Identifying Capacity for Local Community Participation in Wildlife Management Planning

Case 1: White-tailed Deer Issues at Fire Island National Seashore

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EXECUTIVE SUMMARY

This project, supported by a cooperative agreement between Cornell University and the National Park Service, studies human dimensions of issues related to white-tailed deer and deer management in Fire Island National Seashore. Face-to-face interviews with residents of communities near parks are used to understand and describe opinions and experiences of local stakeholders with respect to deer and deer management in parks, the role of parks in deer and other wildlife management, and the influence of public input on wildlife management in parks.

Local community residents collectively described deer issues on Fire Island as a complex web of interrelated components. However, individuals placed weight on different components of the system, which often led to disagreements on how to resolve deer issues. Important impacts included not only physical and emotional impacts to people (damage to landscaping and gardens, concerns about Lyme disease and/or tick transmission, sanitation issues from deer getting into garbage, positive wildlife viewing opportunities provided by deer, concerns about deer health, concerns about deer interactions with pets), but also on impacts to deer (habitat loss and habituation). Three dimensions of "the deer problem" emerged: population size and density, deer home range and movements, and deer behavior.

In addition, interviewees identified collective and collateral impacts from management interventions. While fencing was used by many to alleviate individual level impacts, at the community level, fencing served to concentrate deer even more in undesirable locations and caused safety concerns. Many interviewees also spoke negatively of safety issues related to the research hunts conducted on Fire Island in the late 1980's. They also indicated that hunting was not an acceptable form of management for habituated animals. Finally, interviewees were concerned about baiting stations used to facilitate an ongoing immunocontraception study and debated the project's success. Much of this debate was fueled by differing criteria of success.

Immunocontraception addresses only one dimension of deer issues, population size and density. Many interviewees were equally or more concerned with two other dimensions: deer home range and movements and deer behavior. Management actions that focus on all three dimensions will be necessary to reduce and then sustain negative deer impacts at acceptable levels. Clarification of problem frame, including responsibilities and jurisdiction for various system components will be essential to implement management actions.

While deer were controversial, they were not believed to be the most important issues that affected community-FINS relationships. Beach erosion and driving permits were described as in need of greater attention. Resolving some of these other highly visible and contentious controversies could help build the relationships that will be needed to sustainably manage impacts from deer.

Deer were more highly valued when they were perceived as wild life, symbols of wild nature rather than evidence of mankind's effects on nature. Communication efforts that establish appropriate expectations for encounters with deer in a human-dominated landscape will likely be a key factor in ensuring that current and future generations enjoy an acceptable mix of positive and negative experiences with deer at FINS.

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INTRODUCTION

This project examines human dimensions of white-tailed deer *(Odocoileus virginianus)* issues in National Park Service (NPS) units in the northeastern U.S. as part of a cooperative agreement between the NPS Biological Resource Management Division (BRMD) and Cornell University's Human Dimensions Research Unit (HDRU). The project consists of three phases:[1]

Phase I: A web-based survey and semi-structured in-depth discussions with NPS natural resource managers and staff were used to describe the deer situation in northeastern parks and develop an approach for inquiry to aid in management practice and policy interpretation, resulting in a study plan. Managers described a multi-tiered complex of influences shaping a park's management environment and identified five key elements for the foundation of successful management plans: understanding the park's unique management environment, internal NPS coordination, coordination with external stakeholders, effective planning processes, and adequate resources. For each of these elements, local communities were seen as significantly affecting management activity and will be the focus of future inquiry (for full report, see Leong and Decker 2005).

Phase II: In-depth semi-structured interviews with 20 public participation practitioners were completed to determine how public participation and civic engagement methods fit within NPS wildlife management, including (but not limited to) NPS policies that fulfill the purposes of the National Environmental Policy Act (1969). Interviewees included: natural resource managers, superintendents, rangers, and scientists with the NPS, USDA Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and US Geological Survey, and; specialists in community planning, dispute resolution, and public participation who regularly provide their services to federal land management agencies. Practitioners identified participatory strategies that integrate the substance of negotiations, relationships between stakeholders, and process design. A manuscript based on these interviews currently is in progress.

Phase III: Conduct studies with specific parks. **Phase IIIA:** Interviews with residents of communities near parks were used as an orientation to community members' understanding of park wildlife management, expectations for public input in management planning, and experiences with the park related to wildlife management. Capacity needs were identified to improve future public participation efforts in wildlife management planning. **Phase IIIB:** Scheduled for implementation in 2007, this phase employs a mail-back survey to NPS managers and residents of communities near parks. The survey is designed based on results from Phase IIIA to describe and understand the differences in values and assumptions of NPS managers and stakeholders with respect to deer issues, and suggest how NPS staff might utilize this understanding to enhance management practices. In addition, the survey will help determine whether the perspectives of Phase IIIA respondents are representative of a random sample of local residents and whether responses differ for parks with longer histories of deer impacts.

[1] For more information and copies of project reports, please contact the Human Dimensions Research Unit or visit our project website: http://www.dnr.cornell.edu/deerpeopleparks.

This report focuses on results of Phase IIIA inquiry.

The goal of Phase IIIA in this research project is to gain an in-depth understanding of a variety of stakeholder beliefs and attitudes regarding deer-related impacts. Impacts are the socially-determined important effects (e.g., ecological, economic, psychological, health, and safety, etc.) of events or interactions involving (a) wildlife and other natural resources, (b) humans and wildlife, and (c) wildlife management interventions (Riley et al. 2002).

White-tailed deer 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 (for example: Frost et al. 1997, Lovallo and Tzilkowski 2003, Porter and Underwood 1999, Shafer-Nolan 1997, Underwood 2005, Underwood and Porter 1991, Warren 1991). In an effort to reduce adverse impacts of deer to park resources, the NPS may propose actions that are consistent with NPS policy and the park's enabling legislation. Deer can have profound impacts not only on a park's natural and cultural resources, but also on the residents of neighboring communities. In addition, any management actions considered by a park also may impact stakeholders (i.e., may cause collateral impacts, Decker et al. 2006), either tangibly or intangibly. Likewise, actions taken by park neighbors can affect impacts experienced in the park that are associated with deer.

While park management decisions ultimately are made by NPS, the fundamental purpose of the NPS includes "…providing for the enjoyment of park resources and values by the people of the United States" at a type and use level that avoids impairment of the resource condition or value (National Park Service 2000:12). In addition, the NPS has adopted a civic engagement philosophy "… that will help ensure the relevance of NPS resources and programs to people, as well as ensure NPS responsiveness to diverse public viewpoints, values, and concerns" (National Park Service 2003:2). NPS policies also recognize that "…parks are integral parts of larger regional environments, the service will work cooperatively with others to anticipate, avoid and resolve potential conflicts…and address mutual interests in the quality of life of community residents" (National Park Service 2000:12). Local stakeholders often are crucial to the initial identification and articulation of wildlife issues at parks, such as those related to deer, although park management objectives and policy influence the degree to which NPS becomes involved in management of those issues (Leong and Decker 2005). After an issue is formally identified by the NPS, defined, publicized and action is being planned, regional or national stakeholder groups also may become involved in management planning. In addition, NPS policies place emphasis on public participation in wildlife management planning, especially local publics (National Park Service 2000, 2003). Federal agencies also are required to engage stakeholders whenever any action is considered that may significantly impact the environment (National Environmental Policy Act 1969). Few studies have addressed the ways in which human values and attitudes affect wildlife management planning in national parks.[2] This phase of research focused on residents of communities near parks who had potential to experience impacts from deer or deer management at parks.

[2] The NPS currently administers many different types of units, one of which is National Park. However, for convenience, the term "national park" will be used throughout this paper to refer to any unit administered by the NPS, regardless of actual designation.

Potential study sites were identified based on discussions with BRMD staff, Regional Chief Scientists from the Northeast and National Capital Regions of NPS, and Natural Resource Managers at NPS units throughout the northeast. Seven NPS units volunteered to participate in the project; three sites were ultimately chosen to represent various stages of maturity of their deer issues and amount of outreach effort related to these issues. Fire Island National Seashore (FINS), on Long Island, New York, represents a park with a long history of deer issues and experience with deer outreach activities. Valley Forge National Historical Park, in southeastern Pennsylvania, represents a park with a long history of deer issues and limited deer outreach activities. Prince William Forest Park, in Virginia, represents a park where deer issues are emerging only recently and relatively few outreach activities have occurred related to deer. No parks were identified that were experiencing recently emerging deer issues yet had engaged in many outreach activities about deer.

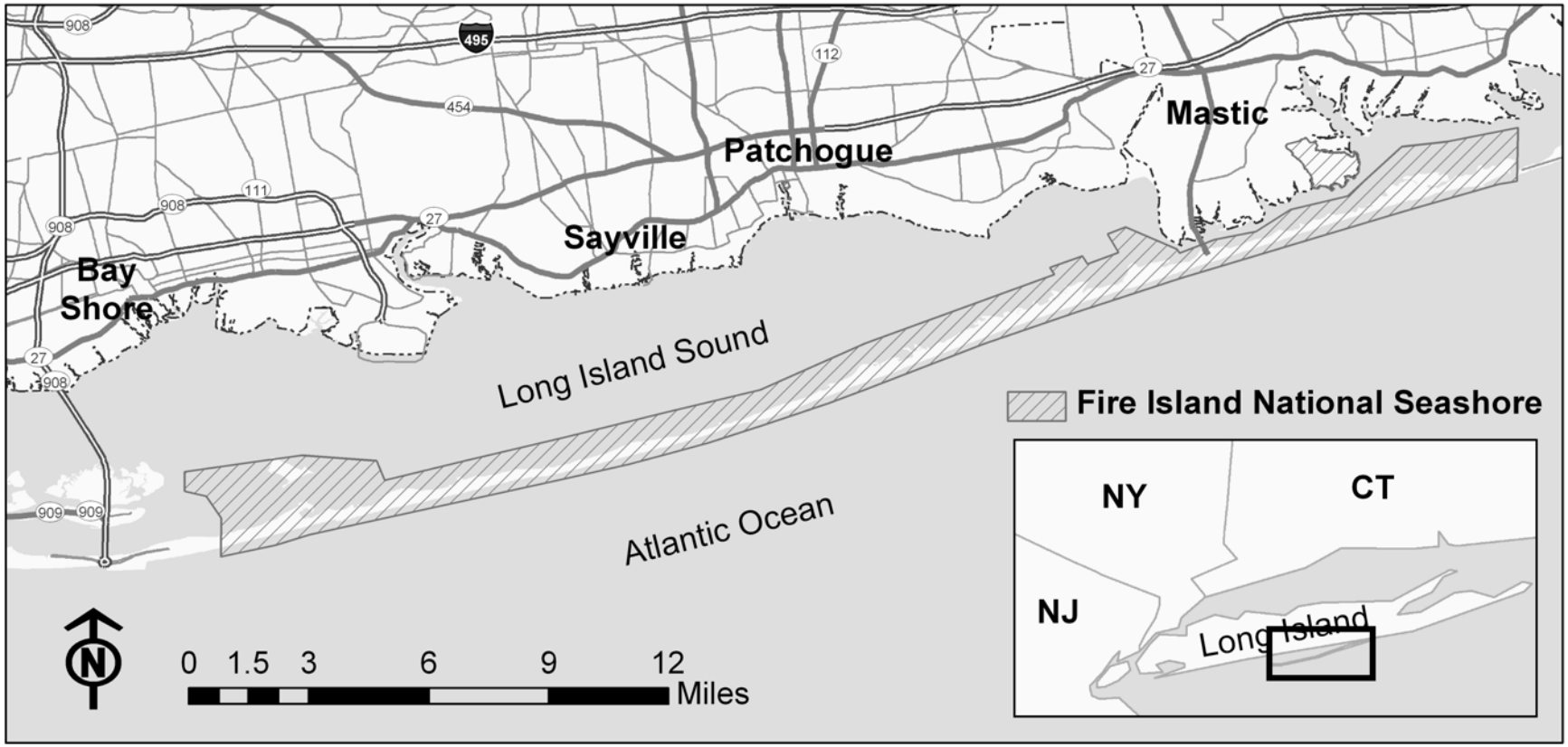
This report details experiences at Fire Island National Seashore.

Fire Island and deer

Fire Island is a 32-mile long barrier island that runs along the southern coast of Long Island, separating the Great South Bay from the Atlantic Ocean. In 1964, Congress created Fire Island National Seashore "…for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes and other natural features…which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population" (Public Law 88-587, Sept. 11, 1964). FINS encompasses approximately 26 miles of Fire Island (including the 17 communities that were already established at the time of designation), 24 smaller islands, and the William Floyd Estate on Long Island, home of one of the signers of the Declaration of Independence (Figure 1).

The population of white-tailed deer on Fire Island has grown dramatically in the last two decades, causing concerns about: impacts to native vegetation, Lyme disease, habituation of deer, and complaints from community members, among others. In response, FINS conducted research hunts in 1988 and 1989 to assess the physical condition of the deer and the effectiveness of public hunting as a means of reducing deer populations. The hunt generated considerable controversy, and in 1993 the Humane Society of the United States (HSUS) began a long-term research project to explore the efficacy of using a remotely administered porcine zona pellucida (PZP) immunocontraception vaccine as a management tool. This project was largely driven by community members and continues today, with FINS recently assuming a more active role in the study. In 1998 FINS, the HSUS, and the United States Geological Survey (USGS) developed an inter-disciplinary outreach project to discourage deer feeding and decrease human-deer conflicts. A team consisting of a law enforcement ranger, biologist, and interpreter distributed brochures and bumper stickers, visited schools and other end-user groups, and undertook daily education/enforcement patrols. FINS currently lacks funding to sustain such an effort, but provides outreach where possible; for example they recently developed a Junior Ranger program about deer where children earn a pin after completing a series of exercises.

Figure 1. Map of Fire Island National Seashore.



Clearly, FINS has engaged in a number of different approaches to deer management, from different forms of population control to education and human behavior change (see Appendix A for additional resources). While biological studies can help assess whether management activities affect physical impacts to the environment, sociological studies are necessary to determine whether these efforts affect impacts to stakeholders. This sociological study assesses local community members' opinions and experiences related to: deer issues and deer management at FINS, the role of FINS in deer and other wildlife management, and the influence of public input in wildlife management at FINS. By describing the current socio-political context surrounding deer and public participation at FINS, results from this study will: (1) help inform the design of future management efforts that address impacts to stakeholders, and (2) serve as a baseline for evaluation of such efforts.

METHODS

To become familiar with the physical setting and better understand the perspective of local community residents, the senior author resided in Ocean Beach on Fire Island and in Sayville on Long Island from August 21 to September 11, 2005. A qualitative, inductive, interview-based approach was used to discover more detailed, in-depth understanding about a few key classes of local community perspectives than would be expected from a quantitative survey instrument. These interviews provide insights into the deer situation at FINS and nearby areas, and inform development of the instrument to be used in the mail survey for the subsequent, quantitative, phase of inquiry (IIIB). Such interviews often are used to reveal the scope of an issue in a community and to provide richer understanding of various perspectives. The qualitative nature of these findings does not permit inferences about the proportions of members of the community who hold particular views. To achieve that ability requires random or systematic sampling. Phase IIIB, the design of which will be informed by results of this phase (IIIA), is intended to provide statistics that describe the populations of concerns.

Two types of interviews were conducted. Type A were in-depth, semi-structured, open-ended interviews with known stakeholders and influential community residents (N=22). Type B were brief interviews with residents intercepted in local gathering places (N=65). Community leaders, local homeowners, and long-time residents were purposefully targeted (not randomly selected) as subjects because this study focuses on local community participation in management planning. Thus, subjects should not be considered a random sample representative of the general public. Interviewees were asked about their experiences related to deer and deer management in and around FINS, the role of FINS in deer and other wildlife management, and the influence of public input in wildlife management at FINS (Appendix B). Interviews were conducted with local community residents in Kismet, Saltaire, Fair Harbor, Atlantique, Ocean Beach, Seaview, Ocean Bay Park, Cherry Grove, Fire Island Pines, Davis Park, Patchogue, Sayville, and in the Mastic Beach area. All interviews were conducted in English by the senior author, with the exception of four interviews that were conducted in Spanish using a translator from FINS (D. Barrera).

For Type A interviews, subjects were identified through snowball sampling (Babbie 2003). This method ensured that community leaders and individuals with known stakes in deer issues were included in the study. First, NPS natural resource managers identified individuals with whom the park had regular contact related to deer or other natural resource issues. Interviews were conducted with these individuals, who were then asked to identify other influential local residents as potential subjects, whether or not those individuals typically interacted with the NPS. The sample reached saturation when the same individuals were named repeatedly. Subjects were interviewed either individually or in groups at a day/time/location that was most convenient and comfortable for the subject(s). Face-to-face interviews were preferred, but telephone interviews were used when necessary based on interviewee schedule and preference. Interviews lasted from 35 to 165 minutes; the majority (64%) were audio recorded and later transcribed by one of three transcriptionists. All transcriptions were checked for accuracy by the senior author. Some interviewees preferred not to be audio recorded while others could not be recorded effectively due to environmental conditions (e.g., wind, noise, etc.). For interviews that were not audio-recorded, hand-written notes were taken during the interview and detailed notes were written up as soon as possible following the interview (usually within one day).

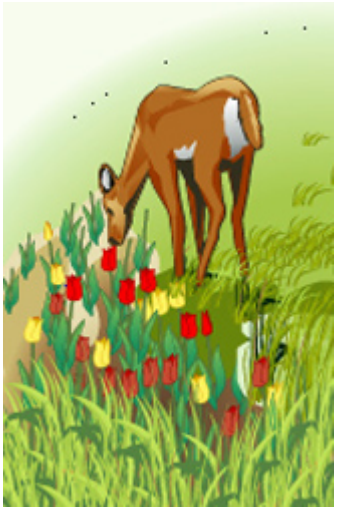
For Type B interviews, participant-observation (i.e., observation in which the researcher both observes and participates in the setting, Emerson 2001) and information from Type A interviews were used to identify informal gathering places (e.g., recreation sites, community events, cafes and quick-service restaurants, retail sites) in the area and in neighboring communities on Long Island (with a focus on the areas near the William Floyd Estate). Local residents encountered at these locations were approached randomly to participate in face-to-face interviews, which typically lasted 15-20 minutes. Only three of these interviews were audio recorded due to environmental conditions. Hand-written notes were taken during the interviews and detailed descriptions were written up as soon as possible following the interview (again, usually within one day).

Unlike quantitative research that emphasizes numerical data, qualitative research examines "…things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them" (Denzin and Lincoln 2000:3). Thus, interview transcripts and notes are the "data" (Miles and Huberman 1994). Interview transcripts and notes were coded for themes using ATLAS.ti (version 5.0, Scientific Software Development GmbH, Berlin). An iterative process was used to generate codes based on themes that emerged in the interviews. That is, segments of text in the first interview were assigned thematic codes as they emerged. Each of these codes was then applied to text from the second interview. If the second interview introduced new themes, they were then added to the coding scheme. When new themes were added, previous interviews were re-scored to assure that codes were applied uniformly. Themes and topic areas were linked and quotes were sorted to reveal key concepts and to capture emergent relationships between themes.

FINDINGS

A total of 110 subjects were interviewed individually or in groups. Only eight individuals refused to be interviewed. Subjects' average age was early 40's, with the average tenure of residency approximately 20 years. Type A interviewees included: board members of homeowner associations and year-round resident associations, volunteers who worked on the deer immunocontraception project, park neighbors who regularly contacted FINS, and representatives of other local governmental entities and agencies. Type B interviewees included: homeowners and renters living on Fire Island and in surrounding communities and local business owners. Approximately equal numbers of year-round residents and seasonal residents were interviewed, in both Type A and Type B interviews. However, many interviewees had spent time as both a seasonal and year-round residents and shared insights from both perspectives. In addition, year-round residents of neighboring communities on Long Island had different perspectives than year-round residents of Fire Island. Thus, for the remainder of this report, the term "year-round resident" will be used to describe only individuals who lived in one of the communities on Fire Island year-round. Interviewees were predominantly white; only six were Hispanic, two Black, and one Asian. Most results refer to Fire Island proper; observations specific to the area surrounding William Floyd Estate on Long Island are summarized in a separate section.

Deer-related impacts to FINS and to local communities



When asked about deer and deer management at Fire Island National Seashore, interviewees identified common deer-related impacts; i.e., the socially-determined important effects of events or interactions involving deer, humans and deer, and deer management interventions (adapted from Riley et al. 2002). For interactions involving deer or humans, over half of both Type A and Type B interviews described damage to landscaping and gardens from deer browse. In addition, over 25% of the interviews included: concerns about Lyme disease and/or tick transmission, sanitation issues from deer getting into garbage, and positive wildlife viewing opportunities provided by deer. Other less commonly identified impacts included concerns about deer health (due to either injury or starvation) and deer interactions with pets.

Only 15 interviews (seven of Type A and eight of Type B) mentioned negative effects of deer browse on native vegetation, ecosystem health, and/or biodiversity, which typically are the focus of concern to NPS managers (Leong and Decker 2005). When these impacts were noted, they often were described with a sense of loss:

> "The Sunken Forest is one of the great flora treasures of the Northeast. It's been decimated by deer" (FA14).[3]

[3] Numbers and letters in parentheses denote interview identification codes. For group interviews, individual respondent is indicated following the id code.

> "There used to be the most beautiful ferns out here. I loved all the kinds of lush ground cover that was out here like the ferns and everything was so beautiful. That's all gone. It's all gone. It's nothing like it used to be, and to me that's the real, that's the sad loss" (FA21).

> "The biggest impact to me, my wife used to make these great beach plum jelly preserves. Now there are no beach plum left. Now we're left with blander's grape jelly. It's depressing. [Deer have] rid this island of native vegetation" (FB26).

Other categories of positive and negative interactions also were associated with emotional responses, again both positive and negative. For example, many expressed positive emotional impacts from viewing deer: "I feel blessed to be surrounded by this wildlife…They are a joy" (FA7), and, "It's a thrill to see big wild animals like that" (FB30). Others had equally strong negative emotional responses: "…when you see deer with ticks, it's pathetic" (FB25), "I hate them. I call them rats with hooves" (FB39, R1), and, "It's frustrating spending money on plantings and they're half chewed" (FB43).

The affective component (i.e., emotional response) sometimes was given more weight than the physical nature of interaction. Many interviewees described conflicting values about deer; even though they experienced negative impacts from deer, on the whole, the presence of deer on Fire Island was seen to be positive. For example, in response to the question "Do you believe deer impact the park, either positively or negatively?," one interviewee answered,

> "Yeah, I think positively. It just adds to the natural, to being out on the Seashore and a more natural environment…I'm not so happy about them when they break through my fence and get into my garden but it's kind of part of the package" (FA22).

Similar responses were given to the question "Do you believe deer impact the community, either positively or negatively?" For example:

> "As a homeowner, I would like to see the population reduced a little, they get in the garbage. As a business person, as a human being, I like to take kids to see them, a fox hole, deer over there, those are the things they don't forget" (FA16).

> "On the whole, positive, because of the sense of wonder people have when they see deer running. The fact that they eat people's petunias from time to time is a small price to pay" (FB22).

Often, interviewees concluded that they liked deer, but there were just too many, because they were experiencing too many negative impacts.

> "…they shouldn't be in our backyards. They shouldn't be on the streets running up and down. There are too many, it's nice to see them once in a while but there are so many of them…" (FA9, R3)

"We want some control over the deer. We're not trying to eliminate them all. We like having deer, it's nice to have nature, as long as it doesn't destroy the balance of the communities and the areas in between. Have you seen the area between the Pines and Cherry Grove? Up to here [gestures to height of browse line], they eat everything. And we're losing the things that bind the sand, we're losing the dunes" (FA14).

"I think the deer are an important part of being here…the herd needs to be controlled a little bit. They destroyed my garden multiple times and things like that, but it's part of the natural environment, it's one of the more unusual things. But obviously there needs to be control so there's not too many of them and not enough resources for them to survive" (FA22).

Impacts to deer

In addition to impacts on people or resources of FINS, interviewees described (and were concerned about) impacts to deer. Anthropogenic factors such as population growth, landscaping, and development were seen to reduce deer habitat, thereby concentrating deer and increasing human-deer interactions:

"Deer are being forced to be on walks because there's literally no place to go. If you're coming by bike or on foot then there could be an accident. It's visually upsetting" (FA8).

"…the problem is the residents. There are more impacts because there are more people. They've been developing, reducing the habitat…The problem is now that there are more people, the interactions with people increase" (FA18, R2).

"When did [the deer] get out of hand? When the amount of people got out of hand. They had no place to go" (FB11, R2).

In other words, rather than simply "too many deer," part of the reason deer were seen as a problem was that they were perceived to be out of their natural habitat, or "in the wrong place."

Further impacts to deer included habituation and food conditioning. Habituation is defined as a reduction of response to a repeated, inconsequential stimulus (usually resulting in loss of fear response to people), while food conditioning occurs when an animal learns to associate food with the presence of people, due to positive experiences of acquiring food easily (McCullough 1982, McNay 1998). Over 60% of all interviews (over 85% of Type A interviews and over 55% of Type B interviews) observed changes in deer behavior due to habituation and/or food conditioning:

"But they're very, very tame. I saw one girl one day, she's trying to take a picture of it, trying to be so quiet not to disturb it, so I told her 'make a noise like a carrot, it'll follow you anywhere' (laughs). They're really very, very, very tame. And they don't even get out of your way. You know, they just look at you like 'what have you got for me to eat?' So, they've totally lost their fear of humans, because they're now several generations of deer that have been fed by people. Even though people are told 'don't feed them, it's the wrong thing to do,' they're still feeding them" (FA15).

"You cannot believe how absolutely unimpressed they are with us and deer are supposed to be, 'Oh, I'm so afraid of mankind.' Not really. They, as I said, do everything but say, 'where's my carrot? Do you have a cookie for me? I'm sorry, I don't like oatmeal'" (FB48).

"…they no longer have any fear of human beings. Now they beg" (FB62).

Habituation and food conditioning amplify human-deer interactions by bringing people and deer in closer contact on a more regular basis. In addition, the resulting changes in deer behavior also affected whether interviewees considered deer to be wild animals:

"They're domesticated, now they're like dogs. They get in your garbage, take a stand" (FB4).

"I'm all against feeding but when you take away wild life they're not wild animals. In Montana, they call them white-tailed deer, you see the white tail (FB11, R2)."

"I have a problem with deer walking through the community's garbage cans. It takes nature away from being a wild animal. They will walk right up to you looking for food (FB50)."

Habituation of deer also influenced interviewees' emotional response to deer, causing them to be valued less than deer that were perceived to be wild:

"I would say you cross the line when the white flag is no longer showing, when they are so familiar with people and that they are so unafraid of people and no longer wildlife. They are pests (FA1)."

"I don't even think of them as wildlife anymore. To me they're like cows grazing in a pasture…you walk by them, they may look up and kind of look at you or if they think you've got…they'll kind of walk towards you. That's not wildlife. It's not natural and we've encouraged that and that's not who these animals are supposed to be. They're beautiful. I think they're beautiful. But I admire them more when I see them in the wild or down someplace where they were meant to be as opposed to acting like a cow standing by the walk in somebody's yard" (FA21).

"To see a deer should be a rare and wonderful event" (FA20).

The higher value placed on wild deer was especially apparent when subjects directly compared their emotional responses to deer that were perceived to be rare and exhibiting fear responses to humans vs. deer that were common and habituated:

> "Well everybody was aware, when I first came here, seeing a deer was very unusual and it was something you kind of appreciated. They're white-tailed deer and one of the attractive things was that tail sticking up, a sign of alarm and so on. Now you never see that flag. It is always down because the deer are totally acclimatized to people…" (FA1).

> "They've lost the instinct to run away. They're de-deerified, humanized. When I first came here, it was thrilling to see a deer bounding across the main. Now, they knock over garbage cans and stand their ground" (FB13).

> "…but I don't like it when I no longer regard those animals as wildlife but start seeing them as something less and to me the deer out here are…they're just not…I don't even think of them as wildlife. And I think that's unfortunate. I did when I first came here. I'll never forget one time…one of the first summers here a group of us were walking down to Cherry Grove and it was late in the day and it was kind of foggy and misty and you used to never see deer in the communities. And all of a sudden there were like three bucks that came up over the dune and they were at the top and there was like all this mist around and they were so magnificent and you know, and we just like stopped and we were in awe, but in those days to see the deer down in the wild like that it was like…I mean you really were in awe of them and that's no longer the way it is out here anymore. People don't even look at the deer the same way anymore. People, the visitors who come out here, you know, they see them like grazing along the walks and they talk to them and they…in some cases can even practically walk up and pet them and take photographs. That's not really…that's giving the wrong idea of what these animals are all about. It's like you need to appreciate them the way they were meant to be" (FA21).

Collective and collateral impacts from management interventions

In the context of this study, a management intervention is any action that is taken to decrease negative impacts or increase positive impacts related to deer. Individual actions taken to mitigate negative impacts from deer often were described as collectively amplifying the negative impacts experienced by other community members. In addition, interviewees reported collateral impacts, that is, newly created types of impacts resulting from the deer management interventions themselves. Related to the history of deer management at FINS, interviewees focused on collective and collateral impacts resulting from three types of management interventions: fencing, hunting, and reproductive control.

Fencing properties or gardens was used heavily throughout Fire Island to provide individual landowners relief from negative impacts of deer browsing. However, interviewees identified two types of collective, collateral impacts from fencing: habitat loss and safety (to both

deer and people). Similar to development, fencing was described as further concentrating deer in undesirable locations:

> "It seems like there are more deer on the walkways. My own feeling is that it's because there are more fences, it makes it harder for them to cross property" (FA12).

In addition, fences were seen to be hazardous, to deer:

> "And being injured from the fencing that these people put up that are harmful to the animals. They break a leg, they're not able to get their food…"(FA2).

> "Fences give them no place to go except to run into you. Hooves go through fences, deer break legs" (FB4).

> "People enclose their yard because they eat the plants…They get stuck in fences and die" (FB29).

Fences also were viewed as creating a hazard to people:

> "I feel like they are putting up this fencing to keep the deer out and in my opinion you are also locking yourself in and you are also creating I feel a fire hazard in a sense because there are all these walls and boundaries that the people can't get into whether it is a fire truck or other methods of help, whether it's an ambulance or just everybody screens walls. Some of these streets have so many fences that god forbid a deer did have to run down the street just because of whatever it is coming straight at a person and it's not by choice it can't go anywhere else but it doesn't have the whereabouts where to go. So that is one of my concerns about the deer that someday it is going to happen because people are running around screaming" (FB1).

> "They fence in their homes. That could be a problem, if there was a fire, it would be hard to get in" (FB29).

Thus, while fencing is a rational approach to solve individual scale problems (damage to landscaping/gardens), it was seen to contribute to community scale problems. In essence, actions of individual landowners collectively exacerbated deer issues by reducing the overall amount of open space available to deer. In addition, fencing created additional safety hazards unrelated to primary deer impacts.

Hunting also figured prominently in many interviews. There was general agreement that hunting was not an appropriate management alternative to consider on Fire Island. This sentiment was partially due to the research hunts that were conducted in the late 1980's. Many long-time residents and had personal experience with the hunt itself or remembered press related to the hunt. It was considered by many to be, "… a joke. They used shotguns, here! They should have hired a terminator. There were housewives getting arrested. It was on the front page of Newsday" (FB28).

In addition, the hunt surfaced a new group of stakeholders who were not necessarily concerned about deer, but were concerned about safety related to the hunt (i.e., the collateral impacts of hunting):

> "So the year-round people, it was on TV, they stopped the hunt. En force. And we're talking about people that have nothing to do with deer or wildlife, were there right in front of guys' arrows and guns, to stop the hunt. And they stopped the hunt, they shot it right down" (FA2).

> "…the then Superintendent of the Seashore, unfortunately, ill-advisedly staged a deer hunt right out here in…between here and the lighthouse. And it wasn't just bows and arrows and it was absolutely frightening" (FA5, R2).

> "The DEC and the park service said ok without checking with residents. We could see the hunters who got into costume, you know, the fantasy of the hunt. When we finally got organized to oppose, it reminded me of anti-war demonstrations, Vietnam. Most were housewives" (FA6, R2).

> "We didn't have a cause, we just didn't want to see guns going off in our neighborhood" (FA6, R1).

Many negative reactions to the hunt also appeared to be related to the idea of hunting habituated deer, i.e. hunting was not considered appropriate when animals were no longer wild:

> "It was the most horrific thing. We all went to court to stop it and it was a bow and arrow hunt which these animals are like your dogs. We grew up in the community. It would be like letting all the neighborhood dogs into someone's fenced in backyard and shooting them. It is sad" (FA7).

> "This is an environment where you can walk up to deer. Deer are in an urban setting, it's very different from the wild. They're not like a cat or dog, but they're not wild. They're somewhere in between. It was ludicrous that hunters were coming in with camouflage. And they were terrible marksmen. They would discharge X times for every animal. That's what stopped it. The lack of accuracy put other people at risk. They were disrespectful of the context they were hunting in. Injured animals were going into communities" (FA8).

> "People would kill them with a bow and arrow right in front of kids. My mom was shaking bells to scare them. She got arrested. My dad would have gotten arrested but he ran and they couldn't catch him. It was like shooting neighborhood cats" (FB11, R2).

Even those who did not have negative associations with the research hunts described hunting as inappropriate when animals are habituated:

> "You can hunt here with a baseball bat. You shouldn't hunt them, they're like pets. People who hunt upstate say this. Here, they beg" (FA15).

> "They were talking about having a hunting season 20 years ago. They can't do that here, they're tame. One guy I know said 'I can just hit them on the head with a two by four'" (FB9).

> "People can feed the deer out of their hand. You could kill them with a frying pan. I hunt in many states. There's no skill for hunting here…There's no challenge, you could kill them with an axe" (FB28).

> "You can't hunt here. You could hunt with a frying pan, that's not hunting" (FB29).

> "The ones at Smith Point are different, they eat out of your hands. It would be unfair for there to be an open season" (FB44, R1).

Many interviewees also had strong beliefs about reproductive control. Type A interviewees were initially identified based on previous interactions with FINS about deer issues, and many of these individuals were known to FINS because they were involved in the immunocontraception research project, had organized against the project, or were community decision-makers (who were often responsible for deciding whether or not to fund the project). Therefore, it is not surprising that almost all Type A interviews mentioned reproductive control. In contrast, approximately half of the Type B interviews mentioned reproductive control.

As with other management interventions, subjects identified a number of collateral impacts related to reproductive control. The collateral impacts of most concern arose from the baiting stations that were used to increase the likelihood of darting (Figure 2). As noted previously, habituation of deer was seen as a major cause of negative deer impacts. The baiting stations often were viewed as further contributing to reliance of deer on human food sources. Some interviewees were unaware of the immunocontraception project but had seen baiting stations and believed that FINS was provisioning deer, which created a negative opinion of park management:

> "I think the deer management is horrible. Specifically in Ocean Beach. They have feeding stations there. Don't they understand that by feeding them they're making the environment better so the deer can breed more?" (FB51).

When the purpose of the baiting stations was explained during the interview debrief, this respondent replied: "If I knew why they were feeding the deer, I wouldn't object to it" (FB51). Other interviewees were confused about the specifics of the immunocontraception project but had read the permits posted at the baiting stations. They suggested providing additional information about the project at each of the baiting stations.

Locating baiting stations in communities also led to tensions between neighbors who wanted overall deer numbers reduced, but not at the cost of increased concentrations of deer at a baiting station near their own homes. In this case, although the baiting stations were designed to reduce community level impacts from deer, they increased individual level impacts of deer for the neighboring households. In addition, baiting stations were believed to attract other pests: raccoons, rodents, opossums, and even feral cats. There were additional questions about the

efficacy of baiting stations over time. Some interviewees believed that the deer learned to recognize and avoid the darters over time. Others believed that bucks excluded the does from the baiting stations, rendering the stations ineffective in their designated purpose—to facilitate inoculation of does.

Figure 2. Official Deer Baiting Station. Many Type B respondents learned about the immunocontraception research project only from the information provided on permits at the baiting station. Photo by K. Leong.

Immunocontraception also may result in unintended effects on reproduction. Seven interviews included observations of fawns born "…at the wrong time of year" (FB25), and some speculated that this could be related to the immunocontraception project:

> "Two years ago I saw a lot of deer, I've only seen two babies this year. And a lot had babies late. It's usually in April or May, but now I'm seeing them in July and August. That could be a problem if there's a cold fall. But the weather is changing too, through global warming. Animals' instincts are by the weather, not by the calendar, so who knows" (FB11, R2).

> "I think that has something to do with the darting. It offsets them a little bit. I mean, come October, mid-September, they're running. The bucks are running all over the place. And you can see it. But there are some births that take place in the late spring and during the summer and during the winter. All of a sudden, boom, they pop up. Not a lot, but they do. And I don't know if that has to do with the time span of the, or how long the dose takes to desterilize them, that part I don't know that much about, how long does it last, stuff like that. But that's what I've seen with the deer" (FA2).

> "I think the program must be working because there seem to be less fawns in the spring. And there seems to be fawns sometimes at other times of the year, which seems strange, but I don't know if that's part of the contraceptive program or if I'm just seeing something different, but in general I thought the deer were usually born like in June" (FA22).

Most of these observations did not identify immunocontraception as the cause of late-season births, rather, they expressed concern that fawns born late in the year would not survive the winter.

Central to the discussion of reproductive control was the question of whether or not it "works" as a management alternative. Most interviewees who knew about the project had formed opinions about whether or not the program was successful and presented arguments to support their positions. However, different interviewees used different metrics of success. Some believed the project was successful because remote injection of the contraceptive successfully prevented individual animals from reproducing. Others believed it was successful because the population was gradually decreasing, even though there was variation from year to year. Still others believed it was not successful for precisely the same reason—there was variation in the population from year to year. And some argued that it was unsuccessful because high numbers of deer were still visible. On the whole, most interviewees believed the goal of the project was to reduce the population of deer, but there was no agreement on expected time frame or scale of population reduction necessary to qualify as a "success," nor understanding what to look for as evidence of progress (or lack thereof).

Most of the evidence to support arguments for or against reproductive control was related to numbers of deer, either reported in scientific studies or based on "…what I see with my own eyes" (FA8). Reports that supported interviewees' positions were believed to be credible, while reports that did not were dismissed as being flawed. Many of the people who did not support the immunocontraception project were concerned about the collateral impacts stemming from the project and questioned whether it was a time and cost-effective means of reducing the impacts they experienced from deer. Some interviewees re-framed the problem to emphasize reduction of negative impacts from deer, sometimes referencing multiple management alternatives:

> "…the most immediate thing is not so much that they're eating our grass, which they are, but that this tick, you know, is dangerous" (FA9).

> "I hope we are doing the right thing. I hope we are all striving for the same goal which is a reduction in the [deer] population and a reintroduction of natural fauna, flora or whatever that belongs here and people are more understanding to do that in their own yards and stuff. Can you imagine if only three or four houses on every street did that, left a portion of their yard available for browsing and whatever else? You would see less garbage eaten" (FA10).

> "If they're trying to kill them off, I don't want them to. I want them to get rid of feeding the deer" (FB56).

Other local community concerns

To situate the relative importance of deer issues, interviewees were asked to identify other local community concerns involving FINS. Three major topics arose: beach erosion and control, driving permits, and endangered species. Interviewees spoke about beach erosion as an issue that could unite the communities, because "…the condition of the beach affects everyone" (FB6). In addition, Fire Island was seen to provide an important service to Long Island, "…the barrier beach protects the south shore of Long Island" (FA11). Yet not everyone agreed on the best approach to protect the beach. Again, problem frame, including temporal and spatial scale, were important in determining which solutions were believed to be appropriate or successful. Driving permits were another important community issue and generated strong emotions from many respondents. Many believed that residents were treated unfairly by FINS, who administers and enforces the permits, and both year-round and seasonal residents described driving permits as creating bad relationships between FINS and year-round residents. The third frequently cited type of community concern involved endangered species, almost exclusively piping plover. Most of these issues were actually a subset of concerns about driving restrictions and beach access. There were as many other respondents who appreciated the protection afforded to the plovers and respected the jurisdiction of the U. S. Fish and Wildlife Service in setting regulations that are implemented by FINS.

While deer were acknowledged to generate controversy, these other issues were believed to be more important to community members and have greater impacts on relationships between communities and FINS. Other, less frequently mentioned concerns included: mosquitoes and associated spraying, pollution, property rights (zoning, building permits, etc.), and public access (including boating access). Feral cats, raccoons, and injured wildlife were often mentioned as other important animal-related concerns.

Community affiliation with and image of FINS

In general, interviewees did not feel a strong community affiliation with FINS, and many spoke positively of the relative autonomy afforded the communities. For most interviewees, there was little or no interaction with park staff outside of the areas administered by FINS, and similarly scant knowledge of FINS mission and mandate with respect to natural resource management. Typically, NPS staff were only seen when they were enforcing regulations, which many community residents felt to be restrictive:

> "The park for the average person—either they don't realize it's there or the impact is a nuisance. They don't really do anything in the communities, but they create restrictions that communities have to abide by. I don't see anything positive, but I do see negative. They regulate piping plover, close off the beach, limit building permits" (FB26).

Others with the same level of understanding felt more positively towards FINS and the NPS in general:

> "I like the Park Service in general, Chincoteague, General Grant in Manhattan. I'm pro-National Seashore…They're keeping it pristine" (FB7).

> "I think they're a force for good. If they weren't here, there would be a highway, hot dog stands, gas stations. It's a bloody miracle this place exists one hour from New York City" (FB22).

In the absence of specific knowledge about FINS role and responsibilities, most interviewees appeared to rely on their general values about conservation to form their opinions about FINS.

In contrast, community and stakeholder group leaders (Type A interviewees) had more intimate knowledge of FINS. These interviewees described changing relationships with FINS, primarily dependent on the personality of the Superintendent. They believed that:

> "…the Superintendent sets the tone. Superintendents, that's been the personality for what the park service is going to do as part of their overall objective and if the tone is cooperate with the community it makes all the difference in the world and so whatever we have to do to work with them is what we are doing" (FA11).

Again, there were few interactions with other park staff, except when permits were sought for various activities. Characterizations of past Superintendents were fairly uniform, some were beloved, while others were despised. Qualities that contributed to positive relationships with FINS staff included listening, being open-minded, showing respect, earning trust, proactive communication, awareness and consideration of the community perspective, and accessibility. Interviewees often had a difficult time listing specific qualities, but described a general overall sentiment:

> "Because we finally, after all those years had a decent person in there, someone who wore the Smokey, the hat, but he was a human being" (FA2).

> "…he's so much fun. I just adore that man, he's just great. I really like him. He has no pretense" (FA6, R1).

> "…he showed that he was interested in us as people" (FA12).

Fairness and professional judgment also enhanced credibility:

> "I think having a Superintendent who does have the ability to sort things out and who is flexible without giving up his own integrity and principles is, I think, a very important thing for running this strip of barrier beach" (FA5).

> "I like the current administration. I like the way he thinks. He thinks for the people. I don't see any ulterior motives. Others looked at the legacy they would leave behind, put up a sign as their legacy. His current concern is with people and the park, and people in the park, employees and visitors" (FA16).

For the most part, interviewees spoke positively about their relationship with the current Superintendent and were optimistic about future partnerships.

Relative to wildlife and other natural resource issues, interviewees were confused by the widely perceived "let nature take its course" policy of FINS. Many believed that this attitude disregarded communities and some thought it indicated that FINS wanted to get rid of the communities (a sentiment commonly associated with a previous Superintendent). The main objection to this policy was that the environment is no longer seen to be natural, so relying on natural processes for management seemed illogical:

> "The truth of the pudding is that there's no natural environment here" (FA8).

> "Once you start messing around, you're stuck. It's grab the tiger by the tail, and then you can't let go. Because now you've done something, like you do this out here, if you go ahead and build, then what you're going to do is what? You're going to protect houses, you're going to get more expensive, more fancy. And then you're not going to be able to UN-protect them. So, it's a problem" (FA15).

> "It's almost like it's too late to just let nature take its course because things have already gotten out of balance so I think we have to probably try to manage what's here and not let anything get further out of balance…We've screwed up so much that it's kind of like we have no choice now but to try to do what we can" (FA21).

> "There's an argument for letting nature take its course but it's too late. What's there is not nature" (FB30).

This confusion was especially apparent for those who were concerned about sick or injured wildlife and believed that wildlife management should include rehabilitation services.

Perceptions of public participation

Most Type B interviewees had little experience with public input and FINS, although some had attended public meetings. Type A interviewees were in more regular contact with FINS because of their standing as community and stakeholder group leaders. They believed they had good access to FINS, and were comfortable calling, writing, or e-mailing when they had questions. They were also more aware of public meetings and were invited to participate in the more formal decision-making processes. Interviewees spoke positively of 1-1 interactions with the Superintendent; however, many had low expectations for formal public processes as a means to provide meaningful input.

A number of interviewees had either participated in or heard about the negotiated rulemaking efforts to revise the driving permit process, the results of which are currently being incorporated into new draft regulations. Negotiated rulemaking is a consensus-based process that strives to increase the acceptability and improve the overall substance of a rule by involving the parties that will experience significant impacts in its development and by encouraging communication between them (Harter 1989, The Negotiated Rulemaking Act 1996). As noted in one interview, the facilitation of the process is essential to its effectiveness:

> "…I think if they're sincerely interested in hearing from the community, and not just mouthing the latest buzzwords from Washington, you get a whole different outcome than, you know someone can go through the motions and do what they're told to do and it still won't have any meaning" (FA5, R1).

For the driving regulations, the process was initiated by a Superintendent that many respondents disliked and distrusted. As a result, most had negative opinions of the process. They believed that FINS "…stacked the deck in their favor" (FA3), that it was "…totally rigged" (FA6, R1), and, "…an absolute farce" (FA2). However, opportunities for mutual learning did result in some positive outcomes:

> "In that particular case the fundamental thing that everybody agreed on was that anything that *can* come or leave the island by water should come to or leave the island by water, rather than by motor vehicle. And I think that was, just getting that established as the primary rule about transportation on Fire Island, it was a big step forward because everything else goes through that" (FA1).

> "…from those meetings, it sort of has eased up tensions…And that sort of eased up because the people had an education, they had an education. You know, they have a better understanding…had an education really about how the system works. And the true facts of really, what is really on the beach when it comes to driving. It had a major effect" (FA2).

> "One thing worked, people talked to each other for the first time. People from different communities met each other. One woman had never left Kismet. That really worked" (FA3).

Still, many are doubtful that any serious changes will be made to the driving regulations and they are interested to see the extent to which their time and effort affects the new rulebook.

In addition, negative experiences with the negotiated rulemaking led to skepticism of future consensus-building efforts:

> "I wasn't a participant but just my seeing what happened and how it was manipulated, I was off conflict resolution consensus for the rest of my life after that experience. It was so bad" (FA5, R2).

Public meetings in general also were not seen to be constructive:

> "It seems like you have to go to a public forum, unfortunately because that's the way we're constructed, but nothing results, a lot of shouting, a lot of polarization, somehow it's lost down the black hole" (FA6, R2).

> "…public hearings are a waste of time. People throw their hands up, 'They're going to do what they want regardless of what I say.' Nobody trusts the government" (FA16).

Nor were they considered representative of the general public:

> "But you know how people don't, the people who should go to meetings don't. That's the other thing" (FA9, R5).

> "I never go to them…it's always the same people, those that fight the Seashore and those that help them out" (FB28).

Some interviewees believed that it was important for people to hear the views of others and offered alternatives to improve effectiveness of public meetings. Most of these suggestions involved more informal venues, such as: informal coffee sessions or open houses hosted by local residents, a clambake or other event on the beach, or events that provided entertainment for children while parents were talking. One interviewee suggested utilizing a neutral location, such as a hotel because, "…the property owners will meet over here in the Community House, it's like, 'that's our territory, you're coming into our territory'" (FA15). They also suggested presentations at regularly scheduled community meetings, utilization of community bulletin boards and local newspapers to disseminate information, and brochures or announcements on the ferries as means to reach additional community members.

Interviewees displayed a wide range of preferences for providing input; some favored telephone, others mail surveys, 1-1 conversations, web and e-mail, and even public meetings. Because individuals have such wide individual preferences for providing input to parks, residents recognized that opportunities must include "All of the above, it has to be all of them" (FB50), a conclusion also reached by public participation scholars (Chase et al. 2002). However, interviewees also indicated that people would likely participate only if the topic was relevant and if they believed they had enough prior knowledge to provide meaningful input:

> "If I had knowledge on a subject, I would be interested in giving input" (FB5).

> "It's not for me to say. I don't have an input because I don't know enough about it. I wouldn't be able to make a comment because I don't know" (FB24).

> "I'd have to know about it in a form that even a little person like myself would know enough about…People here are concerned. Given the right chance, they'll come out" (FB46).

William Floyd Estate

Interviews with residents who lived near William Floyd Estate (WFE, N=13) described similar impacts from deer in that area as on Fire Island, although at much lower levels. Deer were still somewhat of a novelty, and respondents enjoyed viewing deer more than they were concerned about damage to vegetation. However, vegetation damage was mentioned by almost all respondents. Some also were concerned about ticks, but again the fear and negative language associated with ticks was not as strong as on Fire Island. Habituation also was not yet as prevalent as in the communities on Fire Island, except at Smith Point County Park (on the eastern end of Fire Island) which is accessible via causeway from Mastic Beach.

Like many other small urban parks in the northeast, WFE was seen by some to be a source for deer, which many attributed to development and associated habitat loss:

> "There's been a huge building boom in this area, it took away the deer's space to live. At first we thought they came from Smith Point, but now they're coming out of the wooded areas. The raccoon, opossum and other wildlife, within the last five years have become a problem" (FB55).

Due to the presence of cars, deer-vehicle collisions were an additional concern at WFE. However, they were not considered unique to the area around WFE, but were discussed as a general problem throughout the region of Eastern Long Island. Unlike on Fire Island, some interviewees expressed a desire to hunt at WFE, possibly because Wertheim National Wildlife Refuge (a nearby federal property administered by the U.S. Fish & Wildlife Service) recently began allowing deer hunting. Concerns about pollution led to mixed feelings about the health of deer in the region, and one hunter said:

> "I wouldn't eat any deer on Long Island...They're garbage eaters…The majority of deer except for places like the Estate and Fire Island, a lot of deer on this end of Fire Island are from the Estate. They always seem to be healthy. But all the other deer, particularly around by the Labs and the, they just, for a lack of a better word, turn me off. They just kind of look a little bit funky. I've seen non-conforming racks and things like that, which is part of their nutrition" (FB58).

As on Fire Island, interviewees indicated other local issues that they believed were more important than deer. These included a need for community revitalization and concerns about crime. Interviewees who were aware of the estate spoke highly positively about their experiences on the property but felt that it was underutilized and could be a much larger community resource. Some believed that better integration of the resources at WFE could help the community capitalize on the historical aspects of the region and generate community pride.

Again, most interviewees did not interact with NPS, except for the Mastic Beach Property Owners Association and local fire department, who had regular contact with WFE staff. Almost all interviewees mentioned that the library is used as a community center in the Mastic-Mastic Beach-Shirley "tri-hamlet" area, which they suggested would be a good way to reach more of the general public in the region. In addition to the library, they also suggested the school system, Moriches Bay Historical Society, William Floyd Community Summit, and fire departments outlets for the WFE to reach more community residents.

DISCUSSION

Local community residents collectively described deer issues on Fire Island as a complex web of interrelated components. However, individuals placed weight on different components of the system, which often led to disagreements on how to resolve "the deer problem." Clarification of problem frame, including responsibilities and jurisdiction for various system components will be essential to engaging in constructive dialogues to develop solutions. In addition, while deer issues were controversial, they were not believed to be the most important issues that affected community-FINS relationships. Resolving some of these other highly visible and contentious controversies could help build the relationships that will be needed to sustainably manage impacts from deer.

Interviewees collectively identified a total of three dimensions of deer-related impacts: deer population size and density, deer home range and movements, and deer behavior. Thus, "the deer problem" can be summed up as "too many deer, in the wrong place, acting unnaturally." Therefore, to effectively address stakeholder concerns, potential management actions should address all three dimensions; a combination of management actions may be necessary (Table 1). In addition to effects on the dimension addressed by management actions (population, movements, behavior), other dimensions that are critical to defining success: temporal and spatial scale and assessment of collateral impacts (Table 2).

The immunocontraception research project addresses only the first dimension of the problem, "too many deer." Much of the controversy appears to center on whether or not the project "works." According to HSUS project reports, Phase II of the study (1998-2002) demonstrated that annual treatments of deer significantly reduced fawning rates and that localized deer populations decreased significantly (Naugle and Rutberg 2005). However, interviewees did not necessarily agree with the expected degree of population reduction, time frame, or geographic scale that were used to determine success. The stated goals of the current phase of the immunocontraception project (Phase III) are to:

> "…discover how deep a deer population reduction can be achieved on Fire Island using only immunocontraception, to continue to monitor deer population trends across the island, and to develop new vaccine delivery strategies to more effectively control deer populations in communities that have not yet shown clear reductions" (Naugle and Rutberg 2005:2).

Thus, the current phase of the project is not designed to reduce the population to a certain density within a specific time frame (i.e., does not specify a metric of success *a priori*), but rather is a research project to discover what degree of reduction is possible in a given amount of time (i.e., to determine what is a reasonable metric of success for future use of this method). This distinction is essential. Because the project is a research study, its success should be measured by what it teaches us about realistic expectations for the use of immunocontraception as a management tool, in terms of population level, temporal and geographic scale effects. It may not be successful in reducing the population of deer over the time frame or geographic scale desired by some local community members because this was not the project's goal.

Table 1. Dimensions of "the deer problem." Residents collectively identified three dimensions of "the deer problem": population size and density, home range and movements, and behavior. An X indicates the dimension(s) affected by management actions. To effectively solve "the deer problem," action must be taken simultaneously on all three dimensions.

DIMENSIONS OF "THE DEER PROBLEM"	POTENTIAL MANAGEMENT ACTIONS				
	Identified by Community Members			Additional Actions	
	Fencing	Hunting	Reproductive control*	Reduce food conditioning	Reduce habitat loss
Deer population size and density		X	X		
Deer home range and movements	X			X	X
Deer behavior				X	

Table 2. Dimensions to determine "success." Different management actions are effective at different temporal and geographic scales. In addition, any management action creates associated collateral and/or collective impacts which must be considered. In some instances, such as hunting at FINS, collateral impacts may be viewed as worse than taking no action.

DIMENSIONS TO DETERMINE "SUCCESS"	POTENTIAL MANAGEMENT ACTIONS				
	Identified by Community Members			Additional Actions	
	Fencing	Hunting	Reproductive Control*	Reduce food conditioning	Reduce habitat loss
Temporal Scale	Short	Long	Long	Long	Long
Geographic Scale	Individual	Community	Community	Community	Community
Collateral/Collective Impacts	Safety concerns, Concentrates deer (Increases community scale impacts)	Safety concerns, Empathy with habituated deer	Habituation, Potential reproductive effects, Baiting stations attract pest species	Reduced wildlife viewing opportunities	Reduced wildlife viewing opportunities

* Reproductive control is a research project, NOT a management action, although it was often described as a management action by stakeholders.

In addition, there were concerns about collateral impacts from the immunocontraception research project. Even though the baiting stations were only used for a short time of year, they were viewed negatively by some who believe they further contribute to the habituation of deer. Paradoxically, administering the immunocontraceptive via remote darting is only possible in habituated populations of deer, and use of habituation via bait stations increases effectiveness of darting (Naugle and Rutberg 2005). Yet, habituation was the greatest uniform concern of stakeholders. A few residents of communities that participated in the immunocontraception study also observed fawns born late in the year. While residents did not necessarily link the change in parturition date to reproductive control, studies have shown that does contracepted with only one dose of PZP produced fawns significantly later in the year than does that were not contracepted (McShea et al. 1997), and HSUS darters also noticed late-season births in the communities with the most darting activity (Naugle and Rutberg 2005).

Finally, the immunocontraception study is not designed to assess the relationship between reduction of negative impacts from deer and level of population reduction, which was the concern of many interviewees. While it seems obvious to assume that reduction of deer will result in reduced deer-related impacts, the question of how quickly and to what degree the population must be reduced to result in an acceptable reduction of impacts remains to be answered. Re-framing deer issues to recognize these additional dimensions identifies management actions that may reduce impacts, independent of absolute numbers of deer.

As previously mentioned, habituation/food conditioning was a prominent theme throughout both Type A and Type B interviews. Even a small number of food conditioned deer could cause high levels of impacts to communities by raiding garbage, spending time on walkways, and bringing ticks closer to people. Management actions to reduce food conditioning include: enforcement of garbage ordinances, enforcement of wildlife feeding laws, and strategic communication to discourage feeding. The inter-disciplinary outreach program formed by FINS in 1998 focused on reducing deer feeding and was seen to have dramatic results (Underwood 2005). However, many other means to reduce food conditioning would require initiatives taken by communities, or at minimum, clarification of jurisdiction for enforcement (with a corresponding increase of FINS staff).

Similarly, habitat loss from development, fencing and non-native plantings also were considered responsibilities of communities. FINS discourages the use of fencing because of collateral impacts related to safety (see the brochure: "Deer and People at Fire Island National Seashore," available at: http://www.nps.gov/archive/fiis/deerpeople/deer.html), yet communities are responsible for enforcing fencing ordinances. Increasing awareness of the collective effects of individual actions on community-wide impacts could be another topic for strategic communication, perhaps as a collaborative effort between FINS and communities.

Clearly, any efforts to reduce deer impacts will require coordination between FINS and the communities[4] if they are to succeed in the long run. Due to the recent change in FINS administration, there is an optimistic atmosphere for future collaboration, however, deer were not seen as the top priority for communities. If progress can be made on some of the other big community issues, namely beach erosion and driving permits, relationships may be built that can be used as a foundation for any future deer efforts. Conversely, if attempts to find collaborative solutions to these larger issues fail, additional efforts to rebuild trust and relationships with the communities will be needed prior to any deer-related efforts. In the mean time, clarification of goals and expectations related to ongoing immunocontraception or deer outreach efforts should be made.

In addition, interviewees desired clarification of FINS mission and mandate, especially with respect to natural resource management. One of the objectives used to guide management and operation of FINS is: "To manage Fire Island in ways that will enhance natural processes and mitigate the impacts of human interference with these processes" (National Park Service 1977:24). This was articulated by many interviewees as, "Let nature take its course." While many appreciated the underlying philosophy, they were confused in how to apply it to an environment that they believed was no longer natural. At the same time, interviewees appeared to value deer that were perceived to be wild more than deer that had become tame and indicated a desire for management actions that would help restore what was perceived to be the wild or natural character of deer (namely efforts to combat habituation). From a behavioral ecology perspective, it is perfectly natural for deer to learn that associating with humans provides a source of food and shelter with few negative costs. Yet the language residents used to describe habituated deer indicates that habituation is largely viewed as unnatural. This sentiment appears to align with the FINS use of "natural processes" that indicates a desire for lack of human interference.

Interviews included questions about public participation because any formal deer management plan at FINS would require public input if population control is considered. If deer management is reframed to include additional dimensions of deer impacts at FINS, a focus on anthropogenic processes, coupled with ongoing contraception research, may be effective to meet goals. However, the dimensions of both problem frame and solution frame must be clearly articulated in goal definition or there may be disagreement over whether goals have been met. In the long run, managing impacts from deer will clearly take cooperation between communities and FINS and is not likely to succeed without coordinated efforts between the two. Despite

[4] Coordination with the New York State Department of Environmental Conservation also will be necessary, although this was mentioned infrequently by interviewees.

negative experiences with public participation in the past, many local community residents were willing to contribute to future efforts because of their love for Fire Island:

> "I think people out here do have a lot of interest in being involved and providing input and being supportive to the seashore or keeping Fire Island…making Fire Island even greater. We love the place and there's no reason that the communities and the Seashore shouldn't be able to work together for everyone's benefit…the public's, not just those of us who are residents who are in the communities and live here, but the public at large. I think we're all interested in keeping this a wonderful place for everyone to come and visit and enjoy and protecting it and keeping it special" (FA21).

For interviewees, deer were considered more special when they were perceived as wild life, symbols of wild nature rather than evidence of mankind's effects on nature. This perception appeared to be strongest when encounters with deer were rare and when deer displayed flight response to humans. It is likely that management to achieve an acceptable balance of positive and negative impacts from deer will depend on efforts to affect not only numbers of deer, but also deer behavior and people's expectations for (and consequently, behavior toward) deer in a human-dominated landscape. Deer population control has a long and controversial history on Fire Island, and the current immunocontraception research project is well established. Therefore, we see the greatest area of opportunity for FINS management as assisting local residents and visitors in: (1) having clear expectations for the goals and potential outcomes of the immunocontraception project, (2) understanding the effects of their behavior on deer, (3) effecting change in human activities that influence deer behavior, and (3) developing appropriate expectations for encounters with deer in a human-dominated landscape. Clear communication efforts in all of these areas will be key in reducing controversy over deer issues on Fire Island and increasing the likelihood that current and future generations will continue to enjoy positive experiences with deer at FINS.

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APPENDIX A. RESOURCES FOR ADDITIONAL INFORMATION

Websites

Deer, People and Parks: Human Dimensions of Deer Issues in National Parks: http://www.dnr.cornell.edu/deerpeopleparks

Fire Island National Seashore White-tailed Deer Page: http://www.nps.gov/fiis/naturescience/deer.htm

Fire Island National Seashore brochure "Deer and People at Fire Island National Seashore" (print version also available from FINS): http://www.nps.gov/archive/fiis/deerpeople/deer.html

Science Synthesis Papers in support of the Fire Island National Seashore General Management Plan: http://www.ci.uri.edu/naccesu/CESU_FIIS.htm

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APPENDIX B. INTERVIEW GUIDING QUESTIONS

1. How long have you lived near this park?
2. Are you a year-round or seasonal resident?
3. Which community do you live in?
4. Please describe and draw the boundaries to this community and other communities you interact with on the map.
5. Have you visited this park before?

   If yes:

   a. How often have you visited in the last two years?

   b. What are the main reasons you visit the park? List all that apply.

6. Please describe your observations on deer and deer management at the park and in the surrounding community.
7. Have you learned about deer from park staff, exhibits or other materials, either within the park or in other contexts?

   If yes:

   a. What did you learn?

   b. How did you learn it?

8. Do you believe deer impact the park, either positively or negatively? How?
9. Do you believe deer from the park impact the local community, either positively or negatively? How?

   a. How responsive is the park to these local concerns about deer?

   b. How do you feel about the park's responsiveness to these concerns?

10. In comparison to deer impact, how responsive is the park to other types of local concerns?

    a. How do you feel about the park's responsiveness to these concerns?

11. Please describe the types of interactions you typically have with park staff.
12. Do you believe the park makes good decisions about resource management? Why or why not?

13. Have you acted to influence decision-making at this park? Why or why not?

    If yes:

    a. Please describe your activities and the topics or issues.

    b. Which activities were most effective?

14. Have you ever given input or participated in public meetings or other scoping processes related to park decision-making?

    If yes:

    a. Please describe your participation/input.

    b. Why did you participate?

    c. Do you believe that your input made a difference in park decisions? Why or why not?

    d. What was the best/most effective part of the process?

    e. What could be improved?

    If no:

    a. Did you ever have the opportunity to participate/give input?

    b. Would you like to participate/give input?

    If yes:

    i. How would you like to be notified?

    ii. How would you like to participate?

    c. What could be done to encourage you to participate?

15. Do you have any additional comments that you would like to add?

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