain through their actions, or clarifying how that desired end state was selected as a management goal.

Community leaders and stakeholders can fall victim to the same tendency, becoming preoccupied with management techniques (actions), rather than management goals. The results can include a heated debate about management actions that is not closely tied to societal goals for management.

Allowing stakeholders to focus on alternatives too quickly (before problems are carefully defined based on a full consideration of values) denies them the opportunity to fully evaluate the potential of alternative actions to achieve the ends they desire. This increases the risk that stakeholders will never really clarify the problem(s) underlying a bear management issue. It also increases the likelihood that stakeholders will consider an incomplete set of possible action alternatives (Keeney 1992). If your PIE program incorporates exercises that link ends (goals) to means (management actions), you can help your stakeholders avoid the kind of alternative-focused thinking that unnecessarily constrains public deliberations about bear management. Linking ends and means is a powerful tool for conceptual learning.

### *Use systems thinking approaches*

Our final recommendation in Part I is to use systems thinking exercises in your PIE program to encourage technical and conceptual learning.

A system is a configuration of parts interconnected by a web of relationships (Holistic Education Network, www.hent.org). Systems thinking approaches focus on the whole instead of the individual parts of a system. By focusing on relationships and interactions within the whole problem system, a systems thinking approach can help your PIE team generate understanding about problems and potential solutions in new and more productive ways.

Systems thinking is useful in situations where we know that actions taken to prevent perceived problems may change the natural or social environment in which the underlying problems arise. Systems thinking also is useful to build understanding when the problem(s)

underlying the issue:

- are dynamically complex;
- are created through multiple feedback mechanisms;
- are generated by multiple actors who do not behave in a coordinated fashion;
- are recurring;
- have been made worse by past attempts to fix them (Aronson 1996).

Type III bear management issues have most or all of the traits identified by Aronson (1996). They are rooted in ecological and social systems that are dynamic and nonlinear. Human-bear problem interactions result from multiple feedback mechanisms. Multiple actors (e.g., wildlife management agencies, municipal officials, homeowners, hunters) behave independently and influence problem incidence. And, human-bear interactions recur year after year. The field of system dynamics (Forrester 1968, Sterman 2000) and approaches to systems thinking (Senge and Sterman 2000, Morecroft and Sterman 1994, Richmond 2001) were developed to improve decision-making under such circumstances.

Barry Richmond, a proponent of systems thinking in K–12 education, defined systems thinking as a set of seven skills that help people construct better mental models, simulate them more reliably, and communicate them more effectively (Richmond 1993). He defined those skills as: dynamic, closed loop, generic, structural, operational, continuum, and scientific thinking. Systems thinking creates valuable technical learning opportunities. But more importantly, thinking about issues within a broader context can lead to conceptual learning — people may redefine problems and solutions when they take a higher-level view of their situation.

So how can your PIE team encourage a systems thinking approach to bear management issues? System dynamicists suggest that you do so by working with stakeholders to construct simple models of your problem system.

Model building is beginning to gain favor as a tool to structure discussion and involve stakeholders in public policy decisions. A system dynamics approach for stakeholder engagement is useful because it: (1) focuses groups on careful problem definition; (2) guides stakeholders to look for problem causes within (endogenous to) the system being examined; (3) focuses on public policy levers that can be used to address the problematic behavior of the system; (4) includes feedback mechanisms that increase the rate and amount of learning by stakeholders and decision makers; and (5) results in documentation of assumptions, choices, and consideration of stakeholder input (Stave 1998).

Stakeholders seldom have a common or comprehensive understanding of ecosystems, let alone an understanding that can be communicated in a common language. These conditions make communication difficult. Modeling, especially when done in a group setting, helps organize and communicate the key dynamics of a management system to resource managers, decision makers, and stakeholders (Andersen et al. 1997, Bosch et al. 2003, Starfield 1997, van den Belt 2004, Vennix 1999). Model development also exposes important uncertainties about a wildlife management system (Starfield 1997). Your PIE Team can realize some of these benefits even in the early stages of qualitative modeling (for an example, see the wildlife disease management model developed as a product of a workshop with a team of National Park Service staff and other wildlife professionals [Decker et al. 2006]).

Developing systems models of sufficient complexity to aid understanding, yet simple enough for stakeholders to be comfortable using them, is a knack we need to develop through experience. Such models, incorporating all aspects of the management system (social, economic, political, cultural, etc., as well as ecological dimensions) represent a step forward in understanding systems, communicating about them, and therefore educating people about wildlife management issues of public interest. In the next section of this guide, we describe a specific simulation tool that you could use with small groups of stakeholders. We offer it as a tool that you and your team can use to gain familiarity with dynamic simulations and how they can be used as part of a larger issue education process.

# Using the New York Bear Management Simulator in a PIE Program

Three traits of simulation make it a compelling tool for learning about wildlife management issues. First of all, simulations offer a practical alternative to real-world management experiments. Wildlife management decisions have consequences that unfold over a period of years. High costs and the potential for failure give agencies good reason to be risk-averse when it comes to management experiments. All managers, including wildlife managers, need tools that provide a safe forum for management experiments — places where they and their stakeholders can evaluate ideas and processes without risk to the systems they aspire to manage. Simulations, like the one described in this guide, provide that kind of low-risk testing ground, where managers and stakeholders can use simulation output graphs as a vehicle to exchange ideas, clarify assumptions, and test hypotheses together.

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Second, simulations provide immediate feedback about decisions, which is extremely valuable as a way to learn about the consequences of our choices. When wildlife agencies implement actions like a bear hunting season, it may take agency staff a year or more to fully assess the short-term impacts of that decision. It may be decades before the long-term impacts of some wildlife management decisions become apparent. Those kinds of delays between action and reaction in a human-wildlife system hinder our ability to learn from our choices. Simulations are a great way to address that problem.

Third, quantitative simulations are useful because they give us a tool to assess how our assumptions are likely to play out over time. Simulations offer a mechanism to calculate simultaneous changes in a system. In most cases, limited time, information, and quantitative training prevent participants in a policy making process from fully understanding the likely consequences of policy proposals. Political scientists refer to those limitations as computational constraints (Simon 1985). A quantitative simulation takes care of some computational constraints, allowing the operators of the simulation to track reliably the multiple, interdependent consequences of their decisions or actions.

By doing so, a simulation "holds our feet to the fire" with respect to the basic logic of our assumptions about a system. Simulations connect the dots leading from assumptions to likely system results. If we don't get from point A to point B as expected, we are forced to ask, "were my assumptions about this system wrong?" or "have I been fooling myself about what it takes to get from A to B?" In other words, a quantitative simulation forces us to be more critical with ourselves, and that can lead to discussion, reflection, learning, and positive change.

A big gap exists between interest in simulations and a commitment of time, resources, and specialized skills to develop a quantitative simulation. To begin bridging that gap, the wildlife profession needs example simulations that all wildlife agency staff can "test drive" and become familiar with. Though state-specific simulations won't match the specific context of bear management across the region, state models can provide general insights and experience using management simulations that can benefit all member states in the Northeast Wildlife Damage Management Cooperative.

In that spirit, we offer *Responding to Problems with Bears: A Management Simulator*, a user-friendly computer application that allows people to test three management actions as means to control negative human-bear interactions (and the negative impacts associated with those interactions) in residential areas.

The bear management simulator was developed with a team of wildlife professionals and tested with community members in New York State. The issue addressed in the simulation — how best to manage the negative effects of human-bear interactions in residential areas — is a common issue in many states with bear populations. If you simply have a general interest in how simulations can be used as a learning tool in the context of bear management issues, we offer the bear management simulator to you as an example. But if you find yourself facing a residential bear management issue, we offer the simulator to you as an issue education resource. We encourage you to use the application yourself, familiarize yourself with its operation, and eventually operate it with small groups interested in working through an issue that involves negative interactions between people and bears in residential areas.

We designed Part II of this guide as a primer on using the simulator with stakeholders. Appendices provided after Part II include handouts and templates that should give your team everything you need to design a small group workshop with the simulator as a centerpiece for group activity and discussion.

### Context for development of the bear management simulator

Black bears occur throughout New York State, with primary populations inhabiting three ranges. During the 1990's, The New York State Department of Environmental Conservation (DEC) began experiencing an increase in the number of public complaints about bear-related problems, especially in residential areas. Rise in complaints about bears was not unique to New York. Wildlife agencies in Massachussetts, New Jersey, Maryland, Virginia, and other states also experienced a rise in complaints during or after the 1990's.

Complaints about bear-related problems are an indication that human-bear interactions are producing a range of negative effects on people. Wildlife agency staff view such complaints as an index of how well they are managing interactions that contribute to negative impacts on people. Thus, the increase in complaints was concerning.

Understanding the factors that drive changes in residential complaints has important implications for a wildlife agency. The bear management simulator was developed to help wildlife agency staff and bear management stakeholders learn about the system of interacting factors underlying negative interactions with bears and complaints about bear-related problems. The simulator allows people to test different management actions and receive immediate feedback on how those actions affect various aspects of the bear management system. The simulator was developed as part of a multi-faceted effort to implement a new bear management planning framework in New York State [NYSDEC 2003b]). Its first

application was as a discussion tool for internal use by wildlife agency staff in New York.

### What you will see on the simulator control panel

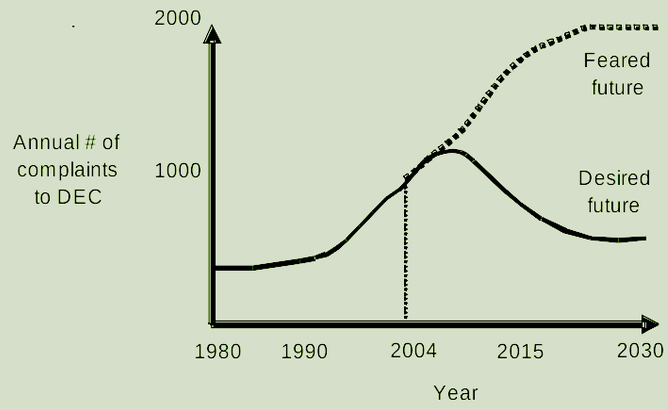
The bear management simulator has three parts: a set of controls for three management actions, a set of simulation output graphs, and an underlying quantitative model that generates the data displayed in simulation output graphs.

The underlying quantitative model utilizes historic data (on rainfall, black bear harvest, and complaints about bear-related problems) along with "soft variables" reflecting managers' understanding of factors such as hunting participation. The underlying model is calibrated to reflect environmental and social conditions similar to those that have existed in New York's Adirondack region over the past 50 years. We developed the underlying model as part of a group-model-building project with a team of wildlife professionals in New York (details about the project are provided in Siemer and Otto 2005). It reflects the team's assumptions about the management system, assumptions based on collective experience and research on both the environmental and social aspects of the bear management system.

A management consultant with experience in group-model-building techniques guided model development. The model structure reflects standards of practice used by system dynamicists. The model has been extensively tested, revised, and calibrated. The model reflects critical review by wildlife biologists and managers in multiple states. However, keep in mind that this model, like all models, is a simplification of reality. Some aspects of the problem system have been excluded purposefully. Many specific details of the problem system were aggregated. We made choices about model boundaries and variable aggregation based on our definition of the problem and the purpose of the model building exercise.

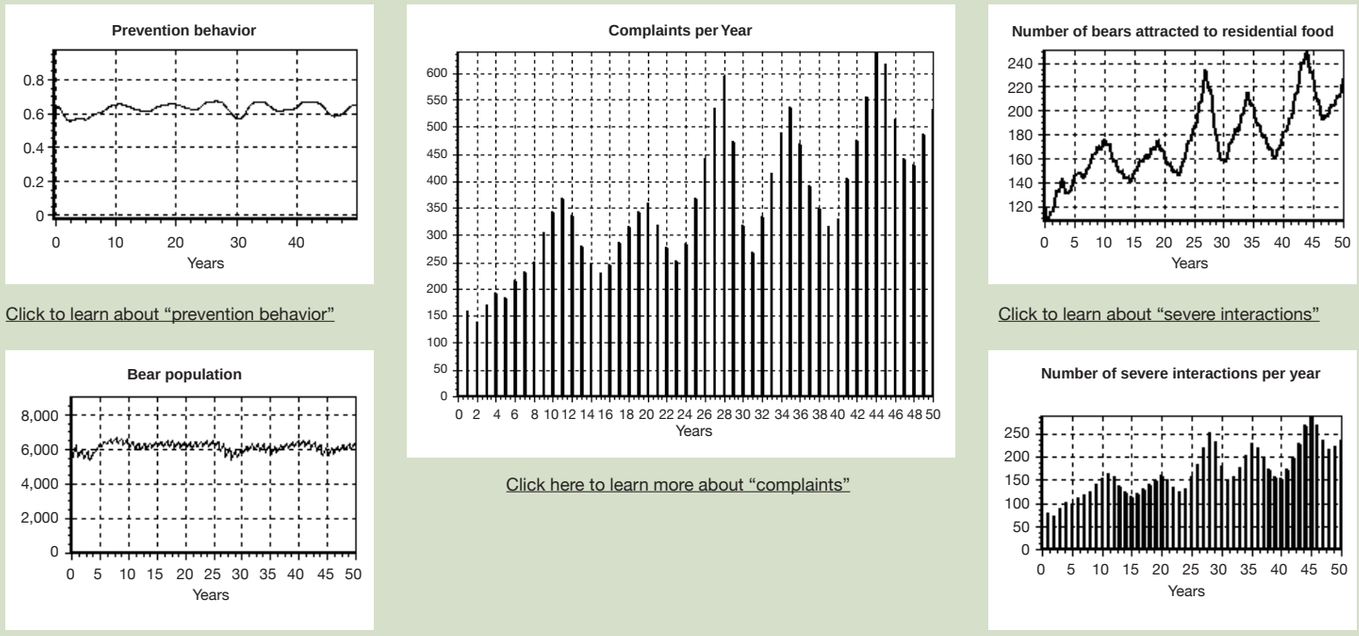
In the New York project, the problem statement focused specifically on complaints about problems with bears in residential areas. They captured their problem statement in the graph depicted in Figure 2.1. Wildlife managers in New York were concerned about rising complaints about problems with bears, because they assumed that complaints were an indication that stakeholders were experiencing negative impacts from bears. Managers expected that, unless they intervened in an effective way, negative interactions and complaints would continue to rise (as depicted in the dotted line in Figure 2.1), with negative consequences for bear management stakeholders, black bear conservation, and the wildlife management agency. Members of the project team believed that some set of interventions was necessary to achieve their desired future, a future in which problems with bears occur, but do not exceed a socially acceptable level (the project teams' desired future is represented by the solid line in Figure 2.1). Note that managers realistically expect some level of complaints in the future, as an unavoidable consequence of human-bear coexistence.

**Figure 2.1** **Problem Statement**




**A graphical representation of the problem statement wildlife management professionals in New York explored using the management simulator.**

**Figure 2.2** **Main screen of Responding to Problems with Bears: A Management Simulator**




The group modeling project in New York culminated in a system dynamics model, which served to improve wildlife managers' understanding of a complex set of interactions occurring between community residents, wildlife agencies, and black bears. The model they developed allowed them to explore the three specific policy questions described below. The simulator will allow you and your stakeholders to explore those same questions.

Policy questions: How would changes in (1) hunting opportunity (i.e., amount of land open to hunting, season dates, season length), (2) agency effort devoted to prevention education (i.e., agency resources expended on informative communication and education actions), and (3) agency staff capacity to respond to bear-related problems (with on-site technical assistance to residents) influence the frequency, severity, and rate of complaints about negative human-bear interactions in residential areas?

## *Simulation controls*

A recreation of the main screen of the management simulation is shown in figure 2.2. Operators of the simulation have an opportunity to make bi-annual management decisions and to observe the consequences of their choices. Each full simulation runs for 50 years. The objective for the operator is to make decisions that result

in a lower complaint load than observed in the historical baseline simulation.

At the beginning of each 2-year increment of the simulation, operators have an opportunity to make three management decisions:

1. Hunting: How much hunting opportunity will my agency allow?
2. Problem prevention education: How much money will my agency invest in prevention education campaigns?
3. Staffing: How much staff capacity will my agency allocate for on-site response to complaints about bear problems?

**Hunting opportunity** — Operators are allowed to vary the level of hunting opportunity from minimum ("min") to maximum ("max"). A minimum opportunity setting actually means closing all bear hunting seasons. A maximum opportunity setting means opening all areas of the state to long hunting seasons.

In a regulated hunting system like that used in New York, hunting opportunity is liberalized as a means to reduce human-bear conflicts and it is restricted if it threatens the viability of a bear population. On a statewide scale, the wildlife agency in New York is legally mandated to maintain the bear population. The state of New York applies a hunting policy ensuring it will be able to sustain bear populations. Bear biologists monitor data to estimate bear population trend, and they reduce hunting opportunity if trend data suggest a substantial decline in the bear population. To facilitate opportunities for learning, the simulator includes a toggle that allows operators to disengage this population maintenance mandate. Operators can remove that constraint by clicking the box labeled, "Remove regulatory control," and then placing a check mark in the box labeled, "Check to set Regulatory Control OFF."

**Education campaigns** — Initial settings for the simulation allow the operator to spend $5,000 per month on campaigns (i.e., on materials and services related to mass communication) to educate stakeholders about preventing bear problems. You can set the level of spending, between $0 and $15,000 per month on education campaigns.

**Staffing** — The simulation begins with an initial assumption of 3 staff members, each of whom can spend up to 50 hours per month responding to bear-related complaints with on-site assistance. The operator can assign additional staff, or choose to add no additional staff. The values range from 0 to 5 additional staff (meaning that the operator will have 3 to 8 staff assigned to handle complaints as one part of their job responsibilities).

The simulation begins with adequate staff resources. However, if complaints increase, staff resources may be exceeded. Operators can click on a hypertext link under the staff slider to see whether their staffing level has been exceeded, and by how much.

### *Simulation output graphs*

The main screen of the simulator provides operators with information updates on five key variables: bear problem prevention behavior, bear population size, annual number of complaints about bears, number of bears attracted to residential foods, and annual number of severe human-bear interactions. Details about each of those variables are provided below.

**Prevention behavior** — Residential problems with bears often involve a food attractant. The prevention behavior variable refers to the proportion of households in a region practicing actions that remove food attractants. This is an aggregated variable. It represents behaviors such as storing garbage indoors, feeding pets indoors, cleaning barbeque grills, and removing bird seed when bears are most active. Survey research in four New York communities in 2004 indicated that about 60% of residents in those areas were practicing prevention behaviors (Gore 2006). Using that statistic as a starting point, we initialized the simulation with 60% (or 0.60) of households taking preventive measures. The proportion of households practicing prevention behavior fluctuates due to personal experience and knowledge gains produced through investment in education campaigns. The model assumes that inability to prevent severe problems with bears may lead to reduced prevention behavior (e.g., repeated

severe problems may teach people that they cannot control bear behavior, so they stop practicing those behaviors).

**Bear population** — Wildlife managers believe that increases in a bear population lead to increases in complaints, and thus, they pay a lot of attention to monitoring trends in bear population. Given the importance of that variable to managers, we designed the interface to display changes in the bear population over the course of a simulation. Cyclical fluctuations in bear population result from changes in natural food production and hunting mortality. Operators who experiment with changes in hunting opportunity will observe that fluctuations in population size occur even in a non-hunted population.

The interface produces a bear population graph that looks a bit like a set of jagged teeth. The quick changes in population size occur because the model calculates mortality on a seasonal basis (to simulate a fall hunting season). Longer oscillations in population size reflect changes in annual precipitation (and natural food production).

**Complaints per year** — Number of complaints refers to the total of all complaints DEC staff receive about negative human-bear interactions. The majority of complaints relate to residential problems, rather than agricultural damage. In actuality, complaint loads are highest in spring and late summer/early fall, when bears are most active. However, to simplify the underlying model, complaints are calculated on a monthly basis that does not differ by season of the year.

Most complainants report moderately negative experiences (e.g., a damaged bird feeder or trash can). Agency records indicate that about 10% of complainants experience more severe problems (i.e., costly property damage, building entry). The underlying model assumes this ratio of 10% severe interactions at the beginning of the simulation.

**Number of bears attracted to residential food** — Availability of anthropogenic food sources (e.g., garbage, bird seed, pet food, gardens, crop fields) influences the frequency and severity of negative human-bear interactions. Complaint records in New York document that many residential problem situations involve an element of food attraction.

The simulation assumes that, as human population density increases, availability of human foods increases, the proportion of the bear population attracted to human food sources increases, negative bear-human interactions increase, and complaints to the wildlife agency about residential problems increase. Controlling access to human food sources reduces the fraction of bears that are attracted to those foods, which leads to reduction in negative interactions and complaints.

**Number of severe interactions per year** — The simulation reflects the actual time that wildlife staff in New York need to address complaints. In New York, response to the typical complaint requires about 1 staff hour. Response to "severe" interactions (e.g., home damage, home entry) requires on-site work and may involve negative conditioning or removal of a bear. Such responses take 12 hours of agency staff time on average. Given the time required for on-site visits, it's easy to imagine the genuine strain on agency resources created if the proportion of severe complaints increases. The simulator includes a graphical output allowing operators to see how staff resources are exceeded as the number of these labor-intensive responses increases in a simulation.

## What your stakeholders may learn from simulations

Using the bear management simulator should allow anyone to gain a few generalizable insights about the dynamic complexity inherent in efforts to manage human-bear problems in suburban areas. Individuals may pick up these insights through self-guided use. However, we think the simulator will be most useful to wildlife agencies and local communities if used as part of a facilitated small-group exercise within a PIE program.

When used in a small group discussion facilitated by a wildlife professional, *Managing Problems with Bears* can be a powerful tool to

create learning opportunities for wildlife management stakeholders. Using the simulation will help your stakeholders understand how managers view the bear management system, including managers' assumptions about relationships between key variables.

Running simulations should build capacity of stakeholders to engage in black bear management planning. A small group meeting structured around use of the simulation affords an interesting and enjoyable way to introduce stakeholders to the notion of systems-thinking, because using the simulation will prompt them to focus on the dynamics in the system of key variables that drive problem interactions between bears and people. As they conduct simulation runs, stakeholders will gain an appreciation of the ways in which considerations of decision scale, natural and social limits, agency capacity, and impacts come into play in bear management decisions.

If all goes well, a session using the simulator could create an opportunity for your team to begin an ongoing dialogue about black bear management with key stakeholders (e.g., you may find it a reasonable starting point for a planning or decision-making process). It could be a terrific ice breaker for ongoing dialogue about: (1) how managers make bear management decisions, (2) how stakeholders can become involved in decision-making processes, or (3) how communities or nongovernmental organizations can help craft, evaluate, or implement alternative solutions. In other words, it sets the stage for additional issue education.

Interaction with wildlife professionals gives us reason to believe that the insights from this project will be of interest to a broad audience. On April 6, 2005, two of the authors met with a diverse group of wildlife management professionals attending the Eastern Black Bear Management Workshop in Tallahassee, Florida. We had convened a 90-minute scoping session at that workshop to identify priorities for stakeholder engagement and issue education needs related to black bear management in the eastern United States. Participants in our session included wildlife biologists, managers, and researchers working in a range of agencies, universities or nonprofit wildlife and conservation organizations. They brought perspectives on bear management from Ontario, Quebec, Maine, Connecticut, New Hampshire, New York, New Jersey, Pennsylvania, Virginia, West Virginia, Kentucky, Tennessee, Arkansas, North Carolina, Georgia, Florida, Mississippi, Louisiana, and Alabama. Session participants identified a range of issue education needs that we grouped into six broad categories (Table 2.1). The management simulator should be of broad interest because it offers an entry point for discussion about all six topics. We outline some of those potential discussion points and insights in the following sections. You may discover others on your own.

### *Time delays*

Time delays play a fundamental role in dynamic systems. For example, the information that wildlife agencies use to assess changes in a bear population accumulates slowly. Delays in information feedback translate into delays in perception changes about the bear population. Once managers perceive a bear population change, they may propose a change in hunting opportunity, but it may be a full year before their proposal is accepted and implemented. For learning purposes, the simulator allows operators to change hunting opportunity at rates that are theoretically possible, but not necessarily realistic in most circumstances. A facilitator can bring this point up for discussion. You can use the simulator to help people see the important role that time delays play in setting hunting policy. In doing so, they may come to understand that changing wildlife management policies can be akin to changing the direction of a large ship. This may help stakeholders understand why wildlife agencies always try to err on the conservative side when it comes to proposals about change in hunting opportunity.

### *Changing hunting opportunity*

Changing hunting opportunity is arguably the most controversial policy wildlife agencies offer as a response to negative human-bear interactions. We doubt that exercising the management simulator will sway polarized stakehold-

ers from their positions with regard to hunting. However, we do have confidence that people with very different viewpoints can use the simulator as a vehicle for productive discussions about hunting. If you are able to engage stakeholders before polarization occurs, the simulator could give your key stakeholders important insights about hunting. Here are some of the insights we've watched people uncover for themselves as they run simulations.

**Hunting addresses the stated problem.** — We stated earlier that stakeholder deliberations about means (like hunting) will be more productive if clearly tied to the ends they are intended to achieve. The stated end of this exercise was to evaluate hunting opportunity as a means to achieve fewer problems with and complaints about bears. Running the 50-year simulation demonstrates that, of the three management actions we investigated, hunting was the highest leverage action for reducing complaints about bear-related problems. For example, running simulations without any hunting (i.e., using the "min" hunting opportunity setting) results in very high complaint levels. However, running the entire 50-year simulation with hunting opportunity set at "max" (and no additional staff or prevention education) the operator achieves fewer complaints about bear problems than the baseline until year 43. At that point complaints exceed the baseline level because residential development

**Table 2.1** **Priority topics for stakeholder engagement and bear management issue education.**

| | |
|---|---|
| **Hunting** | Establishing and maintaining bear hunting as a management tool.<br>Conflict over opening or closing a bear hunting season.<br>Conflict between hunter groups (e.g., allocation issues involving deer and bear hunters or different types of bear hunters).<br>Deer hunters' concern about bear predation on deer (e.g., concern about implications for deer hunting as a bear population increases). |
| **Habitat and human population** | Expanding populations of people and bears (dealing with the success of bear conservation).<br>Restrictions on habitat management.<br>Habitat fragmentation.<br>Land use by single landowners and development companies – land use changes produce human-bear conflicts, contribute to decline in and fragmentation of habitat (all of which is related to human population increase). |
| **Bear-human conflicts** | Escalating nuisance activity. |
| **Education** | Needs for education (human bear conflicts increasing, human fear in woods, illegal harvest, deer hunting (baiting)/ bear hunting, agricultural damage, audience diversity). |
| **Communication** | Understanding how to work with the media.<br>Building cooperation and consistency within and between agencies with jurisdiction–wildlife agencies, law enforcement agencies, educators, elected officials, courts, etc. (developing internal consensus about response to human-bear interactions). |
| **Agency staffing** | Agency staffing issues (staffs declining in most states). |

has removed natural habitat, reduced natural food, increased bear attraction to residential food, and thus created more human-bear interactions.

**Hunting alone isn't the optimal policy.** — Though hunting pressure is very helpful in reducing problems with bears, running simulations also points out that it works best as part of a broader response. Simulations reveal an important dynamic that unfolds over a long time horizon. In a context where number of households increases over time, regulated hunting alone may not be sufficient to control increase in the number of bear-related complaints, because adding households continues to reduce natural food availability and increase bear attraction to residential food sources. Complaints are likely to be elevated in a management system that does not include hunting, but hunting alone may not stop a rise in complaints, given other dynamics and management constraints. In systems where hunting already occurs each year, incremental increases in hunting shouldn't be viewed as a means to eliminate all problems or complaints.

**Complaints aren't the only consideration.** — The simulator was designed to help people think about a specific set of problems. But using the simulator quickly leads back to consideration of the real-world context where managers have more than one impact to consider. It probably goes without saying that society could eliminate all bear-related problems by eliminating all bears. Greatly reducing a bear population should greatly reduce problem interactions with bears. And yet, most states do not attempt to reduce bear populations to very low levels, because society may not tolerate the loss of benefits associated with a greatly reduced bear population. The simulator allows the operator to achieve very low bear populations, but that raises the question of whether people would tolerate such population reduction even if it were something that managers could achieve as easily in the real world.

### *Problem prevention education*

**Education alone is not enough.** — Problem prevention education is sometimes advocated as a stand-alone solution to problem interactions with bears. Simulation results suggest that prevention education is actually the lowest leverage action for reducing complaints about bear-related problems. It's important to note that such results are related to the assumption that education does relatively less to change prevention behavior than does direct experience, especially a severe problem experience.

The optimal solution in the simulation is to maximize hunting, staff level, and investment in education. However, increasing education doesn't add that much to the solution. One can do almost as well without any investment in education if staff capacity and hunting are set at their maximum.

Assumptions about education are critical to the model outcome. Gore (2006) found little behavior change after an ambitious education pilot program in four communities in southeastern New York. Data from that study gives us some justification to set the education effect lower than the effect of personal experience in New York. Running simulations with stakeholders should lead to discussions about the general efficacy of education interventions now delivered across the United States. That provides agency staff and nongovernmental organizations an opportunity to point out the need for better evaluation of existing education programs. Documenting the effects of education on prevention behavior remains an important research need in every state.

### *Agency resource (staff) limitations*

**Staffing is more important than you think.** — Agency resource (staff) limitations play a surprisingly important role in managing public concern and complaints. Increasing staff capacity to respond to complaints had unexpectedly strong leverage in controlling complaint level. Simulations suggest that managers could control complaints based only on changes in hunting opportunity if they could operate outside their mandate to maintain viable populations at a statewide level (the simulator allows operators to do that by toggling off that regulatory constraint). However, the fact that such an option isn't available to most wildlife agencies

suggests that the best solution is a combination of hunting pressure and staff capacity to respond to severe complaints.

Staffing level is especially important in drought years, when bears are more strongly attracted to residential foods and interactions (including severe negative interactions) increase. Managers were already aware that complaints tend to increase in drought years, but running simulations highlights the potential importance of increasing staff in anticipation of those drought-related problems as a strategic response.

### *Residential development*

**Residential development matters.** — Residential development plays an important role in this issue. The simulator gives managers and stakeholders an opportunity to discuss an important facet of bear management issues in most states—the fact that residential development continues to increase steadily (and in some places, rapidly) in areas of core black bear habitat. Your most involved stakeholders may recognize that land use changes play a role in this issue, but many people may not recognize this important dynamic. It is often neglected as a factor in mass media coverage of black bear problems (Siemer et al. 2007). Discussions about land use and development may help stakeholders understand that problem interactions with bears are not merely a result of poor behavior by individual people. Problem interactions are in part a result of societal choices about development. Those choices might be influenced somewhat by, but are largely outside the control of wildlife management agencies.

## Using the simulator with stakeholder groups

We envision multiple ways to use the management simulator to create opportunities for learning by, and dialogue with, bear management stakeholders. In this section, we describe one approach, a 1.5-2-hour meeting/workshop with small groups of stakeholders. Working through this example format should give you the tools you need to offer a workshop. It also may stimulate your ideas about other formats in which to use the management simulator.

The following procedures are appropriate for a range of small group sizes. We recommend that you keep group size small (about 20 or fewer people). If you wish to reach more than 20 individuals using the following format, you can do so by repeating the process with additional groups.

### *Step 1: Load the application*

Your first task will be to load the application onto one or more computers. Complete installation and operating instructions are provided in Appendix A. The system requirements to run the application are modest. The application file is small and requires only simple graphics capability. The application can easily be uninstalled, which is helpful in situations where meeting participants volunteer use of their personal or office computers for temporary use during your workshop.

You may have a copy of the practitioners' guide that came with the simulation software on CD-ROM. If not, you can obtain a zip file with the application by contacting HDRU (at Cornell University) or the Northeast Wildlife Damage Management Cooperative. You can make copies of Appendix A to distribute to anyone interested in installing the interface on their own computer. If you have any difficulties loading or distributing the software application, contact HDRU for assistance.

### *Step 2: Familiarize yourself with the application*

Appendices A and B provide operating instructions and guidance about using the simulator. Read those materials and then give the simulator a try. Run your own management experiments. Get comfortable with the application and the simulation results. It won't take you long to become familiar enough with the application to serve as a technical assistant to the stakeholders who attend your workshop.

### *Step 3: Identify an opportunity to meet with stakeholders*

If your organization has interest in, or responsibilities for black bear management, you may find yourself in a number of different

situations that create a great opportunity to propose a meeting/workshop with stakeholders. For example, you may be approached by one key stakeholder (e.g., a town supervisor) or interest group representative who wants information or advice on a bear management issue. That's a great opportunity to invite them over for a chat, using the management simulator as your starting point. Perhaps a bear management issue is emerging in your local area right now. Issue emergence is a perfect time and opportunity to propose a meeting with a small group of individuals in one of the communities dealing with the issue.

We're sure you can imagine different variations on those scenarios, and each would imply slightly different considerations with regard to group size and types of stakeholders to invite. However, the meeting template offered in Appendix C should be applicable across meetings with different numbers of participants and different stakeholder groups.

### *Step 4: Convene your team*

After you have identified an opportunity to meet with a group of stakeholders, you will need to pull together a team to prepare and deliver your meeting/workshop. You will need to bring together a set of people who can cover some of the process and content roles presented back in Table 1.3. The number of people on your team will depend on group size. At a minimum, you will need one person who can fulfill process roles (i.e., designing your meeting process, inviting participants, making meeting arrangements, facilitating the meeting), and a second person who can serve in content roles (i.e., providing technical expertise on black bears, providing information about the bear management system in your state, helping participants interpret simulation results during and after their breakout session). Learning potential will be enhanced by having one technical expert in each breakout group, so you may need several wildlife professionals on your team. Also, we find that it is helpful to work with a local contact who can use their personal network of relationships to bring in key participants. As pointed out earlier in Part II, wildlife agency staff, Cooperative Extension professionals, and members of nongovernmental organizations can fulfill the many process and content roles identified in Table 1.3, so by all means consider forming a team of professionals from multiple organizations.

### *Step 5: Deliver your workshop*

Appendix C offers a template for a 1.5-2-hour meeting, partitioned into six parts. The template is just a suggested approach; you should feel free to add or subtract elements to tailor the approach to your specific needs and learning objectives.

The meeting template begins with about 10 minutes for introductions. Your team facilitator or a local collaborator can kick off the meeting and ask everyone to introduce themselves to the group. If time allows, prefacing the meeting with a shared meal or some time for refreshments and social interaction will give participants a chance to meet one another before your meeting commences, and that may facilitate richer discussion between group members when they begin working in breakout groups.

After introductions, we suggest that your team set the context with a brief presentation. Suggested main points of a presentation are identified in Appendix C. You'll need a computer and computer projector for your presentation.

You can begin on a positive note by pointing out the many benefits that the people of your state receive because they have a black bear population. You then can move on to information about the problem interactions occurring between people and bears in your state, and the purpose of your meeting or workshop. After establishing the purpose of your meeting (e.g., to open a discussion about black bear management), you can move on to introduce the simulator. We suggest that you have the application loaded on the computer you use for your presentation, so that you can switch over to the application and begin showing the simulation screens to all participants.

Following introduction of the simulator, it is time to assign your participants to breakout groups with 2–4 members per group. Use

your best judgment about assigning people to groups. You may want to pair individuals with different perspectives on or roles related to bear management. You may want participants to self-select their groups.

Make sure that each breakout group has access to a content specialist who can answer any questions their group may have about actual bear management in your state. It would be ideal to have two or even three bear managers participating in your workshop. If only one bear manager is available, ask that person to float from group to group to answer questions during the break out session, serving as expert resource for the groups.

Appendix C provides five sets of management scenarios that you could use as assignments for up to five breakout groups. You can develop additional scenarios as you become familiar with the interface and identify questions you want stakeholders to work through in your own state. Content specialists will be able to help stakeholders in each group have a thoughtful and productive discussion about the real-world implications of their simulated management policies.

After 20 minutes or so, ask your small groups to reconvene. Ask one member of each breakout group to give a debriefing on what his or her group observed or learned during their simulations. The meeting facilitator should be prepared to help identify and reinforce insights uncovered in each small group. The facilitator also should look for opportunities to bring wildlife management professionals back into the discussion, to bridge from simulation results back to the actual context for bear management in your state. If necessary, the facilitator should take 10-15 minutes after the breakout group reports to point out important insights, dynamics, and management constraints identified across groups. This portion of the discussion offers an opportunity to provide a manager's perspective on the action alternatives suggested by participants.

The concluding segment of your meeting should segue into some discussion about next steps. Do participants have ideas about how their local communities could help reduce human bear problems? Are they interested in meeting again at some point to keep talking about black bear management. Do they know of other stakeholders who would be interested in a workshop like the one they just completed? Find out if your workshop can lead to other opportunities for issue education.

**Stakeholders in Woodstock, New York, discuss simulation results during the small breakout portion of a bear management simulation workshop. Workshop facilitators (standing) help answer questions and guide discussion.**

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## Extending stakeholder engagement beyond your workshop

Chances are very good that your workshop will lay the foundation for a productive dialogue with people who care about black bear management. Now you need to build on that foundation. We leave you with a few thoughts on ways to extend stakeholder engagement beyond your workshop.

**Keep cultivating those relationships** — One way to build on the relationships started in your workshop is by maintaining periodic communication with workshop participants. Perhaps you can add them to your organizations' newsletter distribution list, provide periodic research and management updates to their organizations, or work with them to offer simulation workshops to other people. The mechanisms for ongoing communication will vary depending on the strengths and resources of your organization. The take home message is that you should build on the productive

conversation initiated at your workshop. Take whatever simple steps you can to keep up a public dialogue about black bear management. These activities are likely to build trust and community capacity to participate in bear management activities in the future.

**Build your own qualitative model** — The learning interface wasn't developed specifically for your state (unless you live in New York). Moreover, it may not explore some of the management actions that you think may be helpful in your context (e.g., aversive conditioning of problem bears, mandatory use of bear-resistant trash containers, etc.). You could consider the model developed in New York as a useful departure point to develop a qualitative model better suited to your specific situation. Even the initial steps of such a conceptual modeling effort could help you to put your issue into a broader context.

**Develop interactive learning experiences for K–12 education venues** — Consider developing something for education venues like science centers, museums, or classrooms. Black bears are inherently interesting to most people and they serve as a great focus for in-school or nonformal science education. Many states already have prepared materials for education about black bear natural history and ecology. An entire field has developed to offer systems thinking education in K-12 classrooms. A science education package that includes systems modeling focused on black bear ecology and management could be a way for your organization to reach youth with a message about the human-wildlife system that leads to problem interactions with bears. There are abundant opportunities for multi-organizational partnering to prepare these kinds of educational materials.

# Guide Summary

Black bears are among the most well-regarded animals in the pantheon of North American wildlife. However, as bears and people have increasingly come into contact in recent decades, conflicts have occurred and public issues have emerged. Our purpose in this guide has been to help practitioners — wildlife professionals, extension educators, community leaders — to work through these bear management issues

Part I of this guide described a typology practitioners can use to think about their bear management issues. Part I reviewed a model of issue evolution that can help practitioners understand where they are in the life of a bear management issue, and where and how their organizations can effectively intervene to manage those issues. Part I provided a few guiding principles for effective black bear public issue education (PIE) processes. We suggested that your PIE processes: (1) focus on impacts, (2) create opportunities for deliberation, (3) clearly link management means to desired ends, and (4) use systems thinking approaches to facilitate learning among wildlife managers and management stakeholders. No one person can achieve these tasks alone, PIE processes are best delivered by teams of practitioners, often working in multiple organizations.

In Part II, we demonstrated one means by which you can put those ideas into practice. We offered a computerized management simulation that offers the many learning outcomes that may be afforded through skillful use of quantitative simulation. Part II provides everything a team of practitioners need to develop their own small-group workshop centered on the simulation.

The simulation overlays a quantitative model that allows stakeholders and wildlife professionals to discuss and learn about three commonly-used actions to manage problem interactions with black bears. In doing so, the management simulator offers a tool for issue education and an entry point for ongoing dialogue about black bear management.

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# Glossary of Terms and Acronyms

**Community capacity**—Capacity developed within informal relationships among individuals and groups that are bounded geographically (e.g., neighborhood, town, or region). These relationships create social networks that flow from the day-to-day contact of individuals in a community. Community capacity may include productive, mutually supportive relationships; a sense of common purpose; and an understanding of shared values and history.

**Education**—A process of organizing and providing information, stimulating thought, and facilitating understanding that encourages learning.

**HDRU**—Human Dimensions Research Unit, Department of Natural Resources, Cornell University.

**Impacts**—Innumerable effects are created through interactions between humans and wildlife. A subset of effects is recognized as being important. These important effects are impacts. Impacts are significant positive and negative effects resulting from interactions between humans and wildlife.

**Individual capacity**—Capacity gained by individual citizens derived from education and experience. These important traits may include leadership skills, analytical skills, technical skills, and various kinds of knowledge.

**Informative communication**—The process of providing information and increasing awareness.

**Institutional capacity**—Capacity developed within an organization or set of organizations (e.g., state or federal wildlife management agency or a local government). Institutional capacity may include funding, materials, or organizational elements such as partnerships and programming.

**NGO**—Nongovernmental organization (e.g., The National Wildlife Federation and The Nature Conservancy).

**NWDMROC**—Northeast Wildlife Damage Management Research and Outreach Cooperative.

**NYSDEC**—New York State Department of Environmental Conservation.

**Public issues**—Disputes between people that demand intervention by a public agency.

**Public issue evolution**—The process by which a concern emerges into a bona fide issue.

**Public issues education (PIE)**—Education about public issues that takes into account, and sometimes tries to affect, the evolution of the issue.

**Stakeholder (wildlife)**—A person or group that is affected by, or affects, a particular wildlife management issue.

**Stakeholder involvement**—Engagement of stakeholders to help frame issues and problems; offer information and contribute knowledge about different viewpoints; understand, make, implement, or evaluate wildlife management decisions.

**Systems thinking**—A way of thinking and a set of skills that helps people work through dynamically complex issues, by focusing our attention on interrelationships between the many parts of a problem system.

## Appendix A

# Operating instructions for Responding to Problems with Bears: A Management Simulator

### Installing the simulation on your computer

Install the bear management simulator using the setup program on your CD ROM. Click on the file, "DEC_Cornell_Setup_1.1." A menu driven installation program will appear on your screen. Follow the instructions provided to load the application on your personal computer.

1. Start your computer.
2. Make sure to close all applications before running the install program.
3. Insert the CD ROM or memory stick containing the interface setup program.
4. Double click your mouse on the DEC_ Cornell_Setup_1.1 file.
5. Follow the installation instructions on the screen (including installation of the Sable Runtime program).
6. You will be prompted to restart your computer before running the new application.

### System requirements to use the interface

The following table shows the hardware requirements to support this application. The system requirements are modest because the application file is small and requires only simple graphics capability.

| | |
|---|---|
| **Operating system** | **Microsoft Windows** |
| **Microprocesser** | **Pentium** |
| **Memory** | **256 MB** |
| **Hard disk space (approximate)** | **15 MB available** |
| **Disk drive** | **CD ROM drive or USB port** |

### Opening Venapp and the interface

- If you successfully installed the application, it should appear in a subdirectory called Ventana Systems. To open the program, go to the bottom of your computer screen and click on the Windows "START" button. Next, click on "All Programs." In the program listing, click on "Ventana Systems," then click on "Sable Runtime Redist."
- After you click on "Sable Runtime Redist," select the file folder on your computer that contains the file "Interface." Click on that file and the interface will open.

### Viewing the main menu

The application opens to a main screen with the title "Responding to problems with bears: a management simulator." The main menu provides introductory text explaining that your task is to take on the role of a wildlife manager who is trying to minimize complaints about bear-related problems in residential areas.

The main menu contains three brown boxes that you can click on to move to other menus. To leave the main menu, place your cursor arrow over a brown box and click once (you will know when your cursor is over a box, because the text in the box will turn yellow).

- When you click on the box called "Read the Guide," a text passage with more information will appear. To close the screen, click on the "x" in the top right corner of the box.
- When you click on the box called "Management problem," a text passage with more information about bears and bear-related problems in New York will appear. After reading this screen, you can close it by clicking your cursor on the "x" in the top right corner of the box.

- When you click on the box called "Go to Simulation," you will go to a simulation menu that displays five graphs, a set of simulation controls, and a set of "sliders" to adjust the level of three management actions.

### Navigating the simulation menu

*Graphs displaying simulation outputs:*

- The central (and largest) graph on the simulation menu displays complaints per year received by DEC about residential problems with black bears. Additional graphs display simulation data on bear problem prevention behavior, size of the bear population, number of bears attracted to residential foods (e.g., bird feeders, garbage), and number of severe interactions between people and black bears. You can learn more about each graph by clicking your cursor on the blue hypertext below each graph.
- Each time you click the continue simulation button, another 2 years of output data is added to the graphs. The graphs automatically adjust in scale to accommodate new data.

*Simulation Controls:*

- The left bottom corner of the simulation menu contains three simulation controls. Each time you click the "Run simulation" boxes, you complete one round of simulation. Each click of your mouse produces a simulation period of 2 years. You can run an entire 50-year simulation by clicking on the box called "Run to end."
- You can return to the main menu at any time by clicking the box labeled "back to main."

### Adjusting management actions

- The bottom center of the simulation menu contains "slider bars" that allow you to modify the level of three management actions: number of additional staff for response to complaints, dollars per month spent on bear-problem prevention education, and level of hunting opportunity. Each of these sliders can be controlled by clicking the slider tab, then using your left or right arrow keys to change the position of the slider bar. For finer adjustments, place your cursor over a slider bar, hold down the left button on your mouse, move your mouse left or right, then release the mouse button when the bar reaches the level you prefer. Staff size can only be changed in increments of whole numbers.
- You can change the level of all three management actions every 24 months (i.e., once per simulation run). You also can run simulations without making any changes to the management action sliders.

### Conducting a simulation run

- You can run a simulation by clicking your cursor on the "Run simulation" or "Run to End" boxes. Each time you click, the simulation will run for 2 years. You need to click again for each increment of the simulation. Once started, you will need to go through 50 years of simulation before starting again.

### Management actions guide

- The bottom right of the simulation menu contains three boxes you can click on to get brief background information about each bear management action in the simulation. After reading a passage, you can close an information box by clicking your cursor on the "x" in the top right corner of the box.
- The most important box in the management action guide section is labeled "Remove regulatory control." Clicking on this box opens a screen with information about a regulatory loop that prevents overharvest of black bears in New York. This screen includes a small box that you can check to "turn off" this regulatory loop. You can toggle this box to the on or off position by clicking your cursor in the box. The regulatory loop is turned off when a check appears in the box.

## Appendix B

# A Guide to Responding to Problems with Bears: A Management Simulator

Wildlife management decisions have consequences that unfold over a period of years. High costs and the potential for failure give agencies good reason to be risk-averse when it comes to management experiments. All managers, including wildlife managers, need tools that provide a safe forum for management experiments — places where they and their stakeholders can evaluate ideas and processes without risk to the systems they aspire to manage. The bear management learning interface provides that kind of low-risk testing ground, where managers and stakeholders can use simulation outputs as a vehicle to exchange ideas, clarify assumptions, and test hypotheses together.

### Overview of the Management Problem

Black bears occur throughout New York State, with primary populations inhabiting three ranges. During the 1990's, The New York State Department of Environmental Conservation (DEC) has received an increasing number of complaints about bear related problems, especially in residential areas. Rise in complaints about bear related problems is not unique to New York. Wildlife management agencies throughout the northeast have witnessed the same phenomenon.

Complaints, in New York and elsewhere, serve as an indicator that human-bear interactions are producing a range of negative economic, psychological, and physical effects on people. DEC staff consider a reduction in the number of complaints about bear-related problems as an indicator that they are successfully managing interactions that contribute to negative impacts on people.

Understanding the factors that drive changes in residential complaints has important implications for DEC. We designed the management simulator to help DEC staff and bear management stakeholders learn about the system of interacting factors underlying negative interactions with bears and complaints about bear-related problems. The simulator will allow you to test different management actions and receive immediate feedback on how those actions affect various aspects of the bear management system. We hope that by using this simulator you will gain insights about the dynamic complexity inherent in efforts to manage negative human-bear interactions in residential areas.

### Overview of the Simulator

The simulator has three parts: a quantitative model with dynamic feedback, a set of controls for three management actions, and a set of simulation output graphs.

The simulator overlays a quantitative model with dynamic feedback. It utilizes historic data (on rainfall, black bear harvest, and complaints about bear-related problems) along with "soft variables" reflecting managers' understanding of areas such as hunting participation. The underlying model is calibrated to reflect environmental and social conditions similar to those that have existed in New York's Adirondack region over the past 50 years. We developed the underlying model as a part of a group model building project with members of NYSDEC's Bear Management Plan Team. It reflects the Plan Team's assumptions about the management system, assumptions based on collective experience and research on both the environmental (physical) and social aspects of the bear management system.

A management consultant with experience in group model building techniques guided model

development. The model structure reflects standards of practice in the modeling field.

The model has been extensively tested, revised, and calibrated. However, like all models, it is a simplification of reality. Some aspects of the problem system have been excluded. Many specific details of the problem system were aggregated. We made choices about model boundaries and variable aggregation based on our definition of the problem and the purpose of the model building exercise.

### *Simulation controls*

The simulator allows you to step into the role of wildlife manager. You'll have an opportunity to make bi-annual management decisions and to observe the consequences of your choices. Each full simulation runs for 50 years. At the beginning of each 2-year increment of the simulation, you will have an opportunity to make three management decisions:

1. Hunting: How much hunting opportunity will my agency allow?
2. Problem prevention education: How much money will I invest in education campaigns?
3. Staffing: How many staff will I assign to respond to complaints about bear problems?

**Hunting opportunity** — You vary the level of hunting opportunity between a minimum ("min") and maximum ("max"). Minimum opportunity means closing all bear hunting seasons. A maximum opportunity setting means opening all areas of the state to long hunting seasons.

**Education campaigns** — Initial settings for the simulation allow your agency to spend $5,000 per month on campaigns to educate stakeholders about bear problem prevention. You can set the level of spending, between 0 and $15,000 per month on education campaigns (i.e., materials and services related to mass communication).

**Staffing** — The simulation begins with an initial assumption of 3 staff members, each of whom can spend up to 50 hours per month responding to bear-related complaints. You can assign additional staff, or you can choose to add no additional staff. The values range from 0 to 5 additional staff (meaning that you will have 3 to 8 staff assigned to handle complaints as one part of their job responsibilities).

### *Simulation output graphs*

The interface provides you with information updates on five key variables: prevention behavior, bear population size, annual number of complaints about bears, number of bears attracted to residential foods, and the annual number of severe human-bear interactions.

**Prevention behavior** — Residential problems with bears often involve a food attractant. The prevention behavior variable refers to the proportion of households in a region practicing actions that remove food attractants. This is an aggregated variable. It represents behaviors such as storing garbage indoors, feeding pets indoors, cleaning barbeque grills, and removing bird seed when bears are most active. Recent survey research in four New York communities indicated that about 60% of residents in those areas were practicing prevention behaviors. Using that statistic as a starting point, we initialized the simulation with 60% (or 0.60) of residents taking preventive measures. The proportion of residents practicing prevention behavior fluctuates due to personal experience and knowledge gains produced through investment in education campaigns. The model assumes that inability to prevent severe problems with bears may lead to reduced prevention behavior (e.g., repeated severe problems may teach people that they cannot control bear behavior, so they stop practicing prevention behaviors).

**Bear population** — Wildlife managers believe that increases in a bear population lead to increases in complaints, so when you assume the role of manager, you may be interested in tracking changes in the bear population. Cyclical fluctuations in bear population result from changes in natural food production and hunting mortality. Experiment with changes in hunting opportunity and you will observe

that fluctuations in population size occur even in a nonhunted population. The bear population graph looks a bit like a set of jagged teeth. The quick changes in population size occur because the model calculates mortality on a seasonal basis (to simulate a fall hunting season). Longer oscillations in population size reflect changes in annual precipitation (and natural food production).

**Complaints per year** — Number of complaints refers to the total of all complaints DEC staff receive about negative human-bear interactions. Most complainants report moderately negative experiences (e.g., a damaged bird feeder or trash can). About 10% of complainants experience more severe problems (i.e., incidents that involve costly property damage or risk to human safety). Complaint loads are highest in spring and late summer/early fall (when bears are most active). For modeling purposes, complaints are calculated on a monthly basis that does not differ by season of the year.

Complaints to DEC about bear-related problems have increased over the last decade (wildlife agencies in other northeastern states are experiencing the same trend). The majority of complaints relate to residential problems, not agricultural damage. In New York, the greatest increase in complaints has occurred in the Catskill region. Complaints also have increased in western New York, as bears have become more widely distributed across central and western New York.

**Number of bears attracted to residential food** — Availability of anthropogenic food sources (e.g., garbage, bird seed, pet food, gardens, crop fields) influences the frequency and severity of negative human-bear interactions. Complaint records in New York document that many residential problem situations involve an element of food attraction.

As human population density increases, availability of human foods increases, the proportion of the bear population attracted to human food sources increases, negative bear-human interactions increase, and complaints to the wildlife agency about residential problems increase. Controlling access to human food sources reduces the fraction of bears that are attracted to those foods, which leads to reduction in negative interactions and complaints.

**Number of severe interactions per year** — Response to the typical complaint requires about 1 staff hour. Response to "severe" interactions (e.g., home damage, home entry) requires on-site work and may involve negative conditioning or removal of a bear. Such responses take 12 hours of staff time on average. If the proportion of complaints that require site visits by agency staff increases, it puts a real strain on agency resources. As a manager, you'll probably want to limit the number of these labor-intensive responses.

## Looking Under the Hood: An Overview of the Model Sectors

When you click on the button labeled, "Run simulation," you will activate a quantitative model with dynamic feedback. The model contains over 200 differential equations that integrate physical and social aspects of the problem system. Physical variables include black bear population dynamics, annual rainfall and food production, and land development. Social variables include human behavior and behavior change, attitudes and attitude change, knowledge gains, and personal experience. Some aspects of the model are represented by hard data. Other aspects of the model are represented by "soft" variables that reflect assumptions of the Plan Team (professional experience) or judgments based on literature review.

In this document, we provide just the information you need to operate the simulator. If the simulator were an automobile, our purpose would be more akin to driver's education than to auto mechanics. We realize that some readers may want to "get under the hood" and learn more about the underlying model structure. We encourage that. In fact, we hope that some of you will have a strong interest in carefully reviewing the model structure, perhaps leading to second-generation models that refine understanding or yield new insight. Readers who want detailed information about model structure are encouraged to contact the

Human Dimensions Research Unit at Cornell University.

The underlying model is comprised of six highly interconnected sectors. The brief descriptions below provide a look "under the hood," and should give you a general sense of the feedback systems and assumptions that swing into action when you run the model.

**Bear population sector** — The bear population is divided into cohorts of male and female animals in three age groups: cubs (age 0–1 year), subadults (age 2–3 years), and adults (age 4 years and up). Each run of the model simulates birth, death, and aging processes. Bears are removed from the population through hunting and nonhunting mortality. All bears in an age cohort have an equal probability of being removed by natural and hunting mortality. Birth and death rates are based on published literature and agency data. Processes of bear immigration and emigration are not included in the model.

The bear population sector incorporates the concept of a physical limit or biological carrying capacity for bears. We set carrying capacity at 8,000 bears for purposes of simulation. As bear population density increases, the natural death rate also increases (according to a nonlinear death rate index developed by the Plan Team).

**Hunter sector** — The hunter sector is designed to simulate the system of variables that produce hunting mortality. Hunting opportunity is an aggregate variable. The hunter sector does not specify the specific mechanism by which hunting opportunity is changed (in New York it may be changed by adjusting season length or dates, area open to hunting, or method of take [e.g., archery, shotgun, rifle).

The hunter sector includes a stock of big game hunters (in New York, big game licenses permit people to hunt deer or bear). Regional big game license holders are generated from a pool of statewide big game license holders. Survey data was used to determine initial values for these different hunter stocks. Hunter recruitment is increased when public support for bear hunting pressure is high.

This sector links hunters' perceptions of the bear population to their level of hunting involvement. The model structure assumes that hunters form their perceptions about the size of the bear population based on DEC decisions about hunting opportunity. If DEC expands opportunities for hunting, hunters perceive that DEC liberalized opportunities because the bear population has increased. Hunters then invest more time in the field because they perceive that the bear population has increased. Hunter success rate is determined by level of hunter effort and the rate at which hunters encounter bears.

DEC staff form their perceptions of the bear population based on a stream of information from various sources. They change their perception based on information on bear harvest and data on age and sex structure of the bear population. They experience delays in getting that information, so change in perceived bear population occurs only after a considerable time delay. The agency also experiences delays between perception change and change in actions regarding hunting opportunity.

**Food sector** — The food sector contains two stocks: households and natural food. The model is initialized with 52,000 households, an estimate for the Adirondack region. Our simulation assumes a slow rate of growth for number of households and sets a maximum possible number of households for the region. The model assumes that building households reduces natural habitat and land available to produce natural food.

In New York, about 90% of a bear's diet is plant material. In this model, natural food is defined as soft mast. Soft mast includes forbs, shrubs, and berries. Other natural foods include hard mast (acorns, other nuts), insects (e.g., carpenter ants), and animals (e.g., carrion, deer fawns).

Given that bears depend so heavily on natural vegetation, model behavior is strongly influenced by annual precipitation (rain and snow). The model allows the amount of rainfall to influence natural food production. An annual stock of soft mast is produced and

consumed. Soft mast production is determined by amount of rainfall, amount of land developed for households, and the amount of food already available as compared to the maximum that could be produced in the region.

The model assumes that a proportion of the bear population is attracted to residential (nonnatural) foods. The rate of attraction increases when natural food is less available. The rate of attraction to residential foods declines if there is an increase in the proportion of households in a region practicing problem prevention behaviors.

**Interactions sector** — The interactions sector contains several effects that DEC staff would like to influence with management actions. These effects include complaints to DEC about bear-related problems, public concerns about bears, tolerance for presence of bears, and interest in conserving the bear population. All of those effects are related to the level of negative human-bear interactions, especially interactions that have severe consequences for people. In the model, severe interactions are defined as incidents requiring a DEC staff site visit (site visits are made in cases where a bear has entered a home, caused substantial property damage, harmed a pet, or was perceived to threaten human safety).

The model assumes that negative effects (like elevated public concern) are produced more quickly when levels of severe interaction increase. When negative interactions are reduced, interest in conserving the bear population is allowed to accumulate more quickly and that has an influence on tolerance and concern.

Knowledge/interest sector. Problem prevention education is modeled as a management action in this sector. Education campaigns exert influence on knowledge about bears within the households of a region. People also gain knowledge about bears through personal experience with moderate problems (moderate problems fall into the category of moderate interactions in our model). Getting to know bears reduces uncertainty about the type and severity of moderate human-bear interactions. The model suggests that people in a region gain knowledge at a faster rate if the agency invests resources in educational efforts. The model assumes that people learn more from mild problem experiences than they do from education campaigns. The model assumes that people learn even more from severe problem interactions. Education campaigns and mild problem experiences contribute to a higher level of problem prevention behavior in a region. Severe problem interactions reduce problem prevention behavior in a region (because people lose a sense of control over problems).

**Agency resources sector** — DEC staff have a limited capacity to respond directly to complaints. Response to moderate problem interactions requires 1 hour of staff time. Response to severe interactions requires 12 hours of staff time. If staff size is adequate to respond to complaints, collective concerns about bears does not increase. If staff size is inadequate to respond to complaints, collective concern about problems increases, which contributes to an increase in problem complaints. Clicking on the hypertext under the staff level slider reveals a graph showing the number of staff hours required to respond to all severe interactions, and the number of staff hours available during each 24-month segment of the simulation. Complaints rise when staff availability is inadequate to provide direct service to everyone who experiences a severe problem with bears.

# Process guidelines for a management simulation workshop with stakeholders

### Introductory statement (example)

Our state is fortunate to have a thriving black bear population. The people of [YOUR STATE NAME HERE] benefit in many ways from positive interactions with bears. But some people experience problems with bears, too, and the number of such interactions has increased in recent years in some areas.

What can wildlife managers do to control these negative interactions and the public concerns they generate? What can communities like [YOUR COMMUNITY NAME HERE] do to control bear-related problems so that residents continue to regard bears as a valuable part of the natural community and as an enhancement to the quality of life for people in our region? Thoughtful responses to such questions take time. We can't adequately address them in one evening. However, we can have an interesting and insightful discussion about these questions, using a simulation developed jointly by the New York State Department of Environmental Conservation and Cornell University.

The purpose of this meeting is to discuss how wildlife managers in New York view the system of interacting variables that create problem interactions with black bears in residential areas. We will use a computer simulation to facilitate discussion about that problem system and three management tools that the state of New York has used in the past to manage problems with black bears in residential areas. While the simulation was not developed specifically for our state, it reveals some general insights about this problem that can help us think about black bear management in our own context. We hope that you will leave the meeting with a few insights about the problem and a few ideas about how your community might take actions to reduce human-bear problems.

### Agenda:

| Example agenda for a 90–120 minute meeting: | Facilitated by: |
|---|---|
| Introductions (10 minutes) | Local collaborator |
| Bear management background, introduction to the simulation (15–30 minutes) | Local wildlife professional |
| Simulation runs by small groups (experimenting with a few scenarios provided by the facilitator (20–30 minutes) | Meeting participants with assistance from facilitator(s) |
| Debriefing: brief reports from each small group (15 minutes) | Small group leaders |
| Discussing/clarifying dynamics behind the simulation results (15–30 minutes) | Wildlife professionals and meeting facilitators |
| Evaluative comments on the activity; suggestions for how to help communities reduce human-bear problems (20 minutes) | All |

## Ideas for a brief presentation to open your workshop

**1. Begin by noting that black bears are a valued resource:** Begin with general comments about the bear population in your state (or locality). Note that black bears are a valued wildlife resource. If your state has survey research results or other data on attitudes towards bears, use some of those data to make the point that many people hold very positive attitudes towards black bears. Briefly note the types of benefits that your state's residents enjoy as a result of positive interactions with bears, or simply knowing that bears exist in your state.

**2. Point out that some people experience problem interactions:** The workshop will focus discussion on managing problem interactions with black bears. Use your opening presentation to give your participants an overview of negative human-bear interactions in your state (or locality). If you have access to bear-related problem complaint records, share some of those data with your participants. Point out trends in complaints (have complaints been increasing in your state? Where are complaints increasing the most? Are the complaints primarily about agricultural or residential problems?). Next, ask your participants a few rhetorical questions, like: What can wildlife managers do to control these negative interactions and the public concerns they generate? What can communities like [community name] do to control bear-related problems so that residents continue to regard bears as a valuable part of the natural community and as an enhancement to the quality of life for people in this region?

**3. Transition into what you hope to accomplish in the meeting:** Point out that thoughtful responses to such questions take time, so you don't expect them to have all the answers by the end of one meeting. However, let them know that you do think they can have an interesting and insightful discussion about these questions, using a simulation developed in professionals in New York State.

**4. Establish the purpose of your meeting/workshop:** Let your participants know that the purpose of the meeting is to open a discussion about black bear management. Let them know that discussion will center on how wildlife managers in one state (New York) view the system of interacting variables that create problem interactions with black bears in residential areas (you may later point out whether the views in the interface are similar or different than those held by wildlife managers in your state). Let them know that they will be using computer simulation to facilitate discussion about that problem system and three management tools that wildlife agencies have commonly used to manage problems with black bears in residential areas. Point out that your goal for the meeting is that they leave with a few insights about the problem and a few ideas about how their community, group, or organization can take actions to reduce human-bear problems.

**5. Introduce the simulator:** With that brief introduction, go ahead and introduce participants to the simulation. Use a computer and computer projector to show your participants the interface. Give a brief summary of the model behind the interface. Then, take a few minutes to introduce the simulation itself. After your introduction, break the group up into 2–4 person simulation teams and give each team an assignment.

## General instructions for all simulation breakout groups (2–4 person simulation teams):

- Before you run any simulations, write down your predictions about whether changes in hunting, education or staff level will help your team "win" by maintaining complaints at levels below the historic baseline for the entire 50-year time horizon. You can write your predictions as graphs, showing how you expect complaints or other variables to change over time.
- Complete your team simulation as described below and discuss the questions listed with your simulation assignment.

- Select a team member to lead a 3-minute debriefing about your team's results and conclusions.
- Jot down questions, concerns, or insights on the 3 x 5 cards provided.
- Feel free to run other simulation scenarios if time allows.

**Simulation Team #1:** Try to manage complaints as if you are in a system where no hunting is allowed. Feel free to manipulate levels of staff and prevention education as you like, but set opportunities for hunting all the way to the left (i.e., on the "min." setting).

**Questions:**

- What happens to complaints? Over the 50-year simulation can you do better than the historical baseline? Does it help much to maximize staff level or education?
- What do you see as the practical, real-world implications of your simulation results?

**Simulation Team #2:** Try to manage complaints using ONLY hunting. Feel free to manipulate levels of hunting opportunity as you like, but spend $0 on education and set your staff level at 0.

**Questions:**

- What happens to complaints? Can you do better than the historical baseline over the entire 50-year time horizon in the simulation?
- What do you see as the practical, real-world implications of your simulation results?

**Simulation Team #3:** Try to manage complaints using a combination of hunting and staffing. Feel free to manipulate levels of hunting opportunity and staff level as you like, but spend $0 on education.

**Questions:**

- What happens to complaints? Can you do better than the historical baseline over the entire 50-year time horizon in the simulation? What happens to "severe complaints" when staff capacity is high?
- What do you see as the practical, real-world implications of your simulation results?

**Simulation Team #4:** Try to manage complaints using a combination of all three policies (hunting, education, and staffing).

**Questions:**

- What happens to complaints? Can you do better than the historical baseline over the entire 50-year time horizon in the simulation? How much does it help to spend the maximum amount on prevention education?
- What do you see as the practical, real-world implications of your simulation results?

**Simulation Team #5:** Set the regulatory loop to the "off" position (by putting a checkmark in the regulatory box). Then, try to manage complaints by increasing hunting pressure.

**Questions:**

- What happens when you start the simulation with high hunting pressure for 8–10 years? What happens to the output graphs when you make big changes in hunting pressure every few years? Can you put on heavy hunting pressure, but then "back off" in time to maintain a low but steady bear population?
- What do you see as the practical, real-world implications of your simulation results?

## Appendix D

# Interpretation and discussion about variable behavior in Responding to Problems with Bears: A Management Simulator

### Why does the bear population reach an equilibrium level when hunting opportunity is low or zero?

The interface control panel includes a bar labeled "Remove regulatory control." If you click on the bar, you will move to a display screen where you can check a box to disengage that portion of the underlying model which implements regulated hunting. (i.e., you can insert a checkmark in the box that says, "check to set regulatory control off"). You also have the option to set hunting opportunity to zero, or maintain hunting opportunity at a low level.

The underlying model assumes that, when birth rate exceeds death rate, the bear population increases until it reaches a natural equilibrium. When bear hunting mortality is low, those conditions are met, and the bear population increases to an equilibrium that simulates carrying capacity. Biologists assume that bears do not degrade their natural food sources as white-tailed deer might, but bears are still limited by food, space, and other factors. Those limits create a physical carrying capacity for bears. Biologists in New York have never attempted to calculate actual carrying capacity for bears in a particular region.

We defined the carrying capacity in our simulated environment as 8,000 animals, an estimate that the team of wildlife managers working on this project thought was within reason for the Adirondack region. Since we do not have empirical data that would allow us to connect food resources to density or carrying capacity, the bear population in our simulator levels off (i.e., reaches equilibrium) around 7,250 animals when the regulatory loop is removed. An artificially stable bear population graph is generated (see figure) because we do not have the data necessary to produce a more realistic graph.

Recall that the option to "turn off" regulatory control is included only as a learning tool. Toggling the regulatory control switch to the off position allows simulation users to implement hunting policies that drive the bear population to zero. In reality, wildlife managers in New York have a mandate to maintain a viable bear population at the statewide level. An unregulated hunting system that included the possibility of extirpating bears from the state is not legal or desirable in New York.

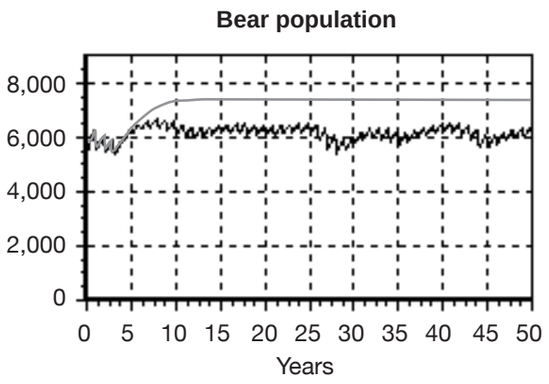


**Figure 1. Simulations using the learning interface produce an equilibrium bear population, due to data limitations, when the bear population reaches carrying capacity**

### Why doesn't the bear population drop to zero even when hunting opportunity is set at the highest level?

In the regulated hunting system we simulated, managers reduce hunting opportunity if trend data suggest that hunting is driving the bear population down below a sustainable level. The model underlying the simulator includes an automatic decision that keeps the system from wiping out the bear population. Since a bear population persists, problems, concerns, and complaints persist. Removing the regulatory loop in the model allows one to reduce complaints about bear-related problems, but high hunting pressure with no regulatory control also drives the simulated bear population to zero (an unacceptable option in New York at the statewide scale).

### Why do complaints per year gradually increase even if opportunities for hunting are maintained at a high level?

The model simulates an area with a slow, steady increase in human population. Slow expansion of residential development results in loss of natural food availability, but increased residential development also means additional human food sources and increased attraction of bears to those human food sources. Thus, as human population increases, human-bear interactions increase, problems occur, and complaints about problems increase.

### How do I interpret the lines on the staff needs graph?

If you click on the hypertext under the "number of additional staff" slider, you will see a graph titled "DEC Staff Hours Required" (see Figure 2). The light-colored line on the graph indicates the number of personnel hours needed to respond to the level of complaints in the baseline graph. The darker line indicates the number of personnel hours needed to respond to all severe complaints generated in your simulation runs. In the example shown here, we ran the entire simulation with maximum hunting, one additional staff member, and $5,000 per month spent on problem prevention education. The number of personnel hours needed begins increasing rapidly around year 40, however, we did not increase staff availability. As a consequence, By the end of the simulation, over 700 hours of staff time per month were required. That equates to 14 staff positions (more than the maximum allowed in the simulation). In this illustration, complaint loads increased beyond control even with maximum hunting. Additional staff capacity would have avoided this outcome.

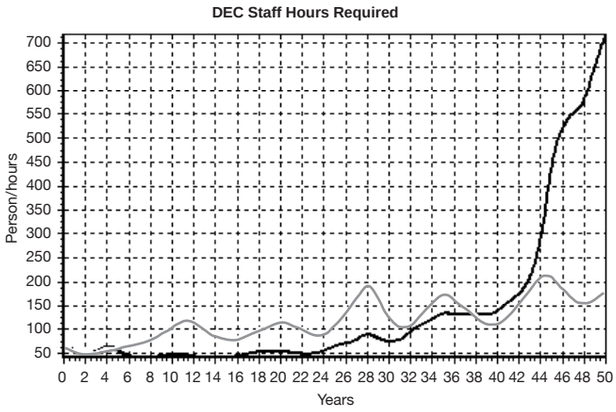


**Figure 2. A large number of severe human-bear interactions can greatly exceed the staff capacity of wildlife agencies to provide direct assistance, as indicated by the dark line on this simulation output graph.**

A PRACTITIONERS' GUIDE

WORKING THROUGH

# Black Bear Management Issues

Black bear management conflicts are emerging across the Northeast. This guide is designed to help wildlife management agencies and communities understand these conflicts as resolvable public issues.

Part I frames bear management conflicts as public policy issues and describes how wildlife agencies can manage conflicts by implementing a comprehensive public issue education (PIE) program. Part II presents a software program called Responding to Problems with Bears: A Management Simulator. The guide provides detailed instructions and support materials to use the simulator as the focus of an issue education event with bear management stakeholders.

Wildlife management professionals, extension educators, and community leaders will find this guide a valuable resource as they work through black bear management issues together.

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