Deer Management Issue-Evolution in National Park Service Units in the Northeastern U.S.:

Preliminary Insights from Natural Resource Managers

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ABSTRACT

The Biological Resource Management Division of the National Park Service and the Human Dimensions Research Unit at Cornell University are collaborating to study human dimensions of white-tailed deer management in NPS units in the northeastern U.S. By using deer as a model to examine the integration of biological and human dimensions of deer management, this project seeks to improve NPS ability to respond to wildlife management needs of park units in general. This report focuses on the first phase of research related to the project, which consisted of semi-structured informal interviews with natural resource managers throughout the Northeast and National Capital Regions of the NPS. Managers described a multi-tiered complex of influences shaping a park's deer management environment and identified five key foundational elements of successful deer management plans: understanding the park's unique management environment, internal NPS coordination, coordination with external stakeholders, effective planning processes, and adequate resources. In each of these areas, local communities were seen as significantly affecting management action. Future inquiry examining managers' approaches to decision-making, effectiveness of techniques for engaging the public, and differences between the specific values for which a park is managed and those held by stakeholders would improve NPS ability to respond to other issues that, like deer, primarily affect and are affected by local communities.

INTRODUCTION

Wildlife management is becoming an increasingly complex task for land resource management agencies, as many species, especially ungulates, have become sufficiently abundant to cause large impacts on ecosystems and pose economic and human health and safety risks. The biological dimensions of wildlife management have been a focus of inquiry for nearly a century,

and while it is acknowledged that more biological science knowledge is desirable, the greatest need in some situations is for knowledge about the social, or human, dimensions of wildlife management.

The Biological Resources Management Division (BRMD) of the National Park Service (NPS) recognizes this need and seeks to improve its ability to respond to wildlife management needs of park units across the country by gaining human dimensions expertise and enhancing its capacity to integrate the biological and human dimensions of wildlife management issues faced by NPS.

White-tailed deer *(Odocoileus virginianus)* have been a major concern in park units of the northeastern U.S. for over two decades, and biological studies have been undertaken at a number of parks to determine deer population density, movement, and impact on park resources. Because of the wealth of biological knowledge and growing management concerns related to deer, management of deer issues in northeastern parks was identified as the "model" system for developing human dimensions insight and expertise in the BRMD. For NPS units in the Northeast and National Capital Regions, BRMD staff identified the need to focus on:

a. Park "capacity" to deal with human dimensions aspects of deer management, especially biological and human dimensions integration.
b. Impediments to resolution of deer management, especially to determine whether the greatest need is biological and human dimensions information, or development of an efficacious policy/management paradigm.
c. Stakeholder perceptions (agencies, landowners, visitors, "community") with respect to park approaches to deer management, and insights into how might parks might create a climate

where constructive deliberation and informed dialogue among stakeholders and between them and the park can be pursued.

d. Citizen participation approaches and appropriate models of citizen engagement that can be used in addressing deer management in parks.

A recent search for a wildlife specialist position in BRMD failed to identify an individual with the breadth of knowledge and experience needed to complement the existing expertise in the Division to adequately address the wildlife management challenges many park units are facing nationwide. BRMD decided it needed to develop a broadly trained individual, one with a strong biological foundation, as a human dimensions specialist and problem analyst for NPS Biological Resources Management Division. As a result, a partnership was formed with Cornell University's Human Dimensions Research Unit (HDRU) to create a collaborative graduate training program. Kirsten Leong was recruited into the Ph.D. program at Cornell as the graduate trainee, beginning August 2003.

The purposes of this training program are twofold: (1) to address the interaction of the biological and human dimensions of deer management issues in northeastern NPS units as a model for how the Biological Resource Management Division can assist with other wildlife management issues across the country and (2) to develop human dimensions expertise of an individual to work in the Biological Resources Management Division in NPS, serving as an advisor/analyst providing technical assistance to Regions and Parks, and development of national policy and programs.

The research project will consist of three main phases:

Phase I: In collaboration with NPS staff in BRMD and northeastern NPS units, describe the deer management situation in northeastern parks and develop an approach for inquiry to aid in deer management practice and policy, resulting in a study plan.

Phase II: Conduct study(ies) in collaboration with BRMD staff, NPS regional staff, specific park unit staff, and NPS partners to determine how public participation and civic engagement methods might fit within NPS wildlife management planning.

Phase III: Conduct study(ies) in collaboration with BRMD staff, NPS regional staff, and specific park unit staff to describe and understand the differences in values and assumptions of NPS managers and stakeholders with respect to deer management, and then to suggest how NPS staff might utilize this understanding to enhance management practices.

This report focuses on results of Phase I inquiry.

METHODS: PHASE I

A project "contact team" was developed consisting of: Margaret Wild (NPS, BRMD, Wildlife Veterinarian), Dan Decker (Cornell University, Professor of Human Dimensions of Wildlife Management), John Karish (NPS, Northeast Region, Chief Regional Scientist), Mary Foley (NPS, Northeast Region, Chief Regional Scientist), and Jim Sherald (NPS, National Capital Region, Chief Regional Scientist). Under guidance of the contact team, a model

representing wildlife issue-evolution in NPS units was conceptualized (Leong et al., in prep.). According to this model, wildlife issues evolve through four main phases (Figure 1):

Identifying issues: The emergence of voiced concerns and increased activity from concerned individuals, although issues are not yet fully formed.

Focusing issues: Issues are formally defined and goals and objectives are set, laying the groundwork for effective program evaluation.

Planning action: Based on the outcome of data collection, appropriate activities are examined. Traditional scoping processes related to the National Environmental Policy Act (NEPA, National Environmental Policy Act, 1969) may be invoked at this phase.

Taking action: Implementation, evaluation and adaptation of the chosen management alternatives. Activities may be refined as a result of evaluation through monitoring, as an adaptive management strategy.

As a first step in understanding NPS resource managers' perspectives on deer issues throughout the northeastern U.S., a brief questionnaire was developed to determine sources and impacts of concern with respect to deer, as well as the level of action parks were taking, in terms of the issue-evolution cycle (Appendix I). Representatives from NPS units were asked to respond to the questionnaire on the project website: http://www.dnr.cornell.edu/research/deerinparks/index.asp. The request was distributed via e-

mail by Chief Regional Scientists to representative resource managers from 52 parks in the Northeast and National Capital Regions that were thought to potentially experience impacts from deer. Between February 21 and March 25, 2004, 44 rangers, biologists, natural resource managers/specialists, superintendents, and others representing 49 NPS units in the northeastern U.S. responded. Respondents were not asked to provide official park position statements based on data, thus responses were considered to reflect only opinions of the individual responding.

Most respondents (N=32, or 73%) had current deer concerns and were at various stages of taking action related to these concerns (Figure 2 shows level of action for each park in map format). While few parks were planning and taking action, ten were collecting data and were poised for future action planning (Figure 3).

A subset of 22 parks was selected for follow-up site visits. Parks were chosen to represent a range of NPS designations (i.e., National Park, National Historic Site, National Recreation Area, National Battlefield, etc.), sizes, and phases in the issue-evolution cycle. Between May and October 2004, semi-structured informal discussions were conducted with 47 natural resource managers and staff at these NPS units (see Table 1 for parks visited).

A set of guiding discussion questions was e-mailed to managers in advance to familiarize managers with our major areas of interest: the history of deer issues at the park, perceptions of differences between manager and stakeholder concerns, the influence of the public on park management planning, and strategic natural resource communication efforts (Appendix II). This set of questions was not used as a formal interview instrument, but merely as a way to guide discussions and ensure that major topics of interest were covered.

These discussions helped to: (1) identify the extent and general nature of deer impacts in NPS units of the northeastern U.S., (2) gain an understanding of how these situations have been

approached, especially with respect to the public engagement and human dimensions of management, and (3) identify common themes or experiences with respect to successes and problems in deer management that would be fruitful for further in-depth inquiry.

RESULTS: INSIGHTS FROM MANAGERS

For this discussion, the following definitions will be used:

Wildlife Management: "...the guidance of decision-making processes and implementation of practices to purposefully influence interactions among and between people, wildlife, and habitats to achieve impacts valued by stakeholders (Riley et al., 2002 p.586)." In contrast to other approaches that focus primarily on the manipulation of wildlife populations and habitat to meet management goals (Bolen & Robinson, 1995; Caughley & Sinclair, 1994), this definition also implies the importance of activities directed towards people. As noted by Decker et al.(2001), wildlife management exists because of the values people place on wildlife as a resource. Fazio and Gilbert (1986) acknowledge that wildlife management can be 10% managing the resource and 90% managing the public (p. 3).

Impacts: The socially-determined important effects of events or interactions involving wildlife, humans and wildlife, and wildlife management interventions (Riley et al., 2002). Impacts are thus defined broadly in terms of human values with respect to wildlife.

Stakeholder: Any person who will be affected by, or will affect, wildlife management (Decker et al., 2001; Decker et al., 1996). Although the National Park Service has recently begun to refer to people who meet this definition as "interested parties," we are

continuing to use the term "stakeholder" as it is more widely used in the natural resource management profession. The term "stakeholder" should not be confused with "special-interest group," as it is possible for someone who may be affected by wildlife management decisions to be unaware of the consequences, or for someone who will not be directly affected by management decisions to show an interest.

Extent and Nature of Deer Impacts

Discussions with managers identified a broad range of both actors and situations that constituted the management environment. Parks are governed and influenced by political, sociological, ecological and economic considerations (Decker et al., 2001) acting at multiple scales, from within the park, to local, regional and national levels. An individual park's management environment will thus depend on the specific combination of influences experienced at each scale, resulting in a deer management environment unique to each park. A range of possible influences on the deer management environment was described by managers (Table 2). With one exception, managers did not identify any NPS staff whose primary role is to address local level influences on a permanent basis. Instead, NPS staff charged with managing resources within park boundaries also addressed cross-boundary influences if/when primary, intra-park responsibilities were affected. When official public scoping efforts were required, as in the development of an Environmental Impact Statement (EIS), contractors or NPS regional offices were recruited to spearhead these efforts. The one park that had permanent staff focused on local level influences houses an institute founded on collaborative leadership and community-based conservation involving cooperation and partnerships.

The management environment, in turn, appears to affect what managers interpret as negative impacts to the park. The suite of impacts experienced by a park and its stakeholders

may interact and develop into broader issues. Results from the preliminary questionnaire indicated that negative impacts from deer primarily impacted park natural and cultural resources and relations with local communities (Figure 4).

Discussions with managers corroborated this finding, and also elaborated on the specifics within each category. Table 3 presents the areas of impact on parks and stakeholders mentioned by managers at each park. The table was created by first listing all areas of impact noted by managers at Park 1. Each of these areas was then checked for impact at Park 2. If managers at Park 2 noted new categories of impact, they were then added to the table. After categories from the final park were added, each park was re-scored to assure that categories were interpreted uniformly over all parks. Managers were not asked to systematically enumerate a list of impacts, therefore, impacts listed in the table should be not be viewed as an exhaustive list, but rather as reflecting the most prominent impacts affecting decision-making for each park.

Patterns emerged when managers' responses were viewed in this way. First of all, managers listed almost twice as many impacts to parks as to stakeholders. This may reflect that parks actually experience more impacts than do stakeholders, or it may be due to only a general understanding of stakeholder concerns. Chase et al. (2002) indicate that by being inquisitive rather than simply receptive, agencies may discover additional areas of concern to stakeholders.

In addition, impacts of primary concern to managers focused on aspects of the parks' natural and cultural resources. In contrast, managers felt that most stakeholder concerns related to property damage, health and safety, or recreational opportunities. Thus, managers described a management environment in which parks and stakeholders were concerned about different impacts, with parks primarily focused on impacts within park boundaries and stakeholders focused on impacts outside park boundaries. Given this perception, it is not surprising that

almost every park noted negative impacts to their relationship with neighboring communities and landowners. The handful of parks that did not note negative impacts to these relationships generally felt their neighbors did not expect them to take a leading role in deer management, either due to the small size of park and number of staff, the purposes for which the park was established, history of inaction on the part of the NPS, or the fact that deer impacts had not yet reached a high level of concern for the local community.

In order to determine which impacts were most strongly related to each other, impact areas identified in Table 3 were subjected to hierarchical cluster analysis using SPSS software (version 11.5, SPSS, Inc.). The resulting dendrogram is shown in Figure 5. The first major branch separated three variables (Group 1) from all the rest: parks experiencing impacts to forest regeneration, stakeholder impacts to ornamentals and impacts on park-neighbor relations. Again, this pattern suggests that parks felt their relationships with neighbors were affected when parks and stakeholders were primarily concerned with different impact areas. Other major branchings appeared to represent the following: Group 2: impacts related to agricultural and other cultural landscape damage, Group 3: impacts related to deer mortality, Group 4: more detailed areas of impact related to forest health, Group 5: impacts noted by only one or two parks.

Key Elements for Successful Deer Management

While deer management has been a concern and focus of study in northeastern NPS units for over two decades, very few parks have developed or implemented formal deer management plans. In our discussions with managers, a number of areas emerged as barriers to taking action with respect to deer management. Each of these barriers can also be seen as a necessary element in developing an effective deer management program. The following discussion identifies

aspects of each element that were perceived to be barriers, as well as proposed or actual solutions managers suggested for overcoming these barriers.

1) Understanding the Uniqueness of the Management Environment

Each NPS unit was created by the President or an act of Congress to preserve an area of national significance. Thus, by definition, each represents a unique natural or cultural resource. Indeed, almost all discussions with managers started with an explanation of the park's unique features. Elements of a park's management environment (Table 2) were seen to determine not only the extent and nature of wildlife issues, but also the appropriateness of various solutions. It became clear that the definition of "deer issues" varied, sometimes substantially, from park to park. While deer issues were set within a context of ecological and economic constraints, the political and sociological elements of the management environment appeared to be stronger influences on how issues were approached.

Much of the disagreement over issue definition arose from different interpretations of impairment, based on the management environment. The fundamental purpose of the NPS, as described in its Organic Act is "...to conserve the scenery and natural historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (The National Park Service Organic Act, 1916)." Congress and the courts have consistently given priority to the conservation mandate, as resources cannot be enjoyed if they are impaired (United States National Park Service, 2000). However, neither the word "unimpaired" nor the phrase "unimpaired for the enjoyment of future generations" are defined by the Organic Act; managers must determine not only what constitutes impairment, but also how both the duration and severity of the impairment are to be evaluated or weighed against the park's public use value

(Southern Utah Wilderness Alliance v. Dabney, 2000). Thus, one of the main challenges facing managers is to determine the threshold at which negative impacts on resources become severe enough to threaten impairment. Because impairment is defined by the overall management environment, managers who described similar levels of deer browse, complaints from neighbors, or deer-vehicle accidents often had very different interpretations as to how soon or how important it would be to take action related to deer. Some managers felt that focusing on "deer management" per se detracted from overall park goals, namely "resource health", which they saw as the real focus of management planning. They felt that understanding the unique management environment of the park determined the appropriate actions and partners to include. One manager stated that the success of deer management depended on the engagement of all divisions of the park, as well as external stakeholders, such as cooperators, concessionaires, volunteers in trail management and backcountry hut management, and state management. If deer were moving out of park, this manager also included adjacent landowners and believed that circumstances determine how broad a net to cast.

A number of managers also cited the importance of individual personalities in shaping a park's unique management environment. Indeed, attitudes of the managers themselves seem to range from risk averse to risk taking with respect to implementing various forms of deer management. Managers often perceived barriers to effective planning when their views did not match with those of their supervisors/Superintendents. Many described situations where managers and their supervisors placed different emphasis on the NPS's public enjoyment vs. natural resource preservation mandate, or took different approaches to implementing management actions. Not surprisingly, managers who reported more success had support from influential actors, either Superintendents, congressmen, or heads of other management divisions.

Understanding the personalities responsible for management decisions was as important as understanding the political, sociological, ecological and economic forces acting on a park at various scales, since these individuals ultimately determine the trajectory of park planning.

2) Internal NPS Coordination

At the park level, many managers indicated that internal communication among park staff often was weak. Lack of coordination between different departments within a park and lack of natural resource training for non-resource management staff were reported as two major impediments to effective natural resource management. Many managers at parks with a primarily cultural focus felt that educators and interpreters were not receptive to incorporating natural resource messages into their communication efforts. Others felt that NPS staff in general did not have enough background in natural resource issues and cited a need for common goals among park staff in different divisions. Activities of different divisions were often seen as being at cross purposes; for example, salting roads in winter, or eliminating weekend trash removal exacerbated wildlife-human conflicts. Managers also felt that increased information-sharing by supervisors and across divisions could improve management efforts.

Some parks actively fostered internal communication. Some natural resource managers and interpreters collaborated in designing messages to further natural resource objectives. One park even developed a formal partnership between natural resource managers, law enforcement officers, and educators to focus on deer issues. Many managers noted that cross-training and education of NPS staff on natural resource management issues would be helpful in furthering support for natural resource management activities. In one park, providing researchers with magnetic "NPS Researcher" signs for vehicles helped facilitate research by avoiding conflicts with law enforcement officers (i.e., parking tickets). Smaller parks with natural resource

managers who also acted as interpreters, or parks that housed natural resource managers and interpreters in the same building, tended to report more success in integrating natural resource messages in interpretive materials. Many of these managers spoke of the small number of staff as an advantage in fostering information-sharing and facilitating discussion among divisions.

In general, managers attributed many difficulties with internal coordination to the traditional distinction between "cultural resource" and "natural resource" staff within NPS culture. Parks seemed to suffer from the bureaucratic paradox that as staff grew in number, divisions became more compartmentalized for efficiency, yet each division became less informed about the others' activities, decreasing efficiency in dealing with issues that cross domains. For larger parks, the role of top management (management chiefs, superintendents, or regional officers) in encouraging and facilitating internal communication as well as providing cross-training opportunities was seen as key in establishing and maintaining good internal NPS coordination.

3) Coordination with External Stakeholders

All parks that were considering a formal deer management program were concerned about external stakeholders, either because stakeholder complaints were a major impetus behind considering a management program, or because of concerns about stakeholder reactions to management decisions. Managers identified a number of areas related to stakeholders that could assist in management: increasing public understanding of park management activities, increasing public interest in issues before they become polarized, understanding the full range of public views (vs. only the vocal extremes), and coordinating management activities with partners.

Most managers felt that neither visitors nor community members understood park management goals. In fact, many managers believed that the public generally did not recognize

the difference between city parks, county parks, state parks, and national parks, but treated them all as (increasingly urban) green space. In addition, managers thought the public was unaware of park planning processes. For example, many managers stated that stakeholders were often frustrated at perceived park inaction, even though the park had been involved in the initial, albeit internal, processes of action-planning for a long time (sometimes years). Another manager mentioned that the public doesn't understand why national parks don't consider public hunting as an option, considering that some state parks allow hunting. The Department of the Interior has issued requirements that interested community members be trained in both community-based planning and the NEPA process (United States Office of Environmental Policy, 2003). However, there currently is no one at the park level that is specifically charged with educating the public on either of these topics; natural resource managers felt that this did not fall within their area of responsibility, or that of park interpreter/educators. Notably, the managers who had strong personal ties to the local community outside of their professional roles tended to report better understanding and respect from community members towards management, even when community members disagreed with the park's final decisions.

Managers were also concerned with better understanding the public's concerns. A number of managers felt they lacked the skills necessary to engage the public before issues became contentious, but that understanding stakeholder perspectives from an early stage would help them move towards issue resolution. In addition, almost all managers said that they only heard from the vocal extremes. As one manager stated, "People who are happy don't tell you about it." Some seemed to accept this as fact, while others desired guidance in how to determine the full range of stakeholder viewpoints. In general, managers often described action-planning scenarios that garnered little public interest until alternatives were being considered, at which

point diametrically opposed groups formed and gathered support for their positions, drawing from both local and national interest groups. Some managers also indicated that issues changed when the dialogue expanded from a local scale to include national stakeholders.

Managers also indicated a general lack of coordination between park activities related to deer management and activities occurring outside the park. All managers either stated explicitly or implied that deer overabundance is a regional issue and not solely a "park problem," however when discussing potential solutions, very few considered including regional partners. NPS management policies recognize the importance of cooperation between parks and other local and regional agencies and organizations in managing these issues (United States National Park Service, 2000), yet managers often discussed deer management only in terms of NEPA requirements, which seemed to result in a park-centric perspective. One manager identified the operational environment of the NPS (its focus on national level planning requirements and increasingly narrow and topical management plans) as contributing to this effect and resulting in a public perception of the NPS as too focused on planning.

While most managers did not refer to developing collaborative management plans with other agencies or organizations, they did engage in other partnerships to enhance deer management. One park began reporting farmer complaints to the local state wildlife management agency, which helped determine the number of hunting permits to issue in neighboring wildlife management areas. Another park reported that actively developing strong ties with the state agency tremendously aided management, as both agencies became more comfortable looking to each other as a resource. This park is also actively seeking to develop a long-term relationship with a local journalist so that their activities will be more accurately portrayed in the press. In addition, this park is involving local community members in gathering

deer movement data. A number of parks partnered with local universities or other federal agencies to collect data on deer populations or visitor behavior. Two parks mentioned that local community groups had organized to reduce deer in areas adjacent to parks. Although these parks were not considering deer reduction on park property, managers from these parks attended the community planning sessions and gave input.

Most managers seemed to equate the term "management" with "population reduction." In contrast, when asked about feasible management alternatives, one park listed: population and impact monitoring (including engaging stakeholders in citizen-science), close coordination with the state agency, neighbors, visitors and stakeholders, education on park mandates and scale of deer issue, and finally the possibility of a program that may include a reduction of deer population. This perspective treats external stakeholders as a resource to assist in management rather than as potential adversaries. To implement effective external coordination, managers also emphasized the need for trust, public awareness/understanding of the park's mission and management processes, developing relationships with influentials in the local community, the importance of long-term relationships (especially in highly transient communities), better understanding of public expectations for park management, and better education of and communication with the public in general. As noted by one manager, it is instrumental to have partners, both external and internal.

4) Effective Planning Processes

Discussions of deer management planning focused mainly on understanding and implementing legal and policy requirements. Managers appeared to be mainly concerned with fulfilling requirements of the general NPS approach to NEPA outlined in the NPS DO-12 Handbook for Environmental Impact Analysis (2001a), which parallels the issue-evolution cycle

outlined in Figure 1. Most activities related to NEPA planning were discussed in terms of defending agency actions to the public. Public participation was also discussed with respect to new policy guidelines that require an effort to sustain partnerships and involve the public as a general way of doing business, beyond legal requirements (United States National Park Service, 2000; 2003). Managers were of the opinion that streamlining the process of developing planning documents and better guidance in how to effectively meet public input requirements would help wildlife planning.

Managers generally described the planning process as laborious, both in terms of the typical 3-5 years of planning prior to implementing action, and in terms of funding evaluation requirements, which they felt resulted in more time tracking funds than evaluating management. Two main planning documents, General Management Plans (GMP's) and Environmental Impact Statements (EIS's), were typically referred to as illustrations of natural resource planning. Newer GMP's tend to be developed as a combined GMP/EIS, thus both types of plans typically are governed by the process outlined in the NPS DO-12 Handbook for Environmental Impact Analysis (2001a). Many parks either did not have a GMP or were in the process of developing a new GMP (required every 10-15 years), and therefore did not have clear guidelines for overall park management, let alone specifics for deer management. While most parks were in the process of collecting data related to deer, in a number of cases, parks had not yet established specific objectives for these studies because the overall park plans had not yet been written. As noted by members of the Inter-Regional White-tailed Deer Team, without clear goals and objectives as standards, it is impossible to evaluate the degree of impact indicated by biological data (M. Coffey and J. Karish, pers. comm.).

An EIS is required whenever parks consider actions that may significantly impact the human environment (National Environmental Policy Act, 1969). Managers indicated that a decade or so of data typically was necessary to support an EIS related to a controversial issue such as deer management. NEPA provides no specific guidance as to the amount of data necessary to make a decision, aside from the mandate to "study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources (National Environmental Policy Act, 1969, § 4332 (E))." However, if challenged in court, agencies must be able to show that they have taken a "hard look" at the action and that their decision was not arbitrary and capricious. Indeed, case law establishes that the purpose of NEPA is to ensure that an agency has at its disposal all relevant information about environmental impacts before embarking on a project (Friends of Endangered Species, Inc. v. Jantzen, 1985; Robertson v. Methow Valley Citizens Council, 1989; Salmon River Concerned Citizens v. Robertson, 1994). Also, courts have ruled against the NPS on the basis of lack of sufficient data in EIS decisions (Coalition for Canyon Preservation v. Slater, 1999; The Fund for Animals v. Norton, 2003).

Clearly, park managers are justifiably concerned about having adequate baseline data. However, in many cases, managers believed they were replicating biological studies that had already been performed repeatedly at other parks. Some felt that a programmatic EIS or a broad policy statement on NPS knowledge of deer biology would help managers move forward with action planning in a more timely fashion. Data to support such policy may already exist, as many managers from different parks indicated that they began using common techniques to estimate deer population density a few years ago.

Managers referred to NEPA as a double-edged sword; while it ultimately allows parks to move forward with preferred management activities, the associated planning process was often described as a hurdle that delays action. This attitude is most obviously reflected by the fact that NPS culture has developed the term "NEPA compliance" which is taken to be synonymous with "park planning." One manager felt that the culture of "compliance" gave planning in general an unjustly negative connotation. Most managers seemed to have three main assumptions with respect to NEPA (in relation to deer management): (1) it allows parks to implement their preferred action (2) it is time consuming and costly to write an EIS (3) a lawsuit is inevitable. A number of parks cited the lawsuit regarding deer reduction at Gettysburg National Military Park as evidence (Davis v. Latschar, 2000). The court ruled in favor of the park, and interestingly, managers spoke of the lawsuit in both positive and negative terms. The lawsuit was seen as further proof that parks can implement any actions they deem necessary as long as they follow the correct procedural proscriptions, yet the inevitability of a lawsuit was also used as a reason to avoid planning for deer management (here, "management" was again equated with "population reduction"). One park felt the lawsuit illustrated a need for better communication with the public, especially local landowners, and as a result, this park focused efforts on fostering relationships with the local community members.

When asked directly about public participation in planning, most managers immediately responded in terms of public scoping efforts related to NEPA. According to NPS NEPA procedures, parks must solicit public input once they begin planning actions (United States National Park Service, 2001a), which occurs halfway through the issue-evolution model (Figure 1) However, it is clear that stakeholders can have a significant role much earlier in the cycle, and even play a crucial part in defining the overall context in which the issue evolves. One manager

even felt any future deer management activities could not be spearheaded by the park, but would have to be part of a larger community effort, precisely because of the controversial nature of the issue. Two managers suggested that early planning meetings with the public, *before* formal NEPA public scoping activities, could not only provide earlier opportunities for public involvement, but could also ensure that both management and public concerns were represented, or at least acknowledged, in the definition of the problem. These managers also believed that the alternatives discussed should be those put forth by the public. Other managers felt the NPS already did a good job of involving the public, by providing a number of avenues to receive public input such as letters, faxes, e-mail, the new Planning, Environment and Public Comment (PEPC) website, and public meetings. They thought it was appropriate to let EIS contractors take charge of the public participation element because these contractors focus on NEPA and therefore have more capacity to engage the public than do park natural resource managers. One park that is entering into a GMP intends to assign a staff member as a community planner, to set up public outreach meetings and otherwise engage the public. This was not the norm for most parks we visited. Instead, most parks relied on ad hoc contacts with public information officers, interpreters, and natural resource managers to transmit information to local community members.

As mentioned above, most managers did not feel that the public understood either park missions or the park planning process, both of which impede constructive public participation in planning. A recent NPS Director's Order (United States National Park Service, 2003) calls for active on-going public participation throughout the planning process, beyond legal requirements. Some managers believed that this requirement would weaken NEPA by preventing the park from implementing *any* action. Others thought that it was superfluous, since "...once in the formal planning process, you're already doing it." Many managers were wary of public participation

because of experiences with public processes that became arguments about polarized positions unrelated to park goals. They were also concerned that consensus-based management would lead to a situation in which all parties lose because there are compromises all around. They felt that "...no matter what action is chosen, someone will complain," and "...people will think they're not being heard if it doesn't go their way." Managers wanted guidance in how to fulfill public participation requirements but still maintain good relations with stakeholders. A few managers suggested that social science studies on both internal NPS and external stakeholder attitudes would help parks prepare for scoping related to NEPA.

Other managers were concerned with representativeness at public meetings. Some managers felt that public meetings typically drew only a few people, usually the same people with specific interests, and were concerned that this resulted in plans that catered to only fringe users. Other managers had the opposite problem, with such a large turnout at public meetings that it was hard for moderators to keep comments on topic. Managers felt the public didn't understand that the volume of replies, in terms of either loudness or number, was not necessarily going to determine the action taken. Again, this points to the need to manage public expectations of the participatory process. Other managers were concerned with how to reach people in the middle ground, how to address the small percentage of people who they believe will (almost inevitably) challenge the park's decision, how to reach national advocacy groups, and how to deal with the fact that Congress can complicate local attempts to engage the public in planning by creating laws and riders, bypassing NEPA entirely. A number of managers noted that even if local communities agreed with or at least respected the park's perspective, national stakeholders often changed the tenor of issues once a Notice of Intent was posted in the Federal Register. While many managers were skeptical of public participation in planning, a few parks felt

otherwise. One manager noted that, "[public engagement is] critical... Deer bring out many emotions on all ends of the spectrum. Public information, press, communications with neighbors, state and local agencies [are] a key component of all of our deer work."

Regardless of public participation activities, one manager noted the key role of planning in wildlife management, "The most important aspect of dealing with deer issues in national parks will be the thread of consistency not in how we manage the populations, but in the process of developing management goals, objectives, strategies and the planning process that gets the parks to implement 'management' programs regarding their populations."

5) Adequate Resources

Adequate resources are necessary to implement any type of management action, and managers focused on a number of key resources, including: funding, sufficient staff, regional support, access to literature, access to funding sources, and staff capacity.

Almost all managers mentioned lack of staff and funding as impediments to deer management. Most of the managers who felt they lacked adequate staff indicated a need for increased support related to natural resource research, such as full-time botanists, biologists, or technicians. Some also mentioned a need for interpreters dedicated to natural resource interpretation. Only one park mentioned a need for a community outreach planner. Most managers who mentioned lack of funds spoke in terms of funds to increase staffing. Many managers described short-term grants that had increased dedicated staff for natural resource projects to illustrate this point. All managers felt they barely had enough resources to meet current management needs, let alone allocate resources for future management planning.

A number of managers expressed a need for guidance in writing proposals that would be approved by NPS funding sources. Their concern was not that past proposals had been rejected,

but rather that they did not receive enough feedback to improve future proposals. Many of the managers who felt they had adequate access to small project funding sources had worked with NPS offices that oversaw those funds (either full time or through short-term details) so had better knowledge of how the funding process worked, who to contact for guidance, or even that these funding sources existed. Some funding sources that were specifically mentioned were: Natural Resource Preservation Program (NRPP), Program Management Information System (PMIS), and BRMD Technical Assistance Calls (TAC). A few parks relied on partnerships with university researchers or local community groups for funding and other resources.

As discussed with respect to internal NPS coordination, managers also felt a need to increase NPS staff capacity for integrating natural resource concerns into other areas of park management and operation. Other capacity concerns related to a need for tools to better understand, engage, and communicate with the public. Many of these concerns were outlined above in terms of both coordination with external stakeholders and effective planning processes.

Managers in the National Capital Region felt that they had an advantage of being able to interact regularly with their natural resource colleagues, which they do formally through bi-monthly meetings. Managers felt that this type of regular contact fostered a "tight natural resource group," and allowed them to give each other feedback on experiences with funding projects, what worked, who they liked to interact with, etc. While geographic proximity facilitated this type of regular interaction, managers also noted supervisors as key resources in helping identify funding sources, supporting proposals for additional staff, and facilitating information sharing between NPS employees.

DISCUSSION

Our discussions with managers corroborated the needs initially suggested by the BRMD: increasing NPS capacity to deal with human dimensions of deer management, identifying impediments to resolution of deer issues, better understanding stakeholder perceptions, and identifying appropriate citizen participation approaches. The impediments outlined above suggest three main theoretical areas for further examination: deer as a "wicked" management problem, what is meant by "public participation," and coorientation of stakeholder and park viewpoints. While park managers are ultimately vested with decision-making power with respect to natural resource management in parks, the agency recognizes that "[the NPS] mission-both in 1916 and today-has been entrusted to us by the American public. We have a fundamental responsibility to ensure that the public understands and supports what we do on their behalf (United States National Park Service, 2001b)." This responsibility can be assumed to include understanding how and why the public choose to influence park management on issues such as deer management.

Deer in northeastern NPS units: a "wicked" management problem

Biological solutions to managing deer populations in parks are well-known, and range from less-invasive options, such as repellents and fencing, to the most invasive, direct reduction (Coffey & Johnston, 1997; Porter et al., 1994). While it is relatively easy for parks to implement "soft" options, such as altering the species of ornamentals chosen for planting or fencing rare or sensitive plants, "hard" options, those involving population control, are subject to compliance with the National Environmental Policy Act (National Environmental Policy Act, 1969). National Park Service Director's Order 12 and its accompanying handbook (2001a) outline the process by which NPS units adhere to NEPA's procedural requirements, including public input

requirements. In addition, Coffey and Johnston (1997) outline detailed decision and alternatives keys to help managers considering deer management, and Leong et al. (in prep.) present a conceptual model of wildlife issue-evolution, from concern to resolution. All of these models reveal an NPS policy environment that stresses rational-comprehensive planning models, modified to allow for public input at various stages in the decision-making process. The rational-comprehensive model of planning focuses on identifying goals, searching for alternatives, evaluating them and choosing the preferred alternative (McCool & Patterson, 2000). This approach is highly effective in solving well-defined problems in systems that always respond in the same way, such as those found in engineering or physics (Wang, 2002).

Given enough time, money, and technical assistance, traditional rational-comprehensive approaches to decision-making may be effective in solving many complex ecological problems faced by parks, such as exotic plant removal, restoration of disturbed habitats and even protection of threatened and endangered species. Deer management in the northeast, however, seems particularly resistant to effective resolution via these conventional problem-solving approaches. As such, it belongs to a class of problems that have been classified as "wicked" and "messy" (Allen & Gould Jr., 1986; Forester, 1989; Lachapelle et al., 2003; McCool & Guthrie, 2001; Rittel & Webber, 1973; Wang, 2002). "Wicked" problems can be distinguished from "tame" problems by at least ten properties (Table 4). They are primarily characterized by scientific uncertainty about cause-effect relationships and result from social conflicts over goals (McCool & Stankey, 2003; Wang, 2002).

Experiences of managers suggest that deer management fits this "wicked" class of problems on a number of different criteria:

- The issue may be defined differently by different people. For example: some park managers may feel that deer overbrowse resources, negatively impacting forest understory; other park managers may be less concerned with forest composition, but may be concerned with impacts to cultural elements of the park such as the species composition and appearance of woodlots; visitors may desire positive wildlife viewing opportunities afforded by high densities of deer that are habituated to people; park neighbors may worry about Lyme disease, deer-vehicle collisions or deer damage to their landscaping, but at the same time may enjoy the opportunity to view wildlife in their backyard; farmer permittees may be primarily concerned with decreased crop yield due to deer damage. Suggestions for appropriate solutions will differ based on how the problem is defined.
- Even if people agree in defining a problem, they may not agree on what means are acceptable for its solution. For example, there may be general agreement that a deer population should be reduced, with hunters and NPS biologists finding direct control (of differing forms) to be acceptable, but animal rights groups finding any form of direct control anathema.
- Park resources are to be managed "...unimpaired for the enjoyment of future generations" (The National Park Service Organic Act, 1916). However, because each park is unique, no standard formula for balancing preservation and enjoyment of resources can be applied uniformly to all parks. While natural resource managers must consider the varying responses from the public in addition to ecological impact on resources, resource preservation ultimately has precedence; if the resource becomes impaired, it can no longer be enjoyed.

- Ecological responses of wildlife to management interventions are uncertain. Park managers cannot guarantee an exact outcome to a population control intervention, although they can predict a range of likely responses. Thus, management goals are more likely to reflect an adaptive impact management approach rather than an unambiguous, static goal with a predictable outcome.

While traditional problem-solving approaches may be suitable and highly effective when problems are well defined, values are shared, and goals unambiguous and uncontested, they are less applicable in solving wicked problems (Lachapelle et al., 2003). Some even suggest that using tame (rational-comprehensive) problem-solving methods on wicked problems may exacerbate the problem, making it even more contentious (Borrie et al., 1998; McCool & Patterson, 2000; Rauscher, 1999).

Park resources are managed in the public trust, and potential stakeholders can include all American citizens. Kellert (1980) described 10 basic typologies, or orientations towards wildlife among the American general public, and other scales, such as the Wildlife Attitudes and Values Scale (Purdy & Decker, 1989), wildlife value orientations (Fulton et al., 1996), and Wildlife Acceptance Capacity (Decker & Purdy, 1988) also indicate a range of ways the public desire wildlife to be managed. There is also increasing evidence that greater segments of the public want to be involved in wildlife management decisions (Decker et al., 2001), and recent NPS policy guidelines indicate that including the public in decision-making should be part of standard operating procedures in parks (United States National Park Service, 2000; 2003). Given the breadth of wildlife orientations among stakeholders with increasing potential to affect management decisions, it becomes clear that biological concerns represent only one dimension of wicked wildlife management problems. Although it is essential to understand the underlying

biological dimensions of wildlife management issues faced by parks, in the case of deer, the social or human dimensions often appear to be the main impediments to easy resolution.

What is meant by "public participation"?

Agreeing on problem definition is a key step in effectively deliberating wicked problems. As observed by Rittel and Webber (1973), the formulation of a wicked problem often *is* the problem. NPS managers appeared to be struggling with problem definition, in some cases, due to internal NPS conflict over problem definition, but in most cases due to disagreements with stakeholders. NPS Director's Order 52A: Communicating the National Park Service Mission clearly states the importance of fostering,

> "...a public with a better awareness of the breadth and depth of their national parks; a public that understands and values the work of the NPS in parks and communities; a public with the knowledge to become better users and stewards of the special places they have entrusted to our care; and a public that understands how NPS partnership programs extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world (United States National Park Service, 2001b)."

In addition, the Department of the Interior's Office of Environmental Policy and Compliance actually requires that bureaus develop training methods and courses for community-based planning and the use of the NEPA process, for both bureau staff and members of the public (United States Office of Environmental Policy, 2003). Park managers indicated a need for resources to increase capacity in both of these areas.

Indeed, public participation appeared to be a main focus from the standpoint of meeting planning requirements and coordinating activities with external stakeholder groups. However, the term "participation" was used to refer to a wide variety of activities, many of which seemed related to one-way communication. The NPS devotes considerable resources to various forms of one-way communication, both in sending information (through interpretation and education efforts that inform the public), and receiving information (by providing opportunities for the public to provide input at public meetings, and send letters, faxes, or e-mails). However, the NPS appears to have less experience in formal processes that encourage two-way communication with stakeholders, i.e. forms of public participation such as deliberation, dialogue, debate, and negotiation. Two recent NPS Director's Orders, 52A and 75A, emphasize the value of communication and public participation throughout the planning process, beyond legally mandated requirements (United States National Park Service, 2001b; 2003). However, little guidance has been provided in how to operationalize these policy directives.

Because this emphasis on public participation is a relatively new directive, its adoption by managers can be thought of in terms of "diffusion of innovation," a process by which (1) new ideas, practices, or objects are (2) communicated through certain channels (3) over time (4) among the members of a social system (Rogers, 1995). Defining what is meant by "public participation" is the first step in identifying barriers to its adoption in the NPS beyond the policy level.

Using Coorientation to Inform Communication Strategies

NPS Director's Order 52A reminds managers to look beyond park boundaries when making management decisions: "Parks are part of broader communities; actions in parks affect their communities just as actions in communities affect parks (United States National Park

Service, 2001b)." Our discussions with managers indicated a need not only to better understand processes for engaging the public, but also to better understand community interests in general. Both of these elements are necessary for effective two-way communication between parks and stakeholders.

A coorientation approach to communication focuses on interpersonal relationships and rests on the assumption that people's behavior is not only based on private cognitive constructions of their worlds, but also is a function of their perceptions of the orientations held by others and their orientation towards them (McLeod & Chaffee, 1973). Thus, a communicator's communication style and content will depend largely on his/her perceptions of the attitudes and perspectives of the audience (Connelly & Knuth, 2002). McLeod and Chaffee (1973) developed a model that measures: (1) the degree of cognitive overlap on the issue (agreement), (2) the degree of perceived overlap on the issue (congruency) and (3) the accuracy of each group's assessment of the other. According to this model, the ability of the groups to predict each other's answers provides a measure of how well the two groups will communicate, or the level of coorientation that will be found in communication between them (McLeod & Chaffee, 1973; Shanks, 1992). An assessment of the ways in which parks differ from stakeholders in agreement, congruency, and/or accuracy on topics related to deer management can then be used as guidance in choosing the types of public participation processes that would be most likely to succeed.

CONCEPTUAL FRAMEWORK FOR FUTURE RESEARCH

Although discussions with park managers helped identify some of the parameters contributing to the "wickedness" or "messiness" of deer management, these discussions also revealed a number of questions that remain unanswered. One key weakness in the argument

against applying traditional linear methods of problem solving to wicked problems is a lack of any concrete alternative. In addition, discussion of inherent "wickedness" distracts from the practical fact that many issues, such as deer management in parks, (currently) must be resolved within a tame decision space (i.e. the process outlined by NEPA, and represented in the issue-evolution model presented above). Integrating public participation throughout the linear decision-making process may be one way to address this dilemma, and specific guidance for this approach should be investigated in more detail.

In addition, the term "participation" was clearly interpreted differently by many managers, as well as NPS policy-makers. Indeed, even the planning literature does not distinguish very well between skills, desired outcomes and process-designs required for dialogues, debates, mediated-negotiations or consensus building (J. Forester, pers. comm.). Examining the differences between these forms of communication will develop stronger tools that help parks fulfill the new civic engagement and public participation requirements.

Finally, managers expressed a need to understand the full range of stakeholder opinions, not just the vocal extremes. A number of techniques have been developed to measure stakeholder values in general. However, development of tools that evaluate differences between the specific values for which a park is managed and those held by stakeholders could assist in design of future communication efforts. Ideally, these tools would indicate not only value differences, but also assumptions or stereotypes that might impede constructive dialogue.

Unlike many public issues that have been studied at parks, deer issues are not primarily driven by visitor concerns, but instead involve local communities. The NPS currently has teams focusing on basic biological, geological, and cultural landscape inventories, as well as visitor surveys. However, less work has been done assessing local communities, their attitudes toward

park actions, and their effect on management activities. Parks face many issues that may impact local communities, for example: predator restoration, fire management, invasive species management, and managing disease outbreaks. A technique to better understand how local communities relate to parks and management issues would be applicable in these types of situations as well.

Future research will therefore examine: the framework managers use to approach decision-making, alternate techniques for engaging the public, and differences between the specific values for which a park is managed and those held by stakeholders. By focusing on these areas, in the context of deer management, Phases II and III of research will help strengthen NPS ability to respond to other issues that involve local communities. In order to bring expertise in these topic areas and strengthen research design, the following Ph.D. special committee members were recruited: Dan Decker (chair), Cornell Department of Natural Resources, expertise: human dimensions of wildlife management; John Forester, Cornell Department of City and Regional Planning, expertise: managing public disputes in diverse settings, the influence of planners on participatory processes; Katherine McComas, Cornell Department of Communication, expertise: the effect of public participation and community involvement on risk perceptions, credibility judgments, satisfaction with outcomes, and willingness to engage in future community activities; Paul Curtis, Cornell Department of Natural Resources, expertise: management of human-wildlife conflicts; Margaret Wild, NPS BRMD, expertise: Wildlife Veterinarian providing technical assistance to parks on animal health and welfare issues.

Phase I research synthesized the breadth of deer management issues throughout northeastern parks and identified common barriers to management, as well as suggestions for overcoming them. Based on areas of need identified in this first phase of research, Phase II

research will examine the policy framework and approaches for integrating various forms of public participation throughout wildlife management planning. Phase III will involve development of a tool to describe and understand the differences in values and assumptions of NPS management and stakeholders with respect to deer management, and suggest how NPS staff might utilize this understanding to choose appropriate techniques for engaging the public. This research plan assumes that a strong understanding of not only one's audience but also the degree of coorientation between the audience and change agent can be used to design more appropriate, and therefore more successful, communication and education initiatives related to public participation. In turn, tailoring participation strategies to the appropriate coorientational context throughout all phases of the issue evolution cycle will ultimately result in more informed, equitable and sustainable management decisions. While these assumptions must be tested, research related to Phases II and III of this study will provide an framework and methodology that can be applied whenever the NPS faces management issues that primarily affect and are affected by local communities.

Table 1. NPS units visited for follow-up discussions (in alphabetical order). All NPS units were visited by K. Leong. Asterisk denotes parks visited by both K. Leong and D. Decker.

Antietam National Battlefield
Cape Cod National Seashore
* Catoctin Mountain Park
* Chesapeake and Ohio Canal National Historic Park
Colonial National Historic Park
* Delaware Water Gap National Recreation Area
* Fire Island National Seashore
Fredericksburg and Spotsylvania National Military Park
* Gettysburg National Military Park
* Harpers Ferry National Historic Park
Hopewell Furnace National Historic Site
Manassas National Battlefield Park
* Marsh-Billings National Historic Park
Minute Man National Historic Park
Monocacy National Battlefield
* Morristown National Historic Park
* Prince William Forest Park
* Rock Creek Park
* Shenandoah National Park
* Saratoga National Historic Park
* Valley Forge National Historic Park
Weir Farm National Historic Site

Table 2. Influences on deer management in NPS units in the northeastern U.S. (excluding National Heritage Corridors). Broad categories of management environment components were modified from Decker et al., 2001. Grey box indicates sphere of influence for focus of future research. See Appendix III for definition of acronyms.

Scale	Components of the Management Environment				
	Political: Law, Policy	Sociological: Internal, NPS/Government	Sociological: External, Stakeholders	Ecological	Economic
National	• NEPA • ESA • FACA • GPRA • NHPA • NAGPRA • NPS Policy • Director's Orders	• President and Congress • DOI • OMB • NPS Leadership • NRPC (e.g., BRMD, EQD, NRID etc.)	• National Interest Groups • Other Federal Agencies		
Regional	• State "NEPA" (e.g. NY State SEQRA) • Programmatic Planning Documents	• NPS Regional Offices • NPS National advisors (e.g. WASO, NRPC, etc.)	• State/Federal Agencies • Universities • Regional Interest Groups	• Deer meta-population structure • Habitat connectivity	
Local	• Local ordinances	• NPS Regional Planning Office/Consultants (when EIS is involved)	• State/Federal Agencies • Universities • Local Interest Groups • Congressmen • Friends Groups • Adjacent Landowners	• Deer population density • Immigration emigration • Predation (hunting/poaching) • Adjacent land matrix • Local landscaping practices • Agricultural practices	• Cash crops • Cost of landscaping • Cost of agricultural practices
Park	• Designation • Enabling Legislation • Park Planning Documents (e.g., GMP's, Resource Stewardship Plans) • Superintendent's Compendium	• Superintendent • Natural Resource Managers • Other Park resource managers • Other Park staff • Other NPS advisors	• State/Federal Agencies • Universities • Citizen Advisory Committees • Park Visitors • Inholdings	• Size of park • Contiguity of park parcels • Deer population density • Immigration/emigration • Predation (hunting/poaching) • Habitat structure of park • Agricultural practices • Landscaping practices	• Cash crops • Cost of preventing/ repairing deer damage • Cost of EIS's/ lawsuits

Table 3. Deer Impact Profiles for parks based on discussions with managers. A park's unique set of impacts may interact to become a suite of "issues." Each number represents one of the 22 parks visited, placement in cell indicates manager's perceived areas of impact for that park.

Impact Area	Affected Parties	
	Park	Stakeholder
Direct Impacts		
Natural Resources		
• Forest composition	1, 2, 5, 12, 18, 19, 20	
• Forest/plant regeneration	1, 2, 3, 5, 6, 7, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22	
• Forest understory	4, 5, 12, 14, 18, 20	
• T&E Plants	2, 5, 13, 15, 18, 19, 20	
• Plant and animal diversity	2, 5, 18, 20	2
• Exotic species management	3, 5, 6, 14, 18, 19, 20	8
• Erosion	5	7
Impacts to deer		
• Behavioral	5, 22	
• Feeding	16, 20, 22	22
• Population		21
Cultural Resources		
• Cultural landscape	1, 5, 6, 7, 9, 11, 15, 18, 19, 20, 22	7
• Agricultural damage	1, 2, 9, 15, 18, 19	1, 2, 3, 9, 11, 15, 18, 19, 22
• Ornamental plantings/ landscaping	2, 5, 7, 10, 21, 22	2, 3, 5, 7, 9, 10, 13, 14, 16, 17, 21
• Other property damage	6	
Health and Safety		
• Deer-vehicle collisions	3, 5, 6, 10, 18, 19	3, 5, 6, 9, 10, 12, 13, 14, 17, 18, 19
• Lyme disease	6, 7	5, 6, 7
Other		
• Park reputation as resource stewards	5, 21	
• Communicating park significance	5	
• Wildlife viewing		2, 5, 16, 18, 19, 20, 22
• Hunting (poaching)		6, 8, 13, 14, 16, 17, 18, 19, 22
Impacts to Relationships		
• Park Visitors	5, 7, 8, 20, 22	
• Neighboring Communities and Landowners[1]	1, 2, 3, 5, 6, 7, 8,10, 11, 13, 14, 17, 18, 19, 20, 22	
• Other State/Federal Agencies	2, 5, 6, 12, 15, 20	
• National Stakeholder Groups	1, 8, 20	

[1] In many cases, local community members also visited parks on a regular basis. They were categorized as "neighboring community" relationships when their views more accurately reflected area resident issues vs. one-time visitor issues.

Table 4. Ten distinctive properties of a wicked problem. Adapted from Rittel and Webber (1973).

1. There is no definitive problem formulation.
2. Wicked problems have no stopping rule.
3. Solutions are not true-or-false, but good-or-bad.
4. There is no immediate and no ultimate test of potential solutions.
5. Every solution is consequential, making it hard to learn by trial-and -error.
6. There is not an exhaustively describable set of potential, permissible solutions.
7. Every wicked problem is essentially unique.
8. Elements of the problem are interdependent; one element may be a symptom of another.
9. The problem can be explained in numerous ways, in terms of both the problem's nature and resolution.
10. The planner has no right to be wrong.

Figure 1. Issue-Evolution Model in Wildlife Management (from Leong et al., in prep.).

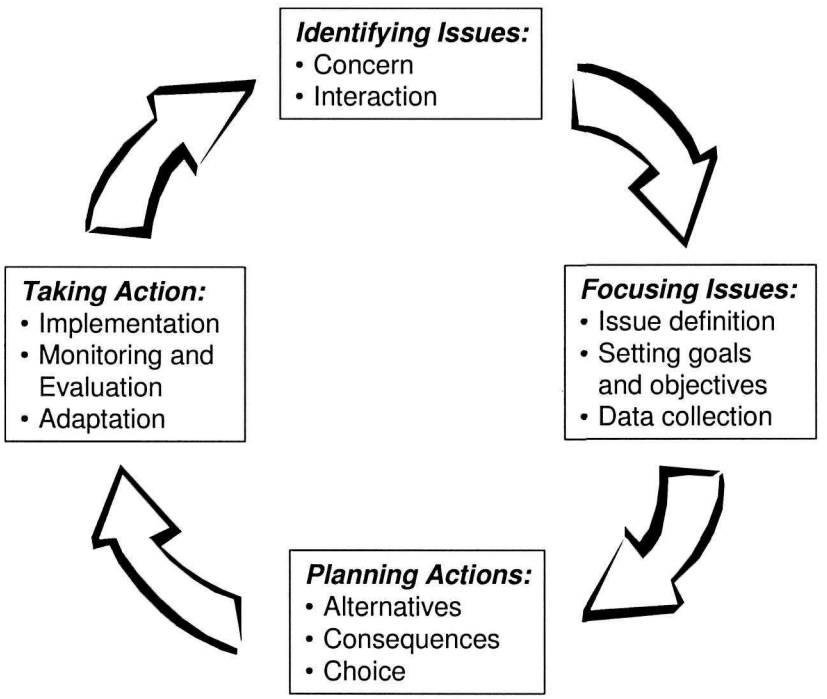


Figure 2. Responses to questionnaire item 5: Activity with respect to negative deer impacts and park response. Warm colors reflect parks that reported negative impacts. Cool colors reflect parks that reported no current deer concerns.

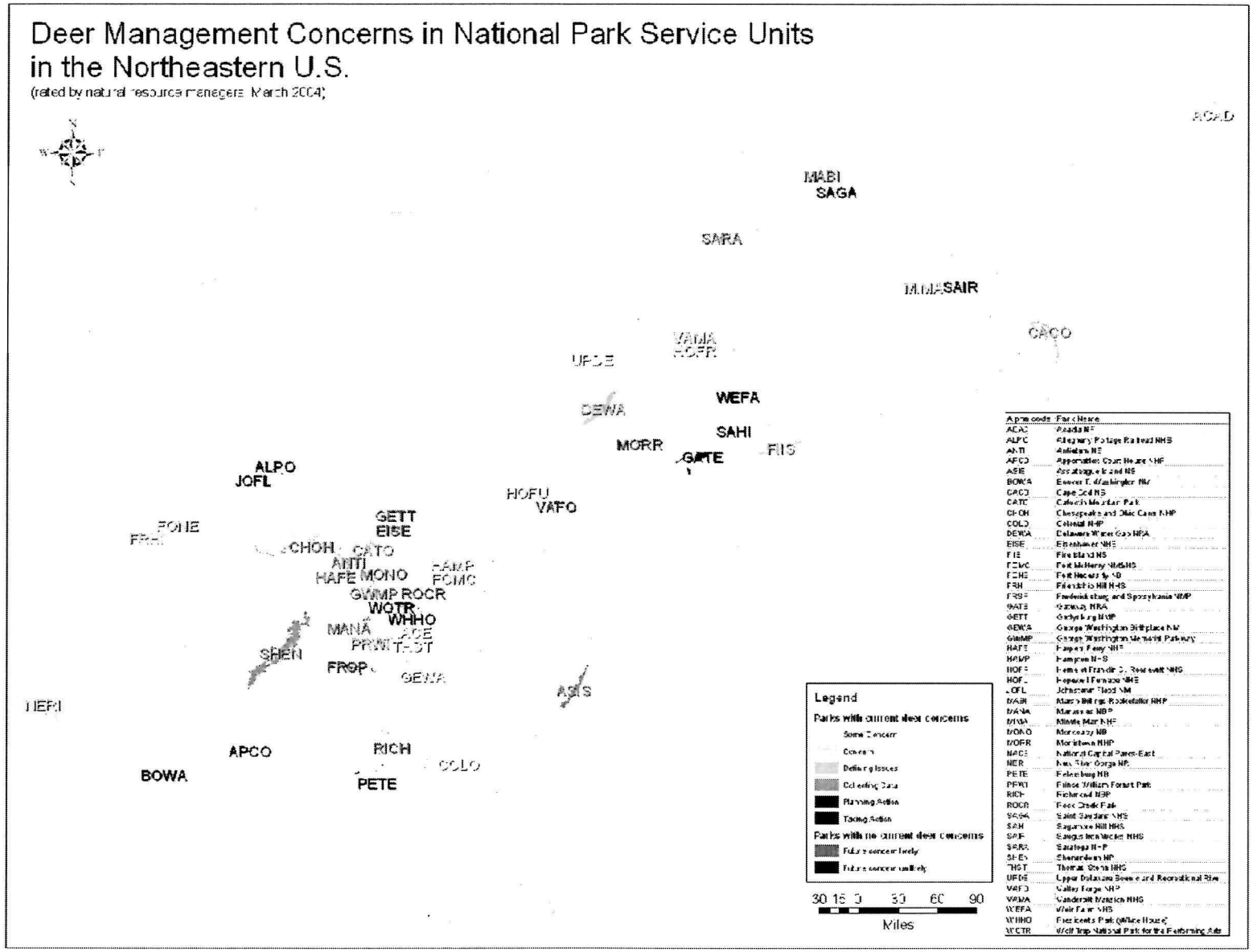


Figure 3. Responses to questionnaire item 5: Activity with respect to negative deer impacts and park response. Categories reflect phases of the issue-evolution cycle. Parks that responded they were not sure how to rate current level of activity were categorized as "some concern."

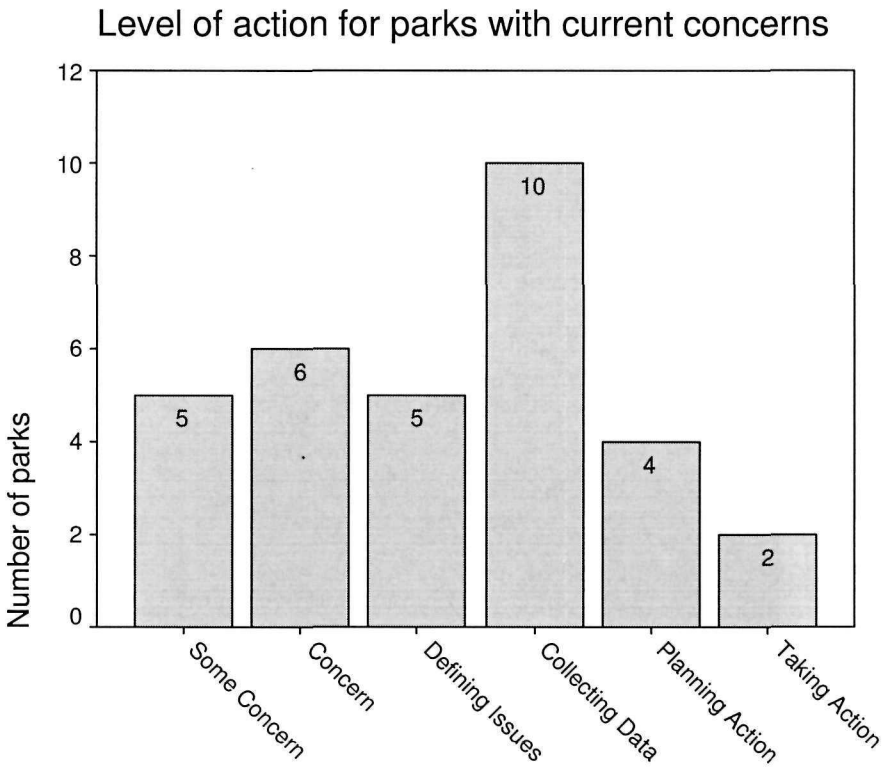


Figure 4. Impact of Deer on Park Resources. Deer were seen to have negative impact primarily on natural and cultural resources, but relationship with local communities was also as a large concern. Other negative impacts included: relationships with farmers, living history farm experience, and park reputation as resource stewards.

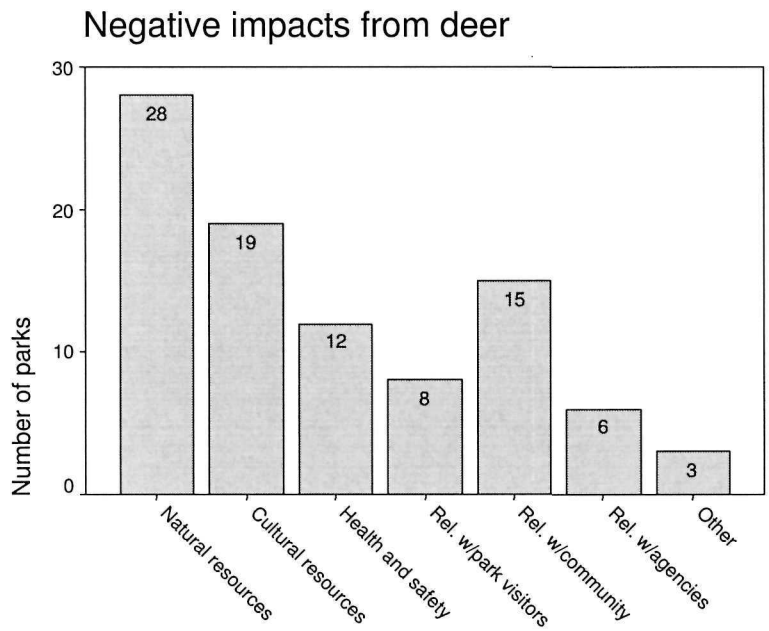
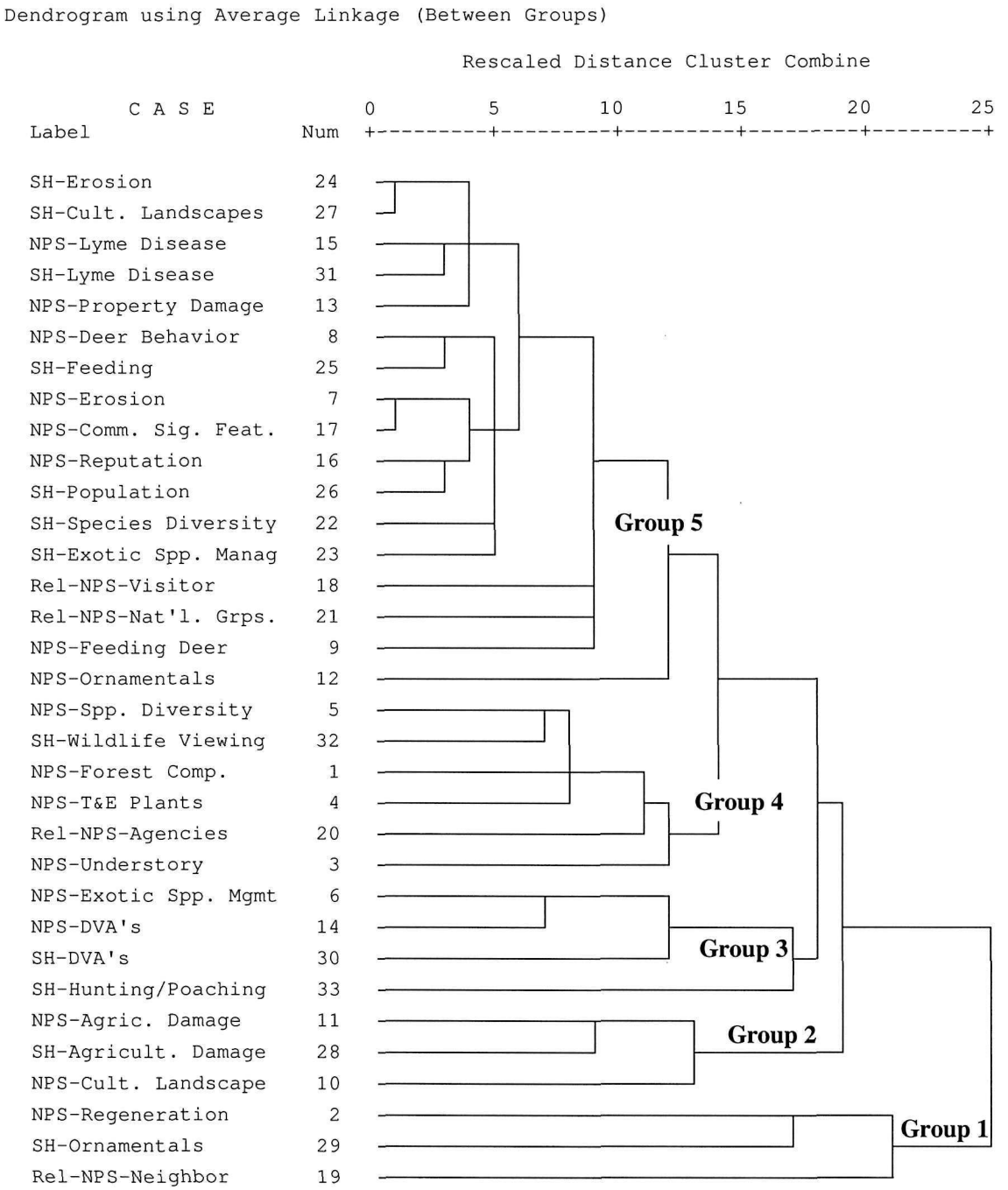


Figure 5. Hierarchical Cluster Analysis of Impacts to Parks and Stakeholders. Major branches show clusters of impacts that are related to each other. Branches that occur at larger distances are more different than branches at shorter distances. Prefix SH indicates impacts to stakeholders, Prefix NPS indicates impacts to park (as described by managers). Num refers to variable number and represents the order in which impact areas were entered into the database.



Appendix I.

Questionnaire: Assessing Deer Impact in NPS Units in the Northeastern U.S.

The Biological Resource Management Division of the National Park Service (NPS) and the Human Dimensions Research Unit at Cornell University are collaborating to study human dimensions of white-tailed deer *(Odocoileus virginianus)* management in NPS units in the northeastern U.S. (for background on this effort, please read more about us). Our first step is to identify the extent and general nature of deer impacts in NPS units of the northeastern U.S.

We are requesting your help in determining whether deer issues affect your park, if at all. ***(Note: even if you have not had and do not anticipate attention to deer management, we'd like your input).*** Many park service units have, to varying degrees, considered or pursued actions to address impacts associated with deer. Still others are contemplating management of deer. Research and experience indicate that deer management issues, like other public issues, develop through phases, a process referred to as an issue-evolution cycle.

Eventually, we would like to examine the development of deer management strategies for a variety of NPS units in various phases of the issue-evolution cycle. We hope to gain understanding of how these situations have been approached, especially with respect to the public engagement and human dimensions of management. It is assumed that the collective experience of NPS units is a rich source of insight into deer management in parks. As our project progresses, we will seek representation of parks facing different management situations and with different management mandates (cultural, natural, etc.).

In this early stage of our project we need to determine the scope of deer management issues throughout NPS units in the northeastern U.S. We request your cooperation by sharing just a few pieces of information concerning deer management in your park. This brief questionnaire (just 7 questions) will help us gain an initial understanding of NPS management perspectives on deer management issues. It is being distributed only to natural resource managers in parks throughout the northeastern U.S.

Before we move to the 7 questions, please provide the following background information:

Your name:_____

Your e-mail address:_____

Name of your park:_____

Your current position at park:_____

---

1. **Generally, which of the following statements best describes your opinion of your park's current situation with respect to deer?**
   (Check one)

☐ I believe that deer are having some negative impact on our park resources, visitor safety, or park relations with adjacent landowners. ***(Continue with questions 2-5.)***

☐ I do not believe that deer are having any perceptible negative impact on our park resources, visitor safety, or park relations with adjacent landowners. ***(Skip to question 6.)***

2. ***How*** **have you determined there is negative impact caused by deer?** ***(Please check all that apply.)***

☐ Personal observation
☐ Data from deer-related research in the park
☐ Reading scientific literature about deer and their impacts
☐ Complaints from visitors
☐ Complaints from local community members
☐ Complaints from other state/federal agencies
☐ Other ***(Please specify):*** _____

3. **Please indicate which aspects of park management are being negatively affected as a result of impacts caused by deer:** ***(Please check all that apply.)***

☐ Natural resources
☐ Cultural resources
☐ Health and safety
☐ Our relationship with park visitors
☐ Our relationship with neighboring communities and landowners
☐ Our relationship with other state/federal agencies
☐ Other ***(please specify):*** _____

4. **Are impacts caused by deer keeping you from meeting any park management objectives?**

☐ Yes
☐ No

If you answered *YES*, which specific objectives are being impacted? Please identify the planning document that is the source of each listed objective.

_____
_____
_____
_____

5. **Which of the following statements *best* describes your current activity with respect to negative deer impacts and park response?** ***(Please check only one response)***

☐ We have begun to notice negative impacts from deer but have not yet initiated any response.
☐ We have begun to define issues, goals and objectives related to deer impact on our park.
☐ We are collecting data to determine whether deer negatively impact management objectives.
☐ We have a planning process underway to develop a strategy for deer management in our park.
☐ We are currently implementing deer management activities at our park.
☐ We believe deer impact our park, but are not sure where we fall in the above list.

[Skip to question 7.]

6. **Do you anticipate experiencing any impacts from deer within the next 2 years?**

☐ Yes
☐ No

7. **Do you have any general observations you'd like to share regarding deer management in national parks?** ***(Please enter your comments in the space provided below.)***

_____
_____
_____
_____
_____

Thank you for your input!

If you have any questions, please contact us.

Appendix II. Guiding Questions for discussions with managers about human dimensions of deer issues.

1. Please describe the history of deer issues and interest in deer management at your park as it has evolved to date.

2. Please describe your experiences with deer management with the National Park Service, at your park and elsewhere.

3. How do you believe deer affect park management at your park?

4. What do you think are the primary concerns of local community members with respect to deer at your park?

5. What types of differences do you see in community member perceptions of deer as a focus of management compared to NPS employee perceptions of deer management at your park?

6. What management alternatives do you believe would be feasible to implement at your park?

7. How do the public (e.g. local community or interest groups, national interest groups, etc.) influence deer management activities at your park? At other parks?

    a. Which groups are most/least successful and why?

8. How does public engagement in management planning affect the effectiveness of deer management at your park? in National Parks in general?

9. What types of communication/education/outreach efforts has your park designed to address deer management? What about other parks?

    a. Which of these do you consider to be the most successful and why? What are the management objectives these public engagement efforts serve to achieve?

    b. What doesn't seem to work? Why?

Appendix III. List of acronyms used in Table 2.

BRMD: Biological Resource Management Division, NPS, NRPC

DOI: Department of the Interior

EIS: Environmental Impact Statement

ESA: Endangered Species Act

EQD: Environmental Quality Division, NPS, NRPC

FACA: Federal Advisory Committee Act

GMP: General Management Plan

GPRA: Government Performance Results Act

NAGPRA: Native America Graves Protection and Repatriation Act

NEPA: National Environmental Policy Act

NHPA: National Historic Preservation Act

NPS: National Park Service

NRID: Natural Resource Information Division, NPS, NRPC

NRPC: Natural Resource Program Center, NPS

OMB: Office of Management and Budget

SEQRA: New York State Environmental Quality Review Act

WASO: Washington Office, NPS

References

Allen, G. M., and E. M. Gould Jr. 1986. Complexity, wickedness and public forests. Journal of Forestry. Journal of Forestry **84**:20-24.

Bolen, E. G., and W. L. Robinson. 1995. Wildlife Ecology and Management. Third Edition. Prentice Hall, Englewood Cliffs, NJ. 620 pp.

Borrie, W. T., S. F. McCool, and G. H. Stankey. 1998. Protected area planning principles and strategies. Pages 133-154 in K. Lindberg, M. E. Wood, and D. Engledrum, editors. Ecotourism: A Guide for Planners and Managers. The Ecotourism Society, North Bennington, VT.

Caughley, G., and A. R. E. Sinclair. 1994. Wildlife Ecology and Management. Blackwell Science, Cambridge, MA. 334 pp.

Chase, L. C., W. F. Siemer, and D. J. Decker. 2002. Designing stakeholder involvement strategies to resolve wildlife management controversies. Wildlife Society Bulletin **30**:937-950.

Coalition for Canyon Preservation v. Slater. 1999. 33 F. Supp. 2d 1276.

Coffey, M. A., and G. H. Johnston. 1997. A planning process for managing white-tailed deer in protected areas: integrated pest management. Wildlife Society Bulletin **25**:433-439.

Connelly, N. A., and B. A. Knuth. 2002. Using the coorientation model to compare community leaders' and local residents' views about Hudson river exosystem restoration. Society and Natural Resources **15**:933-948.

Davis v. Latschar. 2000. 202 F.3d 359.

Decker, D. J., T. L. Brown, and W. F. Siemer. 2001. Human Dimensions of Wildlife Management in North America. The Wildlife Society, Bethesda, Md. xv, 447 pp.

Decker, D. J., C. C. Krueger, R. A. Baer Jr., B. A. Knuth, and M. E. Richmond. 1996. From clients to stakeholders: A philosophical shift for fish and wildlife management. Human Dimensions of Wildlife **1**:70-82.

Decker, D. J., and K. G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. Wildlife Society Bulletin **16**:53-57.

Fazio, J. R., and D. L. Gilbert. 1986. Public Relations and Communications for Natural Resource Managers. 2nd edition. Kendal/Hunt, Dubuque, IA. 399 pp.

Forester, J. 1989. Planning in the face of power. University of California Press, Berkeley, CA. 283 pp.

Friends of Endangered Species, Inc. v. Jantzen. 1985. 760 F. 2d 976.

Fulton, D. C., M. J. Manfredo, and J. F. Lipscomb. 1996. Wildlife value orientations: A conceptual and measurement approach. Human Dimensions of Wildlife **1**:24-47.

The Fund for Animals v. Norton. 2003. 294 F. Supp. 2d 92.

Kellert, S. R. 1980. Americans' attitudes and knowledge of animals. Transactions of the 45th North American Wildlife and Natural Resources Conference **45**:111-124.

Lachapelle, P. R., S. F. McCool, and M. E. Patterson. 2003. Barriers to effective natural resource planning in a "messy" world. Society and Natural Resources **16**:473-490.

Leong, K. M., D. J. Decker, M. Wild, and J. Karish. in prep. Application of a public issue evolution model to deer management in National Parks.

McCool, S. F., and K. Guthrie. 2001. Mapping the dimensions of successful public participation in messy natural resource management situations. Society and Natural Resources **14**:309-323.

McCool, S. F., and M. E. Patterson. 2000. Trends in recreation, tourism and protected area planning. Pages 111-119 in W. C. Gartner, and D. W. Lime, editors. Trends in Outdoor Recreation, Leisure and Tourism. University of Minnesota, Cooperative Park Studies Unit, Department of Forest Resources, St. Paul, MN.

McCool, S. F., and G. H. Stankey. 2003. Advancing the dialogue of visitor management: Expanding beyond the culture of technical control. Protecting Our Diverse Heritage: The George Wright Society/National Park Service Joint Conference. Pages 122-127.

McLeod, J. M., and S. H. Chaffee. 1973. Interpersonal approaches to communication research. American Behavioral Scientist **16**:469-499.

National Environmental Policy Act. 1969. 42 U.S.C. § 4321 *et seq.*

The National Park Service Organic Act. 1916. 16 U.S.C. § 1.

Porter, W. F., M. A. Coffey, and J. Hadidian. 1994. In search of a litmus test: Wildlife management in U.S. National Parks. Wildlife Society Bulletin **22**:301-306.

Purdy, K. G., and D. J. Decker. 1989. Applying wildlife values information in management: The wildlife attitudes and values scale. Wildlife Society Bulletin **17**:494-500.

Rauscher, H. M. 1999. Ecosystem management decision support for federal forests in the United States: A review. Forest Ecology and Management **114**:173-197.

Riley, S. J., D. J. Decker, L. H. Carpenter, J. F. Organ, W. F. Siemer, G. F. Mattfeld, and G. Parsons. 2002. The essence of wildlife management. Wildlife Society Bulletin **30**:585-593.

Rittel, H. W. J., and M. M. Webber. 1973. Dilemmas in a general theory of planning. Policy Sciences **4**:155-169.

Robertson v. Methow Valley Citizens Council. 1989. 490 U.S. 332.

Rogers, E. M. 1995. Diffusion of Innovations. 4th. Free Press, New York. xvii, 519 pp.

Salmon River Concerned Citizens v. Robertson. 1994. 32 F. 3d 1346.

Shanks, R. E. 1992. The Role of Environmental Paradigms in Communication Between NYS Bureau of Wildlife and NYS County Legislators. Department of Natural Resources, Cornell University, Ithaca, NY.

Southern Utah Wilderness Alliance v. Dabney. 2000. 222 F. 3d 819.

United States National Park Service. 2000. Management Policies 2001. National Park Service, Washington, D.C. 137 pp.

United States National Park Service. 2001a. Director's Order #12 Handbook for Environmental Impact Analysis. National Park Service.

United States National Park Service. 2001b. Director's Order #52A Communicating the National Park Service Mission. National Park Service.

United States National Park Service. 2003. Director's Order #75A Civic Engagement and Public Involvement. National Park Service.

United States Office of Environmental Policy. 2003. PEP-Environmental Statement Memorandum No. ESM 03-4 Procedures for Implementing Public Participation and Community-based Training. Department of the Interior.

Wang, S. 2002. Wicked problems and metaforestry: Is the era of management over? The Forestry Chronicle **78**:505-510.