



Everglades National Park Mosquito Risk Assessment Pilot

Results of Focus Groups and Interviews

Natural Resource Report NPS/BRMD/NRR—2010/189



ON THE COVER

Everglades National Park District Ranger Tony Terry in Flamingo, responding to visitors locked out of their car.
Photograph courtesy of Everglades National Park.

Everglades National Park Mosquito Risk Assessment Pilot

Results of Focus Groups and Interviews

Natural Resource Report NPS/BRMD/NRR—2010/189

Kirsten M. Leong

National Park Service
Biological Resource Management Division
1201 Oakridge Dr., Suite 200
Fort Collins, CO 80524

April 2010

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

The National Park Service, Natural Resource Program Center publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Technical Report Series is used to disseminate results of scientific studies in the physical, biological, and social sciences for both the advancement of science and the achievement of the National Park Service mission. The series provides contributors with a forum for displaying comprehensive data that are often deleted from journals because of page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report are those of the author(s) and do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the National Park Service.

This report is available from the Biological Resource Management Division (<http://www.nature.nps.gov/biology>) and the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/NRPM>).

Please cite this publication as:

Leong, K. M. 2010. Everglades National Park mosquito risk assessment pilot: results of focus groups and interviews. Natural Resource Report NPS/BRMD/NRR—2010/189. National Park Service, Fort Collins, Colorado.

Contents

	Page
Tables.....	iv
Executive Summary	v
Introduction.....	1
Methods.....	2
Findings.....	3
Primary impacts.....	4
<i>Health</i>	4
<i>Safety</i>	6
<i>Other impacts</i>	6
Self-efficacy actions and their collateral impacts.....	7
<i>Adapting routines</i>	7
<i>Use of PPE and other actions</i>	8
<i>Collateral impacts</i>	8
Societal-efficacy actions and their collateral impacts	9
<i>PPE</i>	9
<i>Insecticides</i>	10
<i>Other actions</i>	12
Discussion	13
Literature Cited	17
Appendix I: Background information and question guide.....	19

Tables

	Page
Table 1. Proposed activities for mosquito risk assessment.	2

Executive Summary

The National Park Service (NPS) Office of Public Health, Biological Resource Management Division, and Everglades National Park are conducting studies to learn more about risks to employees and residents in Everglades National Park from interactions with mosquitoes and mosquito management. As part of this work, a series of focus groups and interviews were conducted in the park from June 8-12, 2009. Focus groups were audio recorded and transcribed, and interviewees were given the option opt out of audio recording. Discussions followed a questioning guide, with room for elaboration on other associated topics interviewees wished to discuss. Interviews were analyzed with respect to perceptions of: (1) impacts from mosquitoes and mosquito management, (2) self-efficacy actions, measures that individuals can use to reduce their personal risk from mosquitoes, (3) societal efficacy actions, efforts by NPS to reduce employee exposure to risk from mosquitoes, and (4) collateral impacts related to the choice and implementation self-efficacy and societal efficacy actions.

Key findings:

- Perception of risk from mosquitoes generally focused on immediate risks of being bitten, ranging from nuisance to distraction to potential safety hazard, and included informal assessments of trade-offs between potential measures that could reduce the likelihood of being bitten and the collateral impacts of those measures.
- Collateral impacts from most protective measures were described as inconvenient but acceptable, with the exception of protective measures that involved chemicals (i.e., repellents and insecticides). While some were unconcerned about potential health effects from these chemicals, others believed risks from chemical exposure were worse than risks associated with mosquito bites.
- Risk perception includes assessments of both “hazard” (probability of harm) and “outrage” (emotional response). Existing human health and safety statistics indicate that hazards associated with mosquitoes are low. Interviewees identified actions NPS can take to reduce outrage factors, by improving certainty, controllability, and reducing dread.
- Interviewees acknowledged variation in individual levels of tolerance and desired a suite of tools they could use to control exposure to risk, based on individual preferences. These included providing: a range of PPE for all employees, with information outlining pros and cons of each; information about vector-borne disease risks; and information about any management actions undertaken by NPS and their collateral impacts.
- Interviewees desired greater voice when a decision-making process is initiated and identified lack of trust between divisions and with higher levels of NPS management as impediments in the past. Improving communication could begin to address trust issues and may reveal other potential alternatives that have not been identified to date.

Introduction

Mosquitoes play an important role in maintaining ecosystem balance and, like all wildlife, are protected under National Park Service policy. In subtropical habitats, such as Everglades National Park (EVER), mosquitoes can affect human activities, particularly during the summer months of the rainy season when population density increases significantly. Mosquitoes also are potential vectors for human diseases, including West Nile virus (WNV) infection and Eastern equine encephalitis.

Over the last few decades, EVER has utilized pesticides to temporarily control mosquito populations in residential and other developed areas of the park to varying degrees. Under NPS policy, pesticides should not be used in parks unless certain conditions are met (National Park Service 2006); at EVER, potential conditions that could allow for mosquito management include threats to human health and safety. The disease risk at EVER is generally considered low, based on existing data from surrounding areas of Dade and Monroe counties. However, no data are routinely collected within the park. The NPS Office of Public Health, Biological Resource Management Division (BRMD), and Everglades National Park are examining risks to employees from interactions with mosquitoes and mosquito management, based on data collected within the park. This information will be used to develop a strategy to manage employee and resident interactions with mosquitoes and inform and update Integrated Pest Management (IPM) compliance documents.

Primary collaborating agencies and divisions for the overall project include: National Park Service Office of Public Health, Biological Resource Management Division Human Dimensions of Biological Resource Management Program and Integrated Pest Management Program (IPM), Risk Management Division (RMD), Everglades National Park, Southeast Regional Office (SERO); U.S. Geological Survey (USGS); Florida Department of Health, Miami-Dade and Monroe county health departments; Centers for Disease Control and Prevention (CDC); and other medical entomologists and arboviral research groups. This group identified three activities that collectively would assess risks and provide the needed foundation for development of a mosquito management strategy: (1) focus groups and key informant interviews, (2) environmental surveys, and (3) site assessments (see Table 1 for full descriptions). The focus groups and key informant interviews are the subject of this report.

The overall project seeks to achieve three objectives; this report address portions in bold:

1. Describe the assessed and **perceived risks** from living and working with mosquitoes at EVER;
2. Describe **knowledge and practices of park employees** regarding risks associated with mosquitoes and their prevention; and
3. Determine the **need/support for and feasibility** of developing a mosquito-borne disease monitoring and risk communication program at EVER.

Table 1. Proposed activities for mosquito risk assessment.

Activity	Description	Status
Focus groups and key informant interviews	Among EVER managers, employees required to live in park housing, and employees who work frequently in the field, focus groups and exploratory interviews were conducted to better understand knowledge, attitudes, practices, and perceptions of risk from interactions with mosquitoes and mosquito management	Complete (subject of this report)
Environmental surveys	At the Flamingo and Pine Island areas of EVER, baseline environmental surveys will be conducted to collect data associated with mosquito-borne disease transmission risk. The surveys will be conducted over a 12-month period and, at a minimum, will measure a) prevalence and seasonal variability of mosquito species, b) landing rates of mosquitoes, and c) if indicated, positivity of select mosquito pools for WNV and other pathogens.	In discussion
Site assessments	Potential areas for mosquito-borne disease surveillance activities (e.g. placement of captive sentinel chicken flocks) at the Flamingo and Pine Island areas of ENP will be identified, evaluated for suitability, and discussed with park managers. The feasibility of conducting dead bird surveillance for WNV also will be explored.	In discussion

Methods

Target audiences for focus groups and interviews were identified by discussions among NPS staff, including: EVER Superintendent, Deputy Superintendent, Chief of Biological Resources; BRMD IPM Program Manager and Human Dimensions Program Manager; Office of Public Health Medical Epidemiologist; and Southeast Region IPM Coordinator. The following target audiences were identified: EVER Division Chiefs, employees who work in remote field settings (e.g., Natural Resource staff, Fire Cache staff), employees living at Pine Island, employees living at Flamingo, and no more than 9 non-federal employees (e.g., concessionaires, volunteers, family members not employed by the federal government).

Four focus groups were held with residents and staff at Pine Island (N=4), Maintenance staff at Flamingo (N=15), Fire Cache staff (N=10), and Natural Resource staff (N=6). A focus group was originally scheduled for Law Enforcement rangers at Flamingo; however, most were new and had not experienced a rainy season. Individual interviews were conducted instead of a focus group. The Information Technology staff were originally scheduled for individual interviews, but ended up participating in a group interview, which served essentially as a fifth focus group (N=3). Eight semi-structured interviews were conducted with individuals or in pairs. Respondents included Division Chiefs who did not participate in focus groups (N=4), Law Enforcement rangers who had lived in Flamingo for at least one rainy season (N=2), and others who were unable to participate in focus groups due to scheduling (N=3). One former Flamingo resident chose to send written responses to questions via e-mail. Potential interviewees received background information and the questioning guide in advance (Appendix I). The question guide relied on open-ended questions, and follow-up questions and probes were used to clarify intended meaning where necessary. Focus groups were audio recorded and transcribed; interviewees had the option to opt out of audio recording, hand-written notes were written up as soon as possible following the interview (within one day). Focus group discussions ranged in

duration from 45 minutes to 1 hour and 45 minutes. Interviews lasted approximately 45 minutes. All but four interviews were audio recorded. All focus groups and interviews were conducted during regular business hours from June 8-12, 2009.

Interviews were analyzed with respect to perceptions of: (1) impacts from mosquitoes and mosquito management, (2) self-efficacy actions, measures that individuals can use to reduce their personal risk from mosquitoes, (3) societal efficacy actions, efforts by NPS to reduce employee exposure to risk from mosquitoes, and (4) collateral impacts related to the choice and implementation self-efficacy and societal efficacy actions. For the purposes of this report, impacts are defined as the socially-determined important effects of events or interactions involving mosquitoes, humans and mosquitoes, and mosquito management interventions (Decker, Brown, and Siemer 2001). Wildlife managers distinguish between primary impacts, which result from interactions between people and wildlife, and collateral impacts, which are created by the choice and implementation of management actions designed to address primary impacts (Decker et al. 2009). Perceived risk has been defined as “hazard + outrage” (Covello and Sandman 2001), where hazard refers to the amount of harm likely to occur and outrage refers to the emotional response. Both were included in types of impacts identified. Self-efficacy refers to a person’s belief that he or she can take some adaptive response to reduce personal risk, whereas societal-efficacy refers to knowledge of actions that societal entities can take to reduce exposure to risk (Evensen and Clarke 2009). Self-efficacy actions thus encompass any practices used by individuals to reduce their exposure to mosquitoes or impacts related to mosquitoes, while societal-efficacy actions include actions taken by NPS on behalf of employees.

Transcriptions and interview notes were analyzed for common themes using qualitative research analysis software Atlas.ti (version 6.1.8, Scientific Software Development GmbH, Berlin). An iterative process generated codes as thematic concepts and categories emerged in the interviews. Codes were assigned to incidents, i.e., segments of text (Corbin and Strauss 1990), in the first interview as themes appeared. Each of these codes was then applied to text from the next interview. If the next interview introduced new themes, they were added to the coding scheme and previous interviews were re-scored to assure that codes were applied uniformly. One incident could contain multiple codes, for example, the incident, “There’s not much you can do. Wipe poisonous chemicals into your skin or wear a, extremely hot ...garment,” contains the codes “collateral impacts—barriers” and “collateral impacts—repellents (health concerns).” Throughout the coding process, incidents were sorted to reveal key concepts, relationships between them, and the broader phenomena they described, as steps in fine-tuning the coding scheme. A single researcher performed all coding and analysis, with the intent that validity of the findings from this study will be reviewed by interviewees and assessed in future discussions with managers. Interviewees reviewed the initial draft report for accuracy and clarity of concepts.

Findings

Research was conducted towards the beginning of the rainy season. Mosquito conditions in the park and in park housing at the time were similar to what would be expected in a country in the tropics with limited development. Mosquito densities were high enough that a significant number follow people into cars, buildings, and houses and become trapped there. A few live mosquitoes were always present in any enclosed area, as were signs of mosquitoes squashed on walls.

To situate discussions, respondents were asked to compare current conditions to typical conditions they experienced. Most agreed that while there were certain areas of the park where conditions were comparable, densities in general were lower than what is typical during the height of the rainy season. Respondents described times of high mosquito density when they could not recognize co-workers because their faces were black with mosquitoes, and times when their yellow nomex shirts had become black. They also referred to a “5 mosquito day,” when one might inhale 5 mosquitoes at once at any given time.

All interviews and focus groups identified multiple primary and collateral impacts, and many interviewees explicitly talked about trade-offs between the potential efficacy measures that could reduce primary impacts and the collateral impacts of those measures. Each of these areas is summarized below.

Primary impacts

Key primary impacts included concerns about health, safety, lifestyle, nuisance, work efficiency, and relationships with visitors. Less frequently mentioned impacts included concerns about pets and native wildlife (mentioned in fewer than 5 interviews/focus groups).

Health

Potential for disease transmission was identified as a potential impact in all interviews and focus groups, although most perceived low disease risk because the symptoms/consequences of diseases known to be present were not distinguishable from a common flu. Interviewees identified West Nile virus and eastern equine encephalitis as diseases known to be in the area and many stated that they might be more concerned if they were in a demographic group that was known to be at high risk for consequences of the disease. Notably, some employees living in park housing have elderly relatives living with them, for whom this could be a concern. Young children were less of a concern for residents at Flamingo because park housing conditions were seen by most as incompatible with having a family (distance to town, schools, hospitals; lack of child care).

Some compared West Nile virus to other diseases as rationale for their low or high perceptions of risk. One interviewee thought that park employees were likely exposed to greater risk from Hanta virus due to rats in buildings than any mosquito-borne illnesses. Others named diseases such as Lyme disease, malaria, Dengue fever, and yellow fever as examples of vector-borne diseases that would be of higher concern if present due to the greater consequences from contracting them. Some interviewees were concerned about the potential risk from these diseases with low probability of occurrence, but high consequences if contracted. While these diseases were not known to be present in the park, interviewees were concerned that the high level of international visitation could bring diseases like H1N1 or malaria. They believed that the sheer number of mosquito bites they received (described by some as 200-300 per day; however, other interviewees believed this number was excessively high or low) increased their risk for a rare transmission. Some mentioned concerns about blood-borne pathogens in general, noting that these concerns were heightened after killing a mosquito that results in a contact with someone else’s blood. One person mentioned that even though she knew intellectually that HIV cannot be transmitted that way, it was still her instinctual reaction whenever she killed a mosquito and saw blood. While not a disease risk to humans, some also were concerned about increased risk for heartworm for dogs, as many park residents have pets.

Many interviewees believed they did not know enough about the various diseases, in terms of prevalence and transmission pathways, and relied predominantly on the media, especially television, for their information. A few interviewees mentioned briefings and other information provided by the park, and one person even mentioned a West Nile virus fact-sheet that their division used during employee orientation. However, most interviewees did not remember receiving much information from the park or indicate that they had sought information from the park.

In addition to diseases, interviewees described other health impacts. Many discussed reactions to mosquito bites. Some believed that the prolonged reaction to mosquito bites made them worse than bites from other insects such as deer flies whose bites hurt for only a short time. Others mentioned developing a sensitivity to mosquito bites over time, with allergic reactions ranging from large welts that lasted up to a month to physiological effects similar to a flu. On the other hand, some described developing a resistance to mosquito bites, and even noticed reduced reactions by the end of a season. Some desired information on how this resistance develops.

More notably, almost every interview and focus group discussed psychological impacts. They described mosquito conditions as being overbearing, depressing, requiring constant mental preparation and strategizing, and resulting in a siege mentality and hopelessness. Interviewees explained:

“But after living here for six months I couldn’t wait to leave. I was like, all right, I’m going to get my own place outside the park. Because I actually felt like my nerves were shot. Like if I got bit by one more mosquito I would actually kind of run and hide screaming...”

“...you just do the best you can. I mean, there’s nothing that you can do to compensate, I don’t believe. I mean, take breaks and maybe not work as hard, you know, go in and out of vehicles to get away from them, keep your sanity a little bit.”

These descriptions reflect a feeling of dread associated with mosquitoes, the rainy season, and lack of control over conditions. This knowledge of what to expect led to psychological impacts from mosquitoes, even when interviewees were not physically exposed to them:

“It’s just the knowing of the aggravation that’s going to come. It’s just, it’s an aggravation that you can’t do anything about, but it’s sooo, it can get so intense, like... doing hurricane set up last year to close the park, there was no wind whatsoever and it was super humid, and it was just, it was an *awful, awful* night. We were all so crabby because the mosquitoes were just so bad. And it’s that kind of, it’s just like an apprehension of knowing that aggravation’s coming.”

“The feeling of dread comes from the knowledge that you will be constantly under attack, that no matter what you do, you will get bitten every day and suffer every day until the end of the rainy season.”

Many noted that there were field conditions that they accepted as part of their conditions of employment, but that were harder to handle when they came back to the office or park housing. They believed they could mentally prepare for and tolerate mosquito conditions in the field but

were less able to tolerate similar conditions when they came in from the field to a developed area that is already unnatural—for example, mosquitoes at their desk or biting in the bathroom. In addition, some noted that people who live outside of the park know they will have a psychological break when they leave work for the day, while those who live in park housing do not. Even those who did not live in park housing remarked that mosquitoes were a constant during the rainy season:

“It was unrelieved torture, because even though I was able to get away from the park at the end of every day, you still itched from the bites you got at work. I also still have scars from where I accidentally scratched too hard. Even on the weekend you itched. It is a torment you can't escape.”

Safety

Almost all interviews and focus groups discussed safety impacts. Most of the staff interviewed work outside or in buildings that cannot be fully enclosed. For the most part, safety concerns were related to the distraction caused by mosquitoes that magnified work hazards, e.g., working with heavy machinery, electrical boxes, motors, and power tools, all of which require focused attention to avoid accidents. While few substantial accidents have been recorded, interviewees described many potentially severe near misses as well as a generally higher threat of a significant accident due to the constant distraction caused by mosquitoes. Other safety concerns included car accidents, trips/falls, and other types of accidents, also amplified by distracting conditions. As described by one interviewee, “It’s not life-threatening, but you make poor decisions. It’s a safety hazard, you run. It’s like a swarm of bees. You’re getting out of there, you’re not paying attention to what you’re doing.”

Interviewees acknowledged that many of these accidents were not reported to the park, for a number of reasons. First, in some cases interviewees were too embarrassed to report accidents. One even said,

“I’d rather not be on the list for doing something dumb. Plus, you have to explain to the board how you could have done your job better. I could have not run up the stairs in my flip flops. If you’re going in front of the board, you want it to be for something that isn’t dumb.”

Others did not want to deal with the paperwork for reporting accidents, or feared that if they reported every mosquito-related injury they would be seen as a liability and their job could be at stake. Some mentioned that in the past, injuries were never attributed to mosquitoes but were considered the fault of the employee.

Members of law enforcement also were concerned about distractions during required safety checks of equipment and vehicles, including preparation of rescue vehicles. They believed that they were not always as thorough as they might be in this process because of the mosquito conditions.

Other impacts

Lifestyle and nuisance impacts also were noted in almost all interviews. Lifestyle impacts refer to restrictions in lifestyle attributed to mosquitoes. Residents were frustrated at the major alterations they had to make in their lifestyle just to complete seemingly simple tasks like

bringing in groceries, washing/working on cars, walking dogs, and jogging or other physical activity (often, but not always related to physical training requirements). They felt like they could never relax on their day off. Some took offense at people calling mosquitoes a “quality of life” issue. They believed that it was not about *quality* of life but rather being able to have a semblance of a life. Many described the rainy season as the end of social interactions and enjoyment of the park. Some even said that with “...year-round residence you’re not ever comfortable, just halfway normal,” and, “You’re a prisoner in your own house for the summer.” It was especially claustrophobic for those living in RV’s. While most acknowledged the seasonality of mosquito impacts, they did not necessarily have expectations for a different lifestyle during that season and desired the ability to spend time outside, picnic, barbeque, or other activities typically associated with summers in the United States. Only a minority of interviewees drew the analogy between summers in South Florida and winters in the northern U.S.: you hunker down and don’t go outside. In addition to mosquitoes, the heat, humidity, and constant threat of hurricanes also were cited as making life difficult during that time of year.

Most interviewees also described nuisance from mosquitoes. Nuisance was distinguished from other impacts as reference to annoyance, irritation, and other terminology that described mosquitoes as bothersome. Nuisance occurred in many contexts, but was generally used as a descriptor of conditions, rather than as a reason for mosquito management.

Half of the interviews and focus groups included descriptions of impacts to work efficiency due to mosquitoes. These included a need for more frequent breaks, fewer hours spent in the field during the rainy season, accidents with machinery, less thorough maintenance of equipment, and tasks that are abandoned before completion.

Almost half of interviews and focus groups mentioned impacts to relationships with visitors, such as reduced visitation and enjoyment of the park during the rainy season. However, interviewees did not go into the same level of depth for this topic as with the other topics described above.

Self-efficacy actions and their collateral impacts

Staff used a number of measures to protect themselves from mosquitoes. Almost all interviews and focus groups included discussion of: adapting routines; use of bug jackets, long sleeves, or other barriers; and use of personal repellents. More than half of the interviews and focus groups mentioned bug-zapping racquets, and half included driving practices to expel mosquitoes from cars or efforts by employees to learn about conditions in the park prior to accepting their positions. Less frequently used actions included use of fans, dragonfly beepers and light zappers (both described as ineffective), mosquito bed nets, and insecticide.

Adapting routines

The most frequently described tactic was adapting routines to reduce exposure to mosquitoes, either by changing the timing of routines, or by doing things differently. For residents, this was a distinguishing factor between the work week and weekends—during time off, they had more flexibility to alter their routines depending on mosquito conditions. Others cited the ability to alter routines as the difference between their position and maintenance or law enforcement. For those who worked in offices, they felt that at least they had some relief, whereas other positions had less control over their work environment. Adaptations included: avoiding being outside at

dawn and dusk in general; entering buildings in stages (e.g., porch first, keeping doors shut between sections in office buildings, not using entrance doors that are heavily shaded or otherwise provide good mosquito habitat); taking more breaks; keeping indoor temperatures cold to keep mosquitoes sluggish; exercising indoors; planning errands for times of day with fewer mosquitoes; only unloading perishable groceries right away and leaving non-perishables in the car until the middle of the day; consolidating trips to and from the car to spend less time outside; and moving more quickly when outside.

While adaptations to mosquitoes generally were described as an inconvenience, they also served as a form of solidarity and a way to identify those with more experience at the park, especially in contrast to inexperienced visitors. One interviewee even described an unspoken social etiquette that evolved around mosquitoes at Flamingo:

“For example, if you have a guest over for dinner and they’re a good guest, they run straight into you house and slam the door. If you know someone is coming over, you leave the door open and they don’t knock or anything, they just run from their car into the house. You turn on the porch light, set the fan facing outside to blow out of the house. If you’re the guest, as soon as you get in, it’s your job to swat away any bugs you brought in with you. That’s the hallmark of a good guest.”

Use of PPE and other actions

Use of barriers such as long sleeve shirts, long pants, and bug jackets was the next most frequently described approach to protection. Almost all interviewees used bug jackets. There were differing opinions on which type of bug jacket was most effective (number of layers of mesh, fineness of mesh, etc.), which seemed to correspond to different work conditions (amount of time outside, exposure to heat, exposure to plants likely to rip fabric), as well as personal preference.

Mosquito bed nets were only mentioned by two park residents, although a number of interviewees described nuisance or dread from mosquitoes buzzing or biting at night. While bed nets typically are used where malaria or other fatal mosquito-borne illnesses are prevalent, these interviewees pointed out the effectiveness of bed nets in providing a good night’s sleep.

Individual use of insecticide appears low. It was mentioned by only three individuals, all in the context of park housing. All mentioned insecticide spray, one also burned mosquito coils that contained insecticide. Others in the focus groups did not corroborate use of insecticides, and one person countered that mosquito coils were not supposed to be used inside. For the interviewee who used mosquito coils, protection against mosquito bites was deemed more important than potential health impacts from the smoke.

Collateral impacts

Adaptation of routines, use of mechanical devices (bug-zapper racquets, fans) and mosquito nets, and efforts to learn about conditions in the park before arrival did not have any appreciable collateral impacts. That is, interviewees did not identify negative side effects from practicing any of these activities. There were some collateral impacts from personal barriers, namely heat exhaustion and reduction of the senses—added layers exacerbated already hot and humid conditions and head nets made it difficult to see and even breathe. Interviewees compensated for

these constraints by drinking more water, taking breaks, and zipping jackets or putting on hoods only when conditions became unbearable. All of these counter measures were described as inconvenient, but acceptable.

On the other hand, use of personal repellents (especially those containing DEET) was almost always described with reservations about potential side effects. Often, the collateral impacts of repellents were believed to be worse than the relief they provided. Many interviewees relied less on repellents the longer they worked at the park, either because they had different concerns about prolonged exposure than short-term use, or because of personal experience that made them question potential health impacts. Typical experiences that affected use of repellents containing DEET were both physiological (e.g., lips going numb, insomnia, dizziness, headaches, or other nervous system effects), as well as observations of what it could do to other objects (e.g., melting plastic, removing paint). Most interviewees relied more heavily on other self-protective measures and utilized repellents containing DEET only when “it’s really bad,” although this threshold varied by personal tolerance.

There were varying assessments of “natural” or non-DEET repellents. Some stated that they did not work, while others believed they worked well. Still others said they worked but had to be applied more frequently. These differing opinions are likely due to differential working conditions, as well as different levels of personal tolerance. For example, many with more favorable assessments of non-DEET repellents spent more time in offices where the density of mosquitoes is lower. It also appeared that some interviewees did not mind applying non-DEET repellents more frequently, while for others the duration of relief factored more strongly in determination of effectiveness. Some interviewees were sensitive to chemicals or preferred not to use any type of repellent on their bodies.

Collateral impacts also were almost always associated with the “Flamingo flush,” driving with doors or windows open to expel mosquitoes out of the car, which was mentioned in seven interviews/focus groups. There were differing opinions as to the effectiveness of this practice, but most described it as unsafe and widespread.

Societal-efficacy actions and their collateral impacts

Interviewees also discussed actions NPS had or could put into place to protect employees from mosquitoes. Interviewees offered opinions about desired actions as well as actions that NPS had tried but were not seen to be effective, or practices currently in place that interviewees did not agree with. Almost all interviews and focus groups mentioned providing personal protective equipment (PPE) and spraying insecticide, and over half the interviews and focus groups mentioned mosquito magnets and improved communication/education. Other commonly identified actions included improving maintenance of buildings, providing mechanical devices such as fans or blowers, and providing staff with accurate expectations for working/living conditions. Less frequently mentioned actions included altering work routines based on seasonal conditions, considering building design, and offering voluntary disease testing for employees.

PPE

EVER supplied PPE, namely bug jackets and repellents, for employees whose job functions included a significant amount of time outside. Each division was responsible for providing these safety items, and each approached the task differently. Some divisions allowed employees to

choose the type of bug jacket they preferred, others bought a standard type that was distributed to employees. Some supervisors only learned about the option to purchase bug jackets through word of mouth. The park typically did not provide bug jackets for staff who worked primarily in office settings, although many bought personal bug jackets when they were not provided. Both field and office staff described days when they would wear bug jackets at their desks due to high concentrations of mosquitoes indoors.

All repellents purchased with federal funds must be on a list of products approved by the national IPM Coordinator. Pesticide Use Proposals (PUPs) for each repellent are submitted annually by the park IPM Coordinator for approval by the regional or national IPM Coordinator. Repellents with and without DEET were approved for use at EVER, but most interviewees were unaware that any repellents without DEET had been approved. In addition, the park IPM coordinator was open to submitting additional items for approval but did not receive many requests for new products even when she solicited them. Most interviewees purchased non-DEET repellents on their own, without using NPS funds. Some interviewees suggested adding the bug-zapping racquets as an additional approved safety items. These items are currently bought as personal items, but were common in almost all offices visited. Many staff kept one in the office and one in their car. In some work groups, employees organized bulk purchases of the racquets to reduce costs.

The only collateral impact from NPS purchasing PPE was related to differential treatment of staff based on work function. This was not a common concern, although some suggested that providing the option of PPE for all staff, not just field staff, would be appreciated: “I think that it would be really nice for the park to buy each of the employees a bug jacket and the racquet if that’s what they want...If it makes them feel personally better that they can concentrate when they get to the office...” In addition, one interviewee noted that for incidents such as hurricane preparedness all staff are called on to work outside. Extra PPE may or may not be available for those who do not have it as standard issue, but could be provided with some advanced planning.

Insecticides

Insecticide spraying, on the other hand, often was discussed within the context of collateral impacts, primarily ecological impacts and health impacts. Interviewees did not universally support or oppose spraying, and many offered beliefs about severity of collateral impacts to support their position. Ecological impacts were discussed in 10 out of 14 interviews and focus groups. Effects on butterflies was mentioned the most, likely because concerns from the North American Butterfly Association initiated the scrutiny of the park’s spraying program. Proponents of spraying were unconvinced of effects on non-target organisms, or believed that the effects were not severe enough to warrant reduction in spraying. They also voiced the opinion that opponents of spraying cared more about the butterflies than the people who worked to keep the park together. This belief appeared to reflect a lack of trust and communication between divisions in general. Similarly, some proponents of spraying desired participation in studies that evaluate environmental impacts of actual practices at EVER as they did not trust results of studies that had been conducted under different conditions. Opponents of spraying were concerned about effects on butterflies as well as other non-target organisms, including other insects and crocodiles. In addition, a number of interviewees mentioned concerns about spraying insecticides so close to water.

Discussions of health impacts from spraying insecticides occurred almost as frequently as discussions of ecological impacts. Yet, unlike ecological impacts, beliefs about health impacts, when expressed, were uniformly negative. Some were concerned about the cumulative exposure to chemicals from repellents and insecticides, others were concerned about being exposed to insecticides against their will. Others also mentioned concerns about health of pets. While they did notice a reduction in mosquito density after spraying, they preferred exposure to mosquitoes over exposure to chemicals:

“I just have haunting memories of them fogging right under my window as I was waking up in the morning, and the windows weren’t completely sealed, and I know it’s not the best chemical in the world to be inhaling, and to me it was a tough tradeoff for a half hour of keeping mosquitoes away.”

Many of these interviewees noted a lack of available information about risks from the insecticides that were being used. They suggested that if spraying was going to occur, MSDS sheets and a spraying schedule should be available in residences so that employees could make informed decisions about potential risks and alter their routines (or not) depending on their comfort level with exposure to the specific pesticides used.

Insecticide spraying was described by most as reducing mosquitoes noticeably for half an hour to two hours, with some who believed the effect lasted all day (i.e., although numbers increased throughout the day, it would be worse if no spraying occurred in the morning). Most residents described this time period as providing a window of opportunity that could be used to schedule daily routines—taking out the trash, walking the dog, bringing in groceries, etc. For many, this window of opportunity was psychologically very important. Some believed that regardless of actual effectiveness in reducing mosquitoes, spraying boosted morale and sent a signal to employees that NPS was watching out for them. Those who did not agree with spraying cited the small window of effectiveness as a reason not to spray, while those who desired spraying cited the small window of effectiveness as indication that significant impacts to non-target organisms were unlikely.

No one advocated spraying insecticides beyond the developed areas of the park. As one interviewee explained,

“I definitely recognize that we need to have mosquitoes here in the park, they’re part of the food chain, and they’re essential...this place wouldn’t be here without them...I certainly don’t think that we should spray everywhere, it’s just where we have people and are expecting them to do certain jobs.”

A few spoke of mosquitoes as protecting the park from development:

“Most of us acknowledge that the great protector of the Everglades is not the National Park Service but mosquitoes. South Florida would have been completely overrun with humans before we got here if it was a nirvana, but it isn’t. So, it’s a cruel relationship we have with them.”

Many emphasized the small area of the developed zones in comparison to the rest of the park, and some pointed out that these areas were already environmentally degraded. Some voiced

concerns that if visitors discovered that the park was spraying insecticides for employee safety, they would put pressure on the park to spray for visitors. Some thought this was a justification to spray all developed areas, others thought this would not be an issue if there were very specific criteria that were used to determine where and when spraying occurred. A few were concerned that if spraying were discontinued there would be an increase in the use of unregulated pesticides by staff. One interviewee believed that “If they stopped spraying, people would likely take things into their own hands. That could be worse because then you would have untrained people putting God-knows-what, unregulated, into the environment.”

Other actions

Mosquito magnets were mentioned in nine of 14 interviews and focus groups, and always as an example of something the park had tried but that did not work. They are designed to attract mosquitoes away from an area where people will be spending time outside. At EVER, the mosquito density was great enough that although the magnets succeeded in attracting mosquitoes, there were enough replacement mosquitoes that no relief was provided. In addition, the bags filled up quickly, clogging the machinery. While interviewees appreciated the attempt by the park to try other techniques, they were frustrated at the amount of money that was spent on mosquito magnets that turned out to be ineffective. Thus, one collateral impact related to mosquito magnets was a decrease in credibility of decision makers who chose to purchase large numbers of the magnets before determining their effectiveness under park conditions.

Improved communication or education and training were identified as needs in relation to a number of topics. One set of suggestions focused on providing information to help staff make informed decisions about personal exposure to risk. Desired information included: availability of various types of repellents as well as side effects; information about insecticides and spraying schedules; and types of mosquitoes present and associated risk of mosquito-borne illnesses, including prevalence, severity, and treatability. Interviewees also suggested improving efforts to help staff form accurate expectations for living/working conditions. Most staff were aware that mosquitoes were, “bad. No, I mean *really* bad,” before accepting positions. However, most believed that even though they had been told, they had no real frame of reference for what to expect. They desired better description of conditions in position descriptions; consistent orientation protocols for new employees that include discussion of conditions as well as information about the pros and cons of various tools available to protect themselves from mosquitoes; and periodic trainings or reminders of the advent of rainy season, similar to the hurricane preparedness updates. One interviewee also suggested that if insecticides will be used in the park, MSDS sheets, a spraying schedule, and this report should be provided for potential employees (especially those with required housing) so they can make informed decisions about accepting the job depending on their comfort level with exposure to the specific pesticides used. In addition, this interviewee believed that employees should be required to sign a waiver that acknowledges their awareness of mosquito conditions and/or park use of insecticides.

Other suggestions included: use of visual aids such as a “mosquito meter” that was used at Flamingo in the past; providing information on any studies that have been done; providing better information about conditions/criteria that were used to determine when and where insecticide spraying would occur; and developing more inclusive research and decision-making processes for mosquito management. This perceived lack of communication reinforced a belief by some that decisions were being made by people who had never been to the park or experienced the

conditions under which staff lived and worked. For example, multiple interviewees noted that the person with the pesticide applicator's license is personally responsible to the state of Florida for pesticide application and should be more involved in the development of spraying protocols or associated research.

Interviewees also identified a number of other actions that would improve physical conditions for staff. These included: improving routine maintenance, such as keeping the grass near buildings short; repairing screens (including screens over air conditioners); and controlling pests, such as the rats that chewed holes in screens in the first place. Others suggested providing fans or blowers, while others mentioned landscaping considerations, e.g., not planting shade trees near building entrances. They preferred the heat to the mosquitoes. All of these actions could be taken immediately and would not require policy or other review. As summarized by one interviewee, "...if [the park] would just do the things that they know they can do, like mow the lawns, fix the screens, provide blowers if requested by a building. Those are things completely within their control that are not as controversial as spraying." Interviewees recognized that these suggestions put additional burden on maintenance staff, but some noted that they would be willing to help with these activities when they had down time between other projects.

Some infrequently mentioned actions also merit consideration. For example, a few interviewees noted that supervisors altered work routines based on seasonal conditions where possible. There may be additional situations where this kind of reprioritization is possible. Similar to the discussion of landscaping, a few interviewees mentioned building design. They noted that the way some of the older buildings had been designed created micro-habitats preferred by mosquitoes near entrances. They suggested that any new building design, such as the new Visitor Center complex in Flamingo, should take these considerations into account. Two interviewees suggested voluntary disease testing for employees who desired it, perhaps as part of a larger education or morale boosting event that indicates to staff that the park recognizes the conditions employees endure during the rainy season. One interviewee also suggested testing mosquitoes for diseases. Finally, one interviewee thought that alternatives had not been explored enough, that people assumed too quickly that there was nothing else that could be done.

Discussion

Interviewees identified multiple dimensions of risk from living and working in high densities of mosquitoes. While many initially suggested reasons they believed the park should or should not consider insecticide spraying, they also identified a number of other actions the park could initiate immediately that would reduce contact with mosquitoes or improve employee confidence in their ability to protect themselves adequately. In addition, they identified a number of information needs, ranging from the pros and cons of potential tools available to employees or provided by NPS to reduce exposure to mosquitoes (including effects of insecticides on the environment and human health), to risks of disease transmission from mosquito bites.

Perception of risk from mosquitoes generally focused on immediate risks of being bitten, ranging from nuisance to distraction to potential safety hazard, and included individual informal assessments of trade-offs between potential measures that could reduce the likelihood of being bitten and the collateral impacts of those measures. Disease risk was mentioned frequently, but believed to be low by most. For many, an important consideration appeared to be the low

probability and consequences of disease transmission from mosquitoes vs. the certainty of physiological reactions to mosquito bites and collateral impacts from most protective measures. Any collateral impacts from engineering alternatives (e.g., fans, racquets, blowers, landscaping, maintenance), physical barriers (bug jackets, other protective clothing), or communication/education generally were described as inconvenient but acceptable.

On the other hand, there were differing opinions and a broad range of perceptions of risk regarding protective measures that involved chemicals (i.e., repellents and insecticides). While some were unconcerned about potential health effects from these chemicals, others believed risks from chemical exposure were worse than risks associated with mosquito bites. Much of the variation in response was attributed to personal levels of tolerance for risks from mosquitoes vs. chemicals, although many desired more information to help them better assess this trade-off for themselves. They indicated that their comfort level would be greater with information that increased their certainty about (1) health and safety risk assessments for the specific conditions experienced by employees at EVER, and (2) potential negative health impacts from any chemical protective measures.

In addition to uncertainty, a number of other “outrage factors” appeared to play an important role at EVER: uncontrollability, man-made origin, and dread. These outrage factors are generally recognized as contributing to greater perceptions of risk than activities with more certainty, greater controllability, of natural origin, or that are not dreaded, even if the risk hazard (e.g., probabilities of disease, serious injury) is the same (Slovic 2001; Covello and Sandman 2001). Addressing outrage factors can be as important as addressing the hazard itself, especially when hazard probability is low. Control was important in terms of ability to control both exposure to mosquitoes and control over collateral impacts of protective measures. Given the varying levels of tolerance to both sets of risks, interviewees desired access to a broader suite of tools so that individuals would feel empowered to pick and choose those that matched their comfort level.

Mosquitoes were identified by most as only one in a number of cumulative impacts that affected living/working conditions during the rainy season. Others included heat, humidity, and hurricanes, none of which can be controlled under outdoor conditions. Providing protective measures against mosquitoes is the one area where there is potential for NPS to improve outdoor conditions during the rainy season. In residences and offices, heat and humidity are controlled, which may have contributed to the desire for better protection against mosquitoes in these contexts as well. Interviewees also indicated differential tolerance of risk in natural vs. developed areas of the park, and no one advocated spraying outside of developed areas. In natural areas, mosquitoes were more accepted as part of the native ecology. In developed areas, tolerance was much lower and the same risks were less acceptable. Thus, staff are likely to be critical of criteria developed for protection of natural areas that are applied directly to developed areas. Engaging staff in dialogue that contributes to determining appropriate criteria would address this concern as well as build trust between divisions, especially since many felt that they lacked voice in decisions that affected their lifestyle and working conditions.

Lack of control also may be linked to perceptions of dread (Slovic et al. 2005). Dread is associated with risks that evoke fear, terror, or anxiety, which have been shown to be judged as greater risks than activities that do not arouse such feelings or emotions (Covello and Sandman 2001). As previously noted, these emotional reactions were present in almost every interview

and focus group. Residents described a constant state of dread throughout the rainy season, with mental preparation and strategizing as a part of life. The “window of opportunity” provided by insecticide spraying appeared to be as important in providing a break from the dread associated with mosquitoes as providing reduction in mosquito density, as observed by interviewees who described this activity as boosting morale. Improving maintenance and landscaping to more effectively keep mosquitoes out of buildings or developing other activities that provide a psychological break also would be appreciated.

While most interviewees acknowledged seasonality of mosquito impacts, in general, they did not speak of expectations that were in line with actual living and working conditions. Many acknowledged that they were aware there would be high densities of mosquitoes when they accepted their position, yet, after they arrived realized they had no frame of reference for actual conditions. Providing all employees with mosquito nets for beds, bug jackets, rackets, and repellents would send a signal that living/working conditions in the park are very different than in other areas in the U.S. This information could be included when potential employees are considering a position in the park, so they are clearly aware of the conditions of employment they are accepting. If providing such safety equipment for all employees is cost prohibitive, EVER could at minimum provide all employees with information describing the pros and cons of various options, including approximate costs and how to acquire them.

NPS Management Policies (2006) section 4.4.5, Pest Management, states that native pests will be allowed to function unimpeded unless control is necessary to:

“...conserve listed, rare or unique species or communities...preserve cultural resources, protect plants, animals, and facilities in developed areas; prevent outbreaks of a pest from invading uninfested areas outside the park; manage a human health hazard when advised to do so by the U. S. Public Health Service...or otherwise protect against a significant threat to human safety” (p.48).

The NPS Office of Public Health and Risk Management Program have reviewed available data and did not find evidence of significant human health or safety risks. However, there are areas where additional data could be gathered. Currently, health risks are based on passive surveillance based on county data. Active surveillance to test mosquitoes in EVER would provide more accurate determination of disease risk in the park and would address interviewee desires for better information about exposure to health risks in the park. In addition, resolving some of the conditions that affect safety reporting, such as streamlining reporting procedures and addressing the degree to which increased accident reporting would affect employee retention, are necessary to improve the accuracy of safety assessments.

Because the existing body of science on health, safety, and resource impacts does not support the application of pesticides in the housing and maintenance areas to control native mosquito species under current NPS policy, any consideration of use of pesticides will require policy review and NEPA compliance, which can be a lengthy process. In the mean time, interviewees identified a suite of actions the park can implement immediately that would improve their living/working conditions and would not require policy review. Many of these actions include dialogue or communication between divisions (e.g., joint participation in studies, coordination of orientation

materials), which could begin to address trust and may reveal other potential alternatives that have not been identified to date.

Literature Cited

- Corbin, J., and A. Strauss. 1990. Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology* 13 (1):3-21.
- Covello, V. T., and P. M. Sandman. 2001. Risk communication: Evolution and revolution. In *Solutions to an Environment in Peril*, edited by A. Wolbarst, 164-178. Baltimore, MD: Johns Hopkins University Press. Available at <http://www.psandman.com/articles/covello.htm>. Last accessed February 15, 2010.
- Decker, D. J., T. L. Brown, and W. F. Siemer. 2001. *Human dimensions of wildlife management in North America*. Bethesda, MD: The Wildlife Society.
- Decker, D. J., W. F. Siemer, K. M. Leong, S. J. Riley, B. A. Rudolph, and L. H. Carpenter. 2009. Conclusion: What is Wildlife Management? In *Wildlife and Society: The Science of Human Dimensions*, edited by M. J. Manfredo, J. J. Vaske, P. J. Brown, D. J. Decker and E. A. Duke, 315-327. Washington, DC: Island Press
- Evensen, D. T. N., and C. E. Clarke. 2009. Efficacy Information in Media Coverage of Infectious Disease Risks: An Ill Predicament? Paper read at Association for Education in Journalism and Mass Communication Annual Convention, at Boston, MA.
- National Park Service. 2006. *Management policies 2006*. Washington, DC: National Park Service.
- Slovic, P. 2001. The risk game (Reprinted from 'The risk game'). *Journal of Hazardous Materials* 86 (1-3):17-24.
- Slovic, P., E. Peters, M. L. Finucane, and D. G. MacGregor. 2005. Affect, risk, and decision making. *Health Psychology* 24 (4):S35-S40.

Appendix I: Background information and question guide

The National Park Service (NPS) Office of Public Health and Biological Resource Management Division (BRMD) and Everglades National Park (EVER) are conducting studies to learn more about risk to employee health and safety from interactions with mosquitoes. As part of this work, we would like to learn more about employee perceptions, attitudes, and practices related to mosquito management in EVER to inform future management. You were selected as a possible participant because you live in a community in EVER or work in backcountry conditions.

Kirsten Leong, BRMD Human Dimensions Program Manager, will be conducting focus groups and interviews in the park from **June 8-12**. Focus groups will be audio recorded and transcribed, interviewees can opt out of audio recording. Discussions will follow the questions outlined below, with room for elaboration on other associated topics you wish to discuss.

If you would like to participate, please sign up for one of the available times with Janice Lynch.

Question guide:

1. What is the first thing that comes to mind when you think about mosquitoes at EVER?
2. Please describe the living/field conditions at EVER with respect to your interactions with mosquitoes.
 - a. How do these conditions compare to your expectations when accepting your position/housing situation?
3. What concerns do you have, if any, related to your interactions with mosquitoes at EVER?
 - a. How have your concerns changed over time?
 - b. How are they different in work/non-work settings in EVER?
 - c. How are they different from concerns when in other areas of south Florida?
4. What do you do to protect yourself from being bitten? Why or why not?
 - a. How did you learn about or decide to use these practices?
5. What would help you better protect yourself from mosquitoes?
6. What does NPS do to protect you from mosquitoes?
 - a. How effective are these measures? Why or why not?
 - b. How do these measures affect your lifestyle (positively and/or negatively)?
 - c. How satisfied are you with the level of protection provided by NPS? Why?
7. What could NPS do better to ensure you are adequately protected against mosquitoes?

Background: Mosquitoes play an important role in maintaining ecosystem balance and, like all wildlife, are protected under National Park Service policy. In subtropical habitats, such as Everglades National Park (EVER), mosquitoes can affect quality of life, particularly during the summer months, when dense populations significantly affect human activities. Mosquitoes are also potential vectors for human diseases, including West Nile virus infection and Eastern equine encephalitis.

EVER is developing a pilot project to examine the impacts of mosquito spraying in developed areas when specified criteria have been met. NPS policy allows for the implementation of mosquito management actions when the threat of mosquito-borne diseases is imminent. At EVER, the disease risk is generally considered low, based on existing data from surrounding areas of Dade and Monroe counties. However, no data are routinely collected within the park.

Overall project objectives: We are conducting public health and environmental surveys to achieve three objectives. Focus groups and interviews will focus on portions in bold.

- 1) Describe the assessed and **perceived risks** for mosquito-borne disease transmission and identify other risks from living with mosquitoes at EVER
- 2) Describe **knowledge and practices of park employees** regarding mosquito-borne diseases and their prevention
- 3) Determine the **need/support for and feasibility** of developing a mosquito-borne disease monitoring and risk communication program at EVER

Risks and Benefits of Participation: If you decide to participate in these discussions you may encounter the following risks: volunteering your time to participate and not reaping any tangible benefits of the study and being asked potentially uncomfortable questions regarding mosquito-borne disease management in Everglades National Park. You may also experience the following benefits: you will contribute to improving NPS understanding of employee perceptions, attitudes and practices related to mosquito-borne disease management in EVER which will lead to development of a quantitative survey, as well as contribute to management recommendations.

Compensation: You will receive no compensation for your participation in this study.

Voluntary Nature of Participation: Your decision whether or not to participate will not affect your current or future relations with the National Park Service. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

Confidentiality: The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify you. Audio transcriptions and interview notes will be kept in a locked file; only the interviewer will have access to the records. Transcribed interviews will be kept at the BRMD Human Dimensions Program.

Contacts and Questions:

For more information, or if you have any questions, please contact:

Kirsten Leong, BRMD Human Dimensions Program: 970-267-2191, Kirsten_Leong@nps.gov
David Hallac, Chief, Biol. Resources Branch, EVER: 305-224-4239, David_Hallac@nps.gov
Janice Lynch, Ecologist, EVER: 305-242-7867, Janice_Lynch@nps.gov

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 160/102003, April 2010

National Park Service
U.S. Department of the Interior



Natural Resource Program Center
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov