Environmental Consequences

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

This "Environmental Consequences" chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives considered in this *Draft White-tailed Deer Management Plan / Environmental Impact Statement.* This chapter also includes a summary of laws and policies relevant to each impact topic, definitions of impact thresholds (for example, negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative impacts. As required by the Council on Environmental Quality (CEQ) regulations implementing the *National Environmental Policy Act*, a summary of the environmental consequences for each alternative is provided in table 8, which can be found in "Chapter 2: Alternatives." The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in "Chapter 3: Affected Environment."

The Organic Act of 1916 directs the National Park Service to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations.

INTRODUCTION

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and their implementing policies guide the actions of the National Park Service in the management of the parks and their resources — the *Organic Act of 1916*, the *National Environmental Policy Act* and its implementing regulations, and the *Omnibus Management Act*. For a complete discussion of these and other guiding authorities, refer to the section titled "Related Laws, Policies, Plans, and Constraints" in "Chapter 1: Purpose of and Need for Action." These guiding authorities are briefly described below.

The *Organic Act of 1916* (16 U.S.C. 1), as amended or supplemented, commits the National Park Service to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

The *National Environmental Policy Act of 1969* is implemented through regulations of the Council on Environmental Quality (40 CFR Parts 1500–1508). The National Park Service has, in turn, adopted procedures to comply with these requirements, as found in *Director's Order #12* (NPS 2001b) and its accompanying handbook.

The *Omnibus Management Act* (16 U.S.C. 5901 et seq.) underscores the NEPA provisions in that both acts are fundamental to park management decisions. Both acts provide direction for connecting resource management decisions to the analysis of impacts and communicating the impacts of those decisions to the public, using appropriate technical and scientific information. Both acts also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case. Section 4.5 of *Director's Order #12* adds to this guidance by stating, "when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the National Park Service will follow the provisions of the CEQ regulations (40 CFR 1502.22)." In summary, the Park Service must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community. Collectively, these guiding regulations provide a framework and process for evaluating the impacts of the alternatives considered in this draft environmental impact statement.

General Methodology for Establishing Impact Thresholds and Measuring Effects by Resource

The following elements are used in the general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category:

- general analysis methods as described in guiding regulations, including the context and duration of environmental effects
- basic assumptions used to formulate the specific methods used in this analysis
- thresholds used to define the level of impact resulting from each alternative
- methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting park resources
- methods and thresholds used to determine if impairment of specific resources would occur under any alternative

These elements are described in the following sections.

General Analysis Methods

The analysis of impacts follows CEQ guidelines and *Director's Order #12* procedures (NPS 2001b) and is based on the underlying goal of supporting forest regeneration and providing for long-term protection, conservation, and restoration of native species and cultural landscapes at Catoctin Mountain Park. This analysis incorporates the best available scientific literature applicable to the region and setting, the species being evaluated, and the actions being considered in the alternatives.

As described in "Chapter 1: Purpose of and Need for Action," the National Park Service created an interdisciplinary science team to provide important input to the impact analysis. For each resource topic addressed in this chapter, the applicable analysis methods are discussed, including assumptions and impact intensity thresholds. xxx

Forest regeneration — For the purposes of this plan, the regrowth of forest species and renewal of forest tree cover such that the natural forest sustains itself without human intervention.

Assumptions

Several guiding assumptions were made to provide context for this analysis. These assumptions are described below.

Analysis Period

Goals, objectives, and specific implementation actions needed to manage deer at Catoctin Mountain Park are established for the next 15 years; therefore, the analysis period used for assessing impacts is up to 15 years. The impact analysis for each alternative is based on the principles of adaptive management, which

would allow the National Park Service to change management actions as new information emerges from monitoring the results of management actions and ongoing research throughout the life of this plan.

Geographic Area Evaluated for Impacts (Area of Analysis)

The geographic study area (or area of analysis) for this plan includes Catoctin Mountain Park in its entirety. The area of analysis may extend beyond the park's boundaries for some cumulative impact assessments. The specific area of analysis for each impact topic is defined at the beginning of each topic discussion.

Duration and Type of Impacts

The following assumptions are used for all impact topics (the terms "impact" and "effect" are used interchangeably throughout this document):

- *Short-term impacts* — Impacts would last from a few days up to three years following an action.
- *Long-term impacts* — Impacts would last longer than three years up to the life of the plan (approximately 15 years).
- *Direct impacts* — Impacts would occur as a direct result of deer management actions.
- *Indirect impacts* — Impacts would occur from deer management actions and would occur later in time or farther in distance from the action.

Future Trends

Visitor use and demand are anticipated to follow trends similar to recent years. The number of yearly visitors to Catoctin has fluctuated in the past 10 years. Large decreases in visitation from year to year occurred in 1995 (-21.5%) and 1994 (-12.3%), and again in 2002 (-14.1%). However, visitation increased dramatically from 2002 to 2003 (35.7%), and has been increasing since. Visitation has averaged 546,168 from 1994 to 2004. In the absence of notable anticipated changes in facilities or access, a 3% annual increase in visitation is expected over the life of this plan.

Impact Thresholds

Determining impact thresholds is a key component in applying NPS *Management Policies* and *Director's Order #12*. These thresholds provide the reader with an idea of the intensity of a given impact on a specific topic. The impact threshold is determined primarily by comparing the effect to a relevant standard based on regulations, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. In all cases the impact thresholds are defined for adverse impacts. Beneficial impacts are addressed qualitatively.

Cumulative Impacts Analysis Method

The CEQ regulations to implement the *National Environmental Policy Act* require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). As stated in the CEQ handbook, "Considering Cumulative Effects" (CEQ 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on effects that are truly meaningful. Cumulative impacts are considered for all alternatives, including alternative A.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at Catoctin Mountain Park and, if applicable, the surrounding area. Table 25 summarizes these actions that could affect the various resources at the park, and those requiring additional explanation are discussed in the following narrative.

The analysis of cumulative impacts was accomplished using four steps:

Step 1 — Identify Resources Affected: fully identify resources affected by any of the alternatives.

Step 2 — Set Boundaries: identify an appropriate spatial and temporal boundary for each resource.

Step 3 — Identify Cumulative Action Scenario: determine which past, present, and reasonably foreseeable future actions to include with each resource.

Step 4 — Cumulative Impact Analysis: summarize impacts of these other actions (x) plus impacts of the proposed action (y), to arrive at the total cumulative impact (z).

Cumulative Impact Scenario

Past Actions within and around Catoctin

Euro-Americans began to settle in the Catoctin area in the mid-18th century. Timber utilization and farming continued until the creation of the recreational demonstration area, and over the last 250–300 years these activities have influenced the plant communities that now dominate the park, affecting plant distribution, diversity, and abundance. For example, to support the local charcoal industry, large areas of what later became the park were clear-cut about every 30 years from the mid 1700s until the late 1800s. Similarly, parts of the park were farmed, and other portions were burned to encourage blueberry growth (NPS 2004e).

TABLE 25: CUMULATIVE ACTIONS

NOTE: Unless otherwise noted, the time frame for all topics begins in the mid 1800s (when the charcoal industry was peaking) and continues for the life of the proposed deer management plan.

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (15 years)	Alternative A Actions	Alternative B Actions	Alternative C (Preferred Alternative) Actions	Alternative D Actions
Woody Vegetation	Deer home range (½ mile beyond park boundary)	Agricultural lands within park. Logging for charcoal industry and barrel industry and roads to get wood out. Stripped bark from trees for tannery in town. Fire suppression. Previous burning before park established. Past deer management (state and Catoctin). Residential development. Weather events (microburst). Chestnut blight and disease (dogwood anthracnose).	Logging on park boundaries. Fire suppression. Gypsy moth, hemlock woolly adelgid. Deer management in adjacent state park. Invasive plant control. Weather events. Chestnut blight and disease (dogwood anthracnose). Gypsy moth, hemlock woolly adelgid.	Fire suppression with limited prescribed fire. Continuing agricultural use, but decreasing over time. More residential development. Road widening and roadway construction. Utility development. Weather events.	Take no action to control deer population density. Maintain small area fences for specific plant species. Apply repellents to landscape areas. Maintain and monitor existing and new fenced areas. Monitor vegetation plots for seedlings.	Same as alternative A plus: • Reduce deer numbers slowly over time after reproductive control initiated. • Construct 15 large exclosures to exclude deer. • Increase repellent use around buildings and landscaped areas. • Set up clover (or other traps) or dart to capture deer to be treated for reproductive control. • Dispose of deer that die during trapping or handling for reproductive control treatment.	Same as alternative A plus: • Use direct reduction (sharpshooting and capture and euthanasia, where appropriate) to remove deer quickly from park and lower density (468 first year, 50% in subsequent years, 50–100 per year after goal reached). • Set up bait stations to attract deer to safe shooting locations. • Travel to shooting areas. • Set up clover (or other traps) to capture deer to be euthanized. • Establish data collection stations for deer removed. • Process deer and donate to food bank.	Same as alternatives A and C plus: • Use direct reduction (sharpshooting and capture and euthanasia, where appropriate) to remove deer quickly from park and lower density (468 first year, 50% in subsequent years, 50–100 per year after goal is reached). • Maintain population density through reproductive control, with periodic direct reduction if needed. • Increase use of small scale fencing. • Set up bait stations to attract deer to safe shooting locations. • Travel to shooting areas. • Set up clover (or other traps) to capture deer to be euthanized or treated for reproductive control. • Establish data collection stations for removed deer. • Process deer and donate to food bank. • Dispose of deer that die during trapping or handling for reproductive control treatment.
Herbaceous Vegetation	Deer home range (½ mile beyond park boundary)	Gypsy moth, hemlock woolly adelgid. Same as above, except no disease or blights, and no gypsy moth.	Air quality (ozone effects from outside park on sensitive species, e.g., ash, basswood, white pine). Residential development and less hunting. Same as above, except no disease or blights, and no gypsy moth, plus: • Trampling from visitors.	Same as above, except no disease or blights, and no gypsy moth, plus • Trampling from visitors.	Same as above.	Same as above.	Same as above.	Same as above.
Soils	Watershed	Same as herbaceous vegetation.	Same as herbaceous vegetation.	Same as woody vegetation, except no disease or blights.	No reduction in deer population; erosion and sedimentation from loss of vegetation.	Large fenced exclosures. Elimination of deer within exclosures.	Immediate reduction of deer population. Maintenance of viable deer population.	Same as alternative C.
Water Quality	Watershed	Erosion, siltation from development. Cattle (outside and inside park) as related to increased siltation. Wetland creation at Camp Round Meadow. Hunting Creek Dam.	Same as past, except no cattle inside park now, plus: • Hog farm upstream of park	Hog farm(s) seeking expansion. Shifted from cattle to agricultural use/crops and now shifting to residential.	No reduction in deer population; erosion and sedimentation from loss of vegetation.	Large fenced exclosures. Elimination of deer within exclosures.	Immediate reduction of deer population. Maintenance of viable deer population.	Same as alternative C.
White-tailed Deer Herd Health	Deer home range (½ mile beyond park boundary)	Hunting (before park; recreational and subsistence). Reintroduction of deer. Decline in habitat (see Vegetation).	Depredation permits. Roadkills. Decreased number of hunters outside park. Increased development outside park. Return of predators (coyotes and black bears).	Same as current, plus: Predators likely to disappear with increased development. Potential for chronic wasting disease and other diseases. Benefits from prescribed burning for research purposes (habitat)	Same as above plus • Conduct distance sampling surveys.	Same as above.	Same as above.	Same as above.
Other Wildlife	Deer home range (½ mile beyond park boundary)	Same as above for deer, plus • Rabies (raccoons), West Nile virus (birds), other diseases. • Neotropical migratory birds on wintering grounds, habitat loss, collisions with towers.	Same as past, plus: • Effect of cell towers on birds.	Same as past, plus: • Effect of cell towers on birds. • Rabies vaccine (food-laced) outside the park. • Timber rattlesnake could become listed.	Same as above for deer.	Same as above for deer.	Same as above for deer.	Same as above for deer.

TABLE 25: CUMULATIVE ACTIONS (CONTINUED)

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (15 years)	Alternative A Actions	Alternative B Actions	Alternative C (Preferred Alternative) Actions	Alternative D Actions
State Species of Special Concern	Deer home range (½ mile beyond park boundary)	Same as vegetation, plus: • plant collection (which was legal before the park was established and illegal afterwards)	Same as past, plus: • invasive species • water regime (drought) • weather events (microburst)	Same as current.	Continued deer and vegetation monitoring. Maintain existing exclosures around sensitive species and habitats. Small-scale application of repellents. Increased deer browsing from increased deer population.	Same as alternative A plus • Construct large-scale exclosures. • Increased repellent use. • Use reproductive control, when feasible. Long term reestablishment of native plant communities from reduced deer browsing.	Same as alternative A plus • Direct reduction through sharpshooting and capture and euthanasia, where appropriate. • Reestablishment of native plant communities due to reduced deer browsing.	Same as alternative A plus • Direct deer herd reduction through sharpshoot and capture and euthanasia, where appropriate. • Use of reproductive control for maintenance, with periodic direct reduction, if needed. • Reestablishment of native plant communities due to reduced deer browsing.
Archeological Resources	Catoctin Mountain Park	Time period is Woodland Indians and historic period. Same as vegetation except disease and gypsy moth, plus Archeological work was done for more modern utilities but not before 1930s Landfills and small dumps around the park and at Camp Round Meadow. Roads, trails, utilities. Erosion.	Erosion. Camp Misty Mount social trails. Camp Greentop has more defined paths.	Systematic survey of entire park in 2007 could provide more information to justify making entire park a cultural landscape.	Small exclosures.	Large and small exclosures. Possible burial of deer carcasses	Small exclosures. Possible burial of deer carcasses.	Small exclosures.
Cultural Landscapes	Catoctin Mountain Park	Time period is from when Catoctin became eligible for the National Register of Historic Places, illustrating New Deal era of the 1930s: • Deer management or lack of management (no deer). • Catoctin landscaping. • Hazardous tree removal. • Invasive plants and their control. • Removal of elements not part of the original landscape (restoration). • Visitor use, trampling (especially at Camp Misty Mount), social trails.	Same as past.	Same as past, plus: Potential for entire park to be nominated as cultural landscape.	Small-scale fenced areas. Limited repellent use.	Same as alternative A plus: • Large and small exclosures. • Increased repellent use. • Reproductive control.	Same as alternative A plus: • Direct deer herd reduction through sharpshooting, or capture and euthanasia, where appropriate.	Same as alternative C.
Visitor Experience	Catoctin Mountain Park	Lack of vegetation (aesthetics). Transfer of part of park to state and different kinds of visitor experience. Development in park.	Development in park. Cell towers.	Same as current, plus: • 3% annual increase in visitation expected. • Increased pressure for other recreational uses. • Increased scenic driving as opposed to walking.	Continue small exclosures around landscaped areas. Apply repellents. Test for chronic wasting disease, monitor, educate visitors.	Relocate large exclosures throughout the park. Use reproductive control on does. Increased repellent use. Test for chronic wasting disease, monitor, educate visitors.	Use direct reduction of the deer herd (sharpshooting or capture and euthanasia of individual deer, where appropriate). Test for chronic wasting disease, monitor, educate visitors.	Construct small exclosures around landscaped areas. Apply repellents. Use direct reduction (sharpshooting or capture and euthanasia) to decrease the deer herd size. Use reproductive control on does. Test for chronic wasting disease, monitor, educate visitors.
Public Safety	Deer home range (½ mile beyond park boundary)	Past events related to public safety not likely; few game animals to hunt.	Rock climbing. Falling, tripping, slipping. Hunting outside the park.	Same as current.	Continue small exclosures around landscaped areas. Apply repellents. Test for chronic wasting disease, monitor, educate.	Relocate large exclosures throughout the park. Increased repellent use. Use reproductive control on does. Test for chronic wasting disease, monitor, educate visitors.	Use direct reduction of the deer herd (sharpshooting or capture and euthanasia of individual deer, where appropriate). Test for chronic wasting disease, monitor, educate visitors.	Use small exclosures around landscaped areas, Apply repellents. Use direct reduction (sharpshooting or capture and euthanasia) to decrease deer herd size. Use reproductive control on does. Test for chronic wasting disease, monitor, educate visitors.
Socioeconomic Environment (crop damage focus)	Deer home range (½ mile beyond park boundary)	Deer management. Agriculture. Other animal damage.	Same as past, plus: • Private property in surrounding area is leased for hunting.	Same as current, plus: • Biotech crops (genetically engineered).	Educational activities. No other proposed actions considered. Actions will not affect existing crop and landscaping damage.	Large exclosures. Reproductive control.	Direct deer herd reduction through sharpshooting or capture and euthanasia, where appropriate.	Direct deer herd reduction through sharpshooting or capture and euthanasia, where appropriate. Reproductive control.
Park Management and Operations	Catoctin Mountain Park	Designation as park unit and recreational demonstration area. Establishment of presidential retreat. Inflation. Natural disasters.	Same as past.	Same as past.	Construction and maintenance of small fenced areas. Application of deer repellents. Staff required for routine deer management activities (e.g., erecting and maintaining of small exclosures, applying repellents, deer carcass removal, necropsies, conducting spotlight surveys, monitoring vegetation, and organizing volunteers and other agencies to assist in these activities)	Same as alternative A, plus: • Construction and maintenance of large exclosures. • Funding and staff to administer reproductive controls to does. • Increased repellent use.	Same as alternative A, plus: • Funding and staffing required to carry out the direct reduction of the deer herd through sharpshooting and capture / euthanasia, where appropriate. • Funding required for the processing and distribution or disposal of killed deer.	Same as alternative C.

With the establishment of the Recreational Demonstration Area in 1935, land uses changed to recreation and conservation. Farm buildings were removed and fields were allowed to follow natural forest succession patterns. These land uses continue today at Catoctin Mountain Park. However, the park is still bordered by farms and residences that are impacted by deer and the park's deer management actions (NPS 2000a).

Settlement and Development Around the Park

A mountain community developed historically where the terrain and soil could support farming. An east/west road crossed the highland valley at a natural divide, which was the location of a patented property called Round Meadow. By 1800 several early farms were located along what is now Manahan Road. At either end of the road were the small hamlets of Foxville and Lantz (NPS 2000a). Arable lands were converted to agricultural use, which was found almost exclusively on the west side of the park. Clearings were divided into fields for crops or hay and pasture land. Livestock, particularly swine, was allowed to forage in the woods. Until decimated by blight that began in the early 20th century, American chestnut trees were numerous, with the nuts foraged by livestock and collected for income by residents (NPS 2000a).

Large tracts of land that were likely purchased for timber and mineral resources, not for agriculture, were patented above Owens Creek. Cleared fields and pastures were set in a predominantly forested matrix. Local residents owned the timber tracts that surrounded cleared farmland. These tracts were probably less frequently logged than the charcoal furnace's timberland. A few people in the mountain community, usually a sawmill owner or someone involved in timbering or charcoaling, held large forested acreages (NPS 2000a).

In 1850 the average mountain farm property near Foxville consisted of 48 improved acres and 76 unimproved acres. By 1880 property size had decreased to 35 improved acres and 65 unimproved acres, which was when farms devoted solely to growing fruit began to appear (NPS 2000a).

Charcoal Industry

Catoctin's forests were valuable to the burgeoning Industrial Revolution, and the production of charcoal was a substantial enterprise. Extensive logging activities for charcoal production resulted in timber harvest from 11,000 acres of company land during peak years. Old hearths were common since the forest was cut every 30 years during the 96 years that charcoal was used at the Catoctin iron furnace (NPS 2005d). Charcoaling in the mountains declined during the late 1880s and ceased completely some time before the furnace closed in 1903.

Logging

Logging throughout the mountains was heavy and widespread during the early 20th century when as many as 50 logging companies were in operation. Wood was in demand for both the charcoal and barrel industries. After heavy logging, the forests may have reached their limit of profitability. Forest surveys in 1913 indicate that most of the merchantable timber was gone and remaining stands were young (NPS 2000a).

Past Deer Management and Hunting

Although there are no historic records of the deer population specific to Catoctin Mountain Park, it is known that deer herds throughout the eastern United States were heavily exploited after the arrival of Europeans around 1600. By 1790 populations were known to have been low wherever Europeans had settled. Deer populations in the Piedmont Plateau were probably extirpated by the late 1800s (NPS 2004e).

Extirpation — The localized extinction of a species.

By the beginning of the 20th century deer in Maryland survived only in Garrett, Allegany, Washington, and Frederick counties. Deer hunting was prohibited statewide in 1902. Small, protected "seed stock" areas ("deer refuges") were created in hopes of generating population surpluses to overflow onto surrounding lands. Maryland deer and deer purchased from other states served as breeding stock for the refuges. Deer populations began to increase across the state by the late 1920s. As a result of improved habitat conditions and increasing deer numbers, localized regulated deer hunting was re-established in 1927 (MD DNR 1998).

Records from as early as 1927 contain compensation requests from Frederick County farmers for crop damage caused by deer. By the late 1940s, when statewide restocking programs began, deer numbers had decreased in the county. Between 1950 and 1986 the number of deer harvested annually in Frederick County was below 1,000. Between 1991 and 1997 the number of deer harvested annually was between approximately 3,500 and 5,000. In 2002 Frederick County's annual rifle/shotgun deer harvest was 3,948 deer; 4,109 deer were harvested in 2003 (MD DNR data cited in NPS 2004e).

Development within the Park

Developed areas within the park include the visitor center area, the headquarters area, two maintenance yards, a fire cache, Camp Greentop, Camp Round Meadow, Camp Misty Mount, one campground, two picnic areas, and all paved roads. Developed areas have vehicular access and provisions for utilities (NPS 2003d).

CURRENT ACTIONS IN AND ADJACENT TO CATOCTIN MOUNTAIN PARK

Existing Park Plans and Management Actions

Several management actions that have been or are currently being undertaken at Catoctin Mountain Park, and that would continue into the foreseeable future, could affect the health of Catoctin's forests and/or deer management activities. These actions are defined in Catoctin's 2004 *Fire Management Plan,* the 2003 *Hemlock Woolly Adelgid Suppression Environmental Assessment,* the 2003 *Gypsy Moth Suppression Program Environmental Assessment,* and the 2004 update to the *Integrated Pest Management Plan.* In addition, the park has been managing deer under its 1995 *Environmental Assessment for White-tailed Deer Management.* These deer management actions comprise the no-action alternative (alternative A) described in this environmental impact statement.

FIRE. Experts date fires at Catoctin back to 1876. Since then fires have occurred at intervals of 6 to 20 years. Some fires were set by man to burn areas for

increased blueberry production. However, fire within the park has been suppressed for the past 60 years. The park's most recent fire occurred in November 2001 in the Wolf Rock area. After the burn, vegetation study plots were placed in the area to monitor tree regeneration. Within the first year following the burn many tree and herbaceous species regenerated (NPS 2005d). The park's current *Fire Management Plan*, completed in 2004, requires that all wildfires be suppressed to protect the historic camps and adjacent private landowners. However, the use of prescribed fire will be explored for research purposes (NPS 2004c).

DISEASE, BLIGHT, AND EXOTIC PESTS. The health of Catoctin's forest has been and continues to be adversely affected by disease, blight, and exotic pests, including hemlock woolly adelgid, gypsy moths, chestnut blight, and dogwood anthracnose. Details regarding the effects of these on Catoctin's forests can be found in "Chapter 1: Purpose of and Need for Action," "Role of Pests and Disease."

Blight — Any of numerous plant diseases that result in sudden and conspicuous wilting and dying of affected parts, especially young growing tissues.

INVASIVE EXOTIC PLANTS. Within Catoctin Mountain Park, mechanical and chemical controls for invasive exotic plants are targeted in the Owens Creek watershed, Camp Misty Mount, and Camp Greentop, where several species of sensitive plants are found (NPS 2004e). Details regarding the park's exotic plant management actions can be found in "Chapter 1: Purpose of and Need for Action," "Role of Invasive Exotic Plant Species," and "Chapter 3: Affected Environment," "Vegetation."

DEER MANAGEMENT. No actions have been taken to date to modify the size of Catoctin's deer herd within the park unit (although deer hunting is permitted at Cunningham Falls State Park to the south of Catoctin Mountain Park). However, park staff are continuing to take actions to monitor and protect small areas of sensitive vegetation and landscaping.

Current Actions in Adjacent Areas

PREDATORS. Predators have been observed more frequently in recent years, and a coyote was seen in the park in 2002 existing populations of predators, including bobcats, coyotes and bears, are not considered by wildlife biologists to be a significant mortality factor for white-tailed deer in Maryland (MD DNR 2005). As residential development increases around Catoctin, the number of predators such as bobcats may decrease due to habitat loss, which would result in less predation on local deer.

Predators have been observed more frequently in recent years, including a coyote seen in the park in 2002.

HUNTING. Cunningham Falls State Park allows hunting in an undeveloped section of the park (about 3,200 acres of the 4,946 acre park). Hunting is regulated under Maryland state hunting laws for all seasons, from September 15 to January 31 (bow, muzzleloader, handicapped hunt in beach area, rifle, handgun, shotgun, crossbows, etc.). Permits are not required. No density goals are set for hunting. Deer counts are done by region, not by park (NPS 2004e).

The Frederick City Watershed, which is managed by the Maryland Department of Natural Resources, contains over 7,000 acres of forested land in western Frederick County. The area is south of Cunningham Falls State Park, and it is popular for hunting deer, squirrel, grouse, and turkey (MD DNR 2000). Deer density in this area is estimated at 20 deer per square mile, compared to 104 deer per square mile in 2004 at Catoctin Mountain Park (NPS 2004b). Recent harvesting to salvage timber killed by gypsy moth defoliation has enhanced the area for grouse and deer (MD DNR 2000).

Habitat fragmentation — The breaking up of large, contiguous blocks of habitat into small, discontinuous areas that are surrounded by altered or disturbed lands.

Habitat fragmentation, along with changing social habits (the hunting population has steadily decreased since the 1980s), have reduced hunting opportunities and the effectiveness of hunting as a management tool within Maryland's growing suburban areas (MD DNR 1998).

LOGGING. Some logging still occurs on lands adjacent to the park boundary. Small tracts continue to be cleared as residential development expands in the region, resulting in the loss of mature deciduous forest in the general area of the park (Swauger, pers. comm., 2005b).

OZONE EFFECTS ON SENSITIVE PLANTS. Ozone concentrations occasionally are high in and around the Washington, D.C., metropolitan area and the park, and ozone has adversely affected some sensitive species within the park (Swauger, pers. comm., 2005b). Some species that are more sensitive to ozone that are found in the park include basswood, white ash, white pine, sweetgum, yellow (tulip) poplar, sycamore, black cherry (*Prunus serotina*), pin cherry (*Prunus pennsylvanica*), and sassafras.

HOG FARM. A hog farm located upstream from the park has the potential for adding to bacteria, nutrients, and sedimentation in park streams. The farm has a collection system that controls the release of sediments from the property. To date, there have been no incidents or releases, but if the system failed, there would be potential for additional pollutants and sediment to enter downstream park waters (Swauger, pers. comm., 2005b).

CELL TOWERS. Birds have been known to collide with cell towers, and the towers themselves may intrude on visitors' visual experiences in a natural setting. There are three cell towers in the park now, and one is under construction. There is one cell tower in the adjacent Cunningham Falls State Park. To date, there have been no reports of birds colliding with towers or complaints from visitors (Swauger, pers. comm. 2005b).

FORESEEABLE FUTURE ACTIONS

Growth and Change in Surrounding Land Use

The properties adjacent to Catoctin Mountain Park are classified as agriculture (6.6%), residential (0.6%), and deciduous forest (92.6%). These patterns are slowly changing as private residences are increasingly intermingled with the traditionally agricultural areas. The town of Thurmont is east of the park. The movement of people who are seeking a rural atmosphere and moving out of metropolitan areas will eventually cause population and infrastructure growth, resulting in habitat loss and greater pressure on remaining resources. Population movement is also gaining momentum due to cost of living in the metropolitan centers of Washington, D.C., and Baltimore, Maryland (NPS 2003b).

POTENTIAL FOR CHRONIC WASTING DISEASE. Although chronic wasting disease has not reached Catoctin, it has been found within 60 miles of the park. The park plans to monitor for chronic wasting disease in its future deer management program. Appendix D provides detail about CWD and the protocols the park will follow.

HOG FARM EXPANSION. The hog farm upstream of the park could expand, potentially adding to short-term sediment loading in the stream from ground disturbance and erosion during construction and increasing the potential for releases of nutrients, bacteria, and sediment from the collection system (Swauger, pers. comm., 2005b).

IMPAIRMENT ANALYSIS METHOD

"Chapter 1: Purpose of and Need for Action," describes the related federal acts and policies regarding the prohibition against impairing park resources and values in units of the National Park System. According to NPS *Management Policies 2001,* an action constitutes an impairment when an impact "would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS 2000c, sec. 1.4.5). To determine impairment, the National Park Service must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts" (NPS 2000c, sec. 1.4.5).

National park system units vary based on their enabling legislation, natural and cultural resources present, and park missions; likewise, the activities appropriate for each unit and for areas in each unit also vary. For example, an action appropriate in one unit could impair resources in another unit. Thus, this document analyzes the context, duration, and intensity of impacts of the alternatives, as well as the potential for resource impairment, as required by *Director's Order #12* (NPS 2001b). As stated in the *Management Policies 2001* (sec. 1.4.5), an impact on any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it affects a resource or value whose conservation is

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents

The following process was used to determine whether the various deer management alternatives had the potential to impair park resources and values:

- *Step 1* — The enabling legislation, the park's *Statement for Management* (NPS 1996b), its *Strategic Plan* (NPS 2000d), and other relevant background information for Catoctin Mountain Park were reviewed to ascertain its purpose and significance, resource values, and resource management goals or desired conditions.
- *Step 2* — Resource management goals were identified.
- *Step 3* — Thresholds were established for each resource of concern to determine the context, intensity, and duration of impacts, as defined earlier in this chapter under "Impact Thresholds."
- *Step 4* — An analysis was conducted to determine if the magnitude of impact would constitute an "impairment," as defined by NPS *Management Policies 2001* (NPS 2000c).

The impact analysis includes findings of impairment of park resources for each of the management alternatives. Visitor use, park operations and management, and socioeconomic environment are not considered resources per se, although they are dependent on the conservation of park resources. Impairment findings are not included as part of the impact analysis for these topics.

VEGETATION

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act of 1916* and the NPS *Management Policies 2001* (NPS 2000c) direct parks to provide for the protection of park resources. The *Management Policies 2001* state that "the Service will not attempt to solely preserve individual species (except threatened or endangered species) or individual natural processes; rather, it will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological ecosystems" (NPS 2000c, sec. 4.1). The policies further state, "The Service will not intervene in natural biological or physical processes, except to restore natural ecosystem functioning that has been disrupted by past or ongoing human activities, or when a park has identified the intervention as necessary to protect other park resources or facilities."

An ecological system is the interaction of living organisms and the nonliving environment producing an exchange of materials between the living and nonliving.

With regard to the restoration of natural systems, the National Park Service "will re-establish natural functions and processes in human-disturbed components of natural systems in parks," and it "will seek to return human-disturbed areas to the natural conditions and processes characteristic of the ecological zone in which the damaged resources are situated" (NPS 2000c, sec. 4.1.5).

Catoctin's 1996 *Statement for Management* lists as its first management goal to

> identify, protect, and enhance native species populations, natural populations, natural features, and ecological process of the park. Strive to maintain natural abundance, biodiversity, and ecological integrity of the wildlife and plant populations.

This goal contains the following two subgoals:

- Provide protection for rare plants that occur within the park and suffer population reductions as a result of overbrowsing by white-tailed deer, or other natural or man-caused actions.

- Reduce adverse effects of deer browsing pressure to ensure that a diverse forest structure and species composition is perpetuated.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Maps showing vegetation cover within Catoctin Mountain Park, communications with NPS staff, and past monitoring data were used to identify baseline conditions within the study area. Available information on the condition and composition of the vegetation in the park was compiled. The primary component of the forest that provides the best indicator of successful forest regeneration is the number of seedlings observed and their ability to reach heights above the average deer browsing height (60 inches or 150 cm). Thresholds identified for taking management action were based on recent research conducted in habitat similar to that at Catoctin Mountain Park and are based on a certain number of seedlings per monitored plot to indicate the degree of regeneration. Therefore,

the intensity level of impacts to woody vegetation was based on a similar scale, assuming that the moderate impact intensity would be aligned with the point where management action should be implemented to maintain or achieve good forest regeneration. Impact intensities for woody vegetation outside the park were developed as a more qualitative definition, since no monitoring data are available outside park boundaries. Similarly, the impact thresholds for herbaceous vegetation were defined qualitatively, since herbaceous vegetation is not being monitored.

Impact Thresholds

Negligible:	Woody Vegetation	Less than 5% of the monitored plots would have fewer than 51 seedlings per plot. This seedling density would indicate that very good regeneration was occurring.
	Herbaceous Vegetation	A reduction in the herbaceous understory would occur, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor:	Woody Vegetation	From 5% to 33% of the monitored plots would have less than 51 seedlings per plot. This seedling density would represent that fair to good regeneration was occurring.
	Herbaceous Vegetation	A reduction in the herbaceous understory would occur, but it would be small, localized, and of little consequence.
Moderate:	Woody Vegetation	From 34% to 65% of the monitored plots would have less than 51 seedlings per plot. This seedling density would represent that poor regeneration was occurring.
	Herbaceous Vegetation	Some reduction in the herbaceous understory would occur, and it would be measurable and of consequence to the resource but localized.
Major:	Woody Vegetation	More than 66% of the monitored plots would have less than 51 seedlings per plot. This seedling density would represent that little to no regeneration was occurring.
	Herbaceous Vegetation	A noticeable reduction in the herbaceous understory would occur. The change would be measurable and would result in a possible permanent consequence to the resource.

Cumulative Thresholds for Woody Vegetation
(Outside the Park Only, Where No Quantitative Monitoring Data Are Available)

Negligible: Any reduction in woody vegetation would be so small that it would not be of any measurable or perceptible consequence.

Minor: A reduction in the woody vegetation would occur, but it would be small, localized, and of little consequence.

Moderate: Some reduction in the woody vegetation would occur, and the change would be measurable and of consequence to the resource but localized.

Major: A noticeable reduction in the woody vegetation would occur. The change would be measurable, and it would result in a possible permanent consequence to the resource.

AREA OF ANALYSIS

The area of analysis for assessing impacts on vegetation is all of Catoctin Mountain Park. The area of analysis for cumulative impacts is the park and the areas within 0.5 mile of the park boundary, which is based on the average home range of deer within the park (Warren and Ford 1990).

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE A: NO-ACTION ALTERNATIVE (EXISTING MANAGEMENT CONTINUED)

Analysis

Park staff would continue monitoring the deer population and would conduct activities to protect native plants, such as creating and monitoring small fenced areas and applying repellents within landscaped areas (such use is currently minimal).

WOODY VEGETATION. As described in "Chapter 3: Affected Environment," the park has been monitoring woody vegetation growth within the park for over 20 years, with open plots established for monitoring park vegetation. Six exclosures were later constructed and paired with open plots for comparison purposes. In 1991 the park monitored all 45 plots and found that only one had more than 51 seedlings present; 25 had no seedlings present, and 14 had less than 10 seedlings. Similar data were found in 1994 when 35 of the 45 plots were monitored; only two plots had more than 51 seedlings present, and 17 had no seedlings. In 2001, 15 sites were monitored, and none had more than 51 seedlings per plot (7 with zero seedlings, 5 with fewer than 10). Based on these results, alternative A would have long-term, major adverse impacts on woody vegetation due to the amount of deer browsing and the associated reduction in numbers of stems per plot documented by monitoring.

These data are supported by other research that has been conducted in the park. A 1997 study compared three exclosure plots and six open plots (Backer and

Boucher 1997), and a similar study in 1998 and 1999 compared four exclosures and eight open plots (Boucher and Kyde 1999). The 1997 study found that species richness was greater in the exclosures than in the unprotected plots. This was confirmed in the 1998–99 study, which found that areas protected from deer browsing had an increased abundance and diversity of plant species compared to the unprotected plots. These studies looked at both herbaceous vegetation and seedlings. The difference in seedling numbers between protected and unprotected plots showed the same tendency as the herbaceous vegetation, but it was noted that seedling recovery appears to take longer than recovery of herbaceous plants.

The park has previously fenced woody plant species to protect them from deer browsing, including tree restoration areas (e.g., dogwoods), tree nurseries, and landscaped areas. These fenced areas would continue to be maintained. New fencing would be used on a limited basis, as it is today, for any newly identified rare species or for restoration sites sensitive to deer browsing. This action would have long-term beneficial impacts on the plants or areas that were fenced by prohibiting deer browsing. However, the impact on the majority of park vegetation that was not fenced would continue to be adverse, long term, and major because no measures would be taken to limit or control deer population size or growth under this alternative.

Park staff would use commercial repellents in limited areas. These repellents do not have known adverse effects on vegetation. Under this alternative repellents would continue to be used on a limited basis on landscape plants around buildings such as the visitor center, with some minor increased use around other buildings that are not currently treated. The effectiveness of repellents generally decreases as deer density increases and/or other food availability decreases. Therefore, this action would have short-term, beneficial impacts on plants treated with repellents, but as the deer numbers increased or the food availability in the park decreased, the effectiveness of repellents could be expected to decline. Similar to fencing, the impact on the majority of the vegetation within the park that was not treated with repellents would continue to be adverse, long term, and major.

Monitoring vegetation plots and maintaining fenced areas would result in the trampling of vegetation as staff traveled to and around the fenced areas. However, such impacts would be temporary, as these activities typically take only a few days per year. Currently the woody understory is sparse, so the amount of vegetation to be trampled is limited. The amount of vegetation affected by these actions would be less than 1%, as they would occur in only a few areas. Therefore, the impact of these activities would be short term, adverse, and negligible.

Herbaceous plants — Non-woody plants; includes grasses, wildflowers, and sedges and rushes (grass-like plants).

HERBACEOUS VEGETATION. Under alternative A the impacts to herbaceous vegetation would be similar to those described for woody vegetation, because no action would be taken to control deer numbers. Based on observations and research conducted within the park, deer browsing has already caused noticeable changes to herbaceous vegetation, including the elimination of certain plant species or a reduction in their abundance, decreased plant diversity, increased exotic plants, and decreased native plant abundance (Backer and Boucher 1997; Boucher and Kyde 1999). Not controlling the growth of the deer population

would result in adverse, long-term, major impacts on herbaceous vegetation, as deer browsing would continue to cause noticeable changes to the abundance and diversity of herbaceous vegetation throughout the park.

Activities such as monitoring, fence construction and maintenance, or the application of repellents would not result in any measurable or perceptible change in herbaceous vegetation, resulting in adverse, short-term, negligible impacts. Vegetation within small fenced areas would benefit from this level of protection over the long term, and repellent use would have a short-term benefit; however, such benefits would be limited to the small areas of the park.

Cumulative Impacts

Increased impacts to the forest within and surrounding the park are expected from a decrease in the number of hunters outside the park (resulting in higher deer densities outside the park), increased development within the park, road widening and construction projects, and more visitor trampling. In addition to deer browsing, past actions within the park, such as logging and fire suppression, have adversely affected forest resources. Logging for the charcoal and barrel industries resulted in the loss of 11,000 acres of mature forest, and some logging still occurs along park boundaries. Fire suppression has altered the natural structure and composition of the forest. Ozone damage has been observed in some sensitive species, and blowdowns from hurricanes or tornadoes have also damaged vegetation and created open areas within the forest. The park's efforts to control invasive exotic species, gypsy moths, chestnut blight, dogwood anthracnose, hemlock woolly adelgid, and other pests would continue to benefit forest resources and their ability to naturally regenerate. The park plans to implement limited prescribed burning for research purposes in the future, which would also benefit the park's forest. All of these activities, when combined with the continued pressure on forest vegetation (woody and herbaceous) and the limited natural regeneration expected under alternative A because of continued deer browsing, would result in both adverse and beneficial impacts to woody and herbaceous vegetation. Overall, cumulative impacts would be adverse, long term, and major, since deer would continue to restrict forest regeneration.

Fire suppression has altered the natural structure and composition of the forest.

Conclusion

The deer population would remain in excess of the recommended density for forest regeneration under this alternative and would likely continue to increase over time, adversely impacting both woody and herbaceous vegetation. As long as the deer population remained high or continued to increase, overall impacts would include decreased plant diversity, increased exotic plants, and no forest regeneration. Some benefits would be gained from management actions such as maintaining small fenced areas and applying repellents in selected areas; however, the benefits gained would not protect or affect the majority of the park. Some benefits could also be gained after periodic declines in deer population due to disease or lack of available food; however, population records indicate that past population declines have not dropped low enough or lasted long enough for forest regeneration to occur or vegetation to fully recover. The impacts of large numbers of deer browsing on a very large percentage of the park's woody and herbaceous vegetation and consequently limiting natural regeneration would be

adverse, long term, and major. Past, present, and future actions, when combined with the continued pressure on forest regeneration expected under this alternative, would result in both adverse and beneficial impacts, with adverse, long-term, major cumulative impacts. Since alternative A would not reverse the expected long-term continued growth in the deer population, and damage to vegetation would likely continue, it is expected that impairment of vegetation resources would occur over the long term.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

Under this alternative, several non-lethal actions would be implemented in combination to protect forest resources and reduce deer numbers in the park. Actions include the use of large-scale exclosures, increased use of repellents in limited areas, and reproductive control of does.

Placing exclosures throughout the park would allow native woody species within to become established.

WOODY VEGETATION. The repellents and small fenced areas described under alternative A would continue to be used and monitored under alternative B. Large fenced exclosures would be constructed under alternative B to allow forest regeneration to occur within localized areas of the park. Approximately 15 exclosures (1,000 by 1,000 feet), each encompassing 23 acres, would be used throughout the park. This would eliminate deer presence within the exclosures, which would protect a total of 345 acres or about 6% of the park. Protecting these areas from deer browsing would allow native woody species to grow higher than heights reached by deer 60 inches or 150 cm) after a minimum of 10 years, at which time the exclosures would be moved, and another 6% of the park's vegetation would be enclosed. This action would have a beneficial, long-term impact on up to 12% of the woody vegetation in the park after 15 years (the life of the plan): 6% inside the existing exclosures at 15 years, and 6% in the original exclosures, which has grown above deer reach. Since 5–10% of the forested area would need to be fenced at any one time (Bowersox pers. comm. 2005) to meet the park's regeneration goals, the actions under alternative B would meet this minimum by protecting 6% at any one time. However, the effect of no browsing protection on woody species in the remaining undeveloped areas of the park would be similar to alternative A. It is expected that monitoring over the life of the plan would continue to show that more than 66% of the open plots would have less than 51 seedlings per plot, resulting in an adverse, long-term, major impact.

Constructing, maintaining, and monitoring the 15 large exclosures would have some impact to the woody vegetation within the park due to the trampling of small tree seedlings and the removal of existing woody vegetation. Even though fences would be located to avoid most trees, some trees would likely need to be removed during construction. Additionally, tree branches within 5 feet of either side of the fence would be removed to avoid branches hitting the fence in high winds or existing dead branches falling on the fence, thus minimizing future maintenance requirements. The area affected during construction would be about 14 acres (0.002%) of the park (4,000 linear feet/exclosure × 15 exclosures × 10-foot-wide cleared area = 600,000 square feet or 13.77 acres). Given the small size

of the affected area in relation to the size of the park (about 6,000 acres), and the limited nature of the action, the impact of exclosure construction and maintenance would be adverse, long term, and negligible. Trampling during fence construction and removal of deer from within fenced areas, as well as during monitoring, would have adverse, short-term, negligible impacts because construction and monitoring would average only a few days per year.

Repellents would be applied to woody vegetation to deter deer browsing on a very limited basis. Under current conditions with few seedlings present, the efficiency of applying repellents would be low. Additionally, repellents need to be applied frequently in order to cover the new growth on the treated plants. Therefore, repellents would be used only in areas around existing buildings to protect existing landscaping, around historic structures to protect the historic landscape, around park nursery stock, and for forest restoration projects. The size of these areas is estimated at a few acres of the park vegetation. Given the small amount of vegetation that would be protected by using repellents, the impact would be beneficial and short term. Over time this benefit would decrease as the deer population increased, deer adapted to the repellents, or other available food decreased. The effect of repellent use on the untreated vegetation in other park areas would be adverse, long term, and negligible assuming that the repellents were effective because deer browsing pressure on other available woody vegetation would likely increase.

A seedling (between 5 and 150 cm) is a young plant grown from seed; a young tree before it becomes a sapling.

Implementing reproductive control, as described in "Chapter 2: Alternatives," would have several impacts. Given the large number of does that would need to be treated, bait piles would be used to concentrate deer in certain locations so that the darting could be done as efficiently as possible. As many deer as possible would be treated daily (estimated 10 deer treated per day over 60 days) until 90% of the does had been treated. Impacts to vegetation in the areas around the bait piles would be adverse, short term (a few hours to a few days in any location), localized, and negligible.

The effect of reproductive control on the deer population and thus deer browsing could be beneficial. However, the time required for the population to be reduced could be several years; researchers disagree on the amount of time needed to reduce a population size using reproductive controls (Hobbs et al. 2000; Nielsen et al. 1997; Rudolph et al. 2000). The actual amount of time needed to observe a decrease would depend on a number of factors, such as the type of treatment, its effectiveness in stopping reproduction, the size of the population at the time of initial treatment, the actual mortality rate, and the percentage of the population that was treated. Other factors such as untreated deer moving into the park and treated deer leaving the park would also influence the time required to achieve reduced numbers. The benefit of this action would be in proportion to the population reduction, with the greatest benefit achieved when the population was lowered to the point where successful forest regeneration could occur. Hobbs et al. described a model where if 90% of the breeding does in the park were effectively treated annually, mortality would need to exceed the number of surviving offspring from the 10% of untreated does to achieve a population reduction. An average mortality rate in urban/suburban deer populations is 10% (Hobbs et al. 2000). Based on these factors, it is expected that reproductive control could stop population growth, but the park would not be able to reach its

initial deer density goal within the life of this management plan using current technology; therefore, forest regeneration would not be expected outside the large exclosures during the life of this plan. A longer time frame would be needed to see results from current reproductive control technology.

HERBACEOUS VEGETATION. Under alternative B the impacts to herbaceous vegetation would be similar to those described for woody vegetation. The primary impact would result from not taking immediate action to control deer numbers. As described for alternative A, deer browsing has already caused noticeable changes to the herbaceous vegetation, including eliminated or reduced numbers of certain plant species, decreased plant diversity, increased exotic plants, and decreased native plant abundance, based on observations and research conducted within the park (Backer and Boucher 1997; Boucher and Kyde 1999). Providing no immediate reduction or control on the deer population would result in adverse, long-term, major impacts, because deer browsing would continue to cause noticeable changes to the abundance and diversity of herbaceous vegetation throughout the park. Exclosures would provide a beneficial, long-term impact on herbaceous vegetation in 6% of the park at any one time, while repellent use would have a short-term benefit; however, these benefits would be limited to the park areas that were treated. Reproductive controls would cause the deer population to decline slowly; however the regeneration of herbaceous vegetation outside exclosures is not expected to occur within the life of this plan under alternative B. Therefore, the impact of this action would remain adverse, long term, and major.

Providing no immediate reduction or control on deer population would allow deer browsing to continue, causing noticeable changes to the abundance and diversity of herbaceous vegetation throughout the park.

Activities such as monitoring, fence construction and maintenance, repellent application, and administering reproductive control agents would not result in any measurable or perceptible change in the herbaceous vegetation, resulting in adverse, short-term, negligible impacts.

Cumulative Impacts

The same past, present, and future actions described under alternative A would also occur under alternative B. Management actions identified in alternative B, where approximately 6% to 12% of the park's vegetation would be protected from browsing, combined with reproductive control, could reduce the deer density after more than 15 years of implementation, would provide some beneficial impacts over the long term, but not immediately. Large exclosures would give small patches of forest the opportunity to regenerate, and reproductive control would eventually help reduce the size of the deer herd, resulting in beneficial impacts that would combine with the beneficial effects of prescribed burning for research purposes and disease and pest control. However, adverse effects from increased development and other cumulative adverse actions, in conjunction with continued deer browsing pressure on the majority of the woody and herbaceous vegetation and delayed reduction in the deer

population, would not be offset by the beneficial effects of proposed actions. Therefore, cumulative impacts to vegetation under this alternative would be adverse, long term, and moderate to major.

Conclusion

Under alternative B, overall approximately 6% of the herbaceous vegetation and up to 12% of the woody vegetation in the park would benefit from constructing exclosures over the life of this plan, and doubling the use of repellents would help protect small areas. Remaining woody and herbaceous vegetation within the park would continue to be adversely affected by deer browsing over the long term until reproductive controls became effective and the population decreased. However, since the benefits of reproductive control would not be fully realized within the life of this plan, overall impacts to woody and herbaceous vegetation would be adverse, long term, and major as the young woody vegetation and herbaceous ground cover decreased in quantity and diversity in the majority of the park. Past, present, and future activities, when combined with the continued pressure on woody and herbaceous vegetation expected under this alternative, would result in both adverse and beneficial impacts. Over the long term cumulative impacts would be adverse and moderate to major. Alternative B would provide continued protection of certain areas of the park over the long term, would meet the minimum of protecting 5–10% of the park at any one time (Bowersox pers. comm. 2005), and would introduce reproductive controls that could reduce deer numbers gradually over an extended period of time. Therefore, it is not expected that impairment of vegetation resources would occur under this alternative.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE)

Analysis

Under alternative C the deer herd would be reduced through sharpshooting and capture and euthanasia, when appropriate.

WOODY VEGETATION. The repellents and small fenced areas described under alternative A would continue to be used and monitored under alternative C. No additional fencing or repellent use would occur under this alternative. Immediately reducing the deer population would allow natural forest regeneration to occur.

Under this alternative it is estimated that up to 468 deer (approximately half) would be removed during the first year of sharpshooting in the park. Roughly 50% of the population would be removed in subsequent years until the initial density goal (15–20 deer per square mile) was achieved. It is expected with rapidly reduced deer browsing pressure (dropping from over 100 deer per square mile to closer to 20 deer per square mile) would allow the number of tree and shrub seedlings to increase and survive to maturity, providing the necessary growth for natural forest regeneration. The closer the deer density got to 20 deer per square mile, the higher the chance of achieving successful forest regeneration (Bowersox et al. 2003; Horsley et al. 2003; Stout 1999; Marquis et al. 1992).

This conclusion is supported by comparison of open plot data with exclosure data in the park. As described under alternative A, six exclosures were constructed and paired with open plots for comparison purposes. In 2001 one exclosure had 194 seedlings as compared to 2 seedlings in the paired plot. Similarly in 2002 and 2003, seedling counts in all exclosures exceeded counts in the associated open plots. These data are supported by other research that has been conducted in the park. A 1997 study compared three exclosure plots and six open plots (Backer and Boucher 1997), and a similar study in 1998 and 1999 compared four exclosures and eight open plots (Boucher and Kyde 1999). The 1997 study found that species richness was greater in the exclosures than in the unprotected plots. This was confirmed in the 1998–99 study, which found that areas protected from deer browsing had an increased abundance and diversity of plant species compared to the unprotected plots. These studies looked at both herbaceous vegetation and seedlings. The difference in seedling numbers between protected and unprotected plots showed the same tendency as the herbaceous vegetation, but it was noted that seedling recovery appears to take longer than recovery of herbaceous plants.

Providing rapid deer herd reduction and control would result in beneficial long-term impacts on woody vegetation as deer browsing would be substantially reduced, allowing the abundance and diversity of woody vegetation throughout the park to recover. It is expected that after approximately 10 years, monitoring would show that less than 66% of the plots would have fewer than 51 seedlings per plot. Therefore, existing adverse long-term impacts would be reduced from major to moderate and eventually minor levels, with impacts decreasing in intensity over time as regeneration progressed.

A number of other actions would occur as part of sharpshooting, as described in more detail in "Chapter 2: Alternatives," which would further affect vegetation in limited areas. These actions include setting up bait stations, occupying shooting areas, and dragging deer to locations for processing and transport. Baited areas would be small, the bait would not remain long, and any uneaten bait would be removed after annual sharpshooting efforts had been completed. Sharpshooting might take place from elevated positions, which would require portable tree stands to be temporarily hung in trees. Such portable stands do not damage the tree (no nails or screws) and would not have an adverse impact to woody vegetation. Removing deer carcasses from the kill site could require dragging over vegetation, which would temporarily trample some woody vegetation. All of these actions (bait stations, shooting stations, and dragging deer) would result in some trampling of woody vegetation; however, the area of impact would be small (less than 1% of park vegetation). The impact of trampling under this alternative would be adverse, short term, and negligible.

The 1997 study found that species richness was greater in the exclosures than in the unprotected plots.

The waste and/or carcasses of the removed deer would be disposed of either through burial on site or leaving them on the surface for natural decomposition. Whenever several deer were processed in any given location within the park, the waste and/or carcasses would be collected and buried. Disposal pits would be in one or more of the following locations within the park — the Camp Misty Mount field, the Camp Greentop paddock, or the Camp Round Meadow bulk storage area. Disposal pits would be approximately 8 feet wide, 8 feet long, and 4 feet deep. They would be dug prior to direct reduction activities and covered and

fenced to prevent entry. Soil removed from the pits would remain on site and would be covered to prevent erosion. These disposal sites could result in the removal of some woody vegetation. Sites would be selected in areas outside historic districts, previously disturbed, and free of trees. Therefore, the impact on woody vegetation would be adverse, short term, and negligible.

Actions related to the capture and euthanasia of deer, which would generally be used in circumstances where sharpshooting would not be appropriate due to safety or security concerns, would be similar to those described for sharpshooting in that deer would be removed from the park through lethal means. The difference would be the way in which deer were captured and killed. This method would require physically capturing and handling deer before euthanizing them. Up to 15 deer annually might be taken under this method. Limited trampling would occur with the setting up of traps (rather than setting up bait stations), resulting in adverse, short-term, negligible impacts. Given that this method could be used at any time of the year, and that only up to 15 deer would be removed, the waste or carcasses would likely be left on the surface to naturally decompose or would be buried on site in a previously disturbed area. This would have no noticeable impact on woody vegetation in the park.

HERBACEOUS VEGETATION. Under alternative C the impacts to herbaceous vegetation would be the same as what was described for woody vegetation. The primary impact within the park would be the result of immediate action taken to control deer numbers. It is expected with rapidly reduced deer browsing pressure, the changes previously observed in herbaceous vegetation would start to reverse, as was found in a number of exclosure studies conducted in the park (Backer and Boucher 1997; Boucher and Kyde 1999). Immediately reducing and controlling the growth of the deer population would result in beneficial, long-term impacts on herbaceous vegetation, which could regenerate with decreased deer browsing.

Using bait stations, dragging deer carcasses, setting traps, shooting deer, burying waste and/or carcasses, monitoring, maintaining fences, or applying repellents would not result in any measurable or perceptible change in herbaceous vegetation. These activities would result in adverse, short-term, negligible impacts.

Cumulative Impacts

The same past, present, and future activity impacts described under alternative A would also occur under alternative C. Quickly reducing the park's deer population would provide beneficial, long-term effects, with adverse impacts being reduced to negligible or minor levels over time. These effects, combined with the beneficial effects of prescribed burning for research purposes and disease and pest control, would result in cumulative impacts that would be primarily beneficial. These beneficial impacts would somewhat offset the adverse effects from increased development and other cumulative adverse actions. Therefore, cumulative impacts to vegetation under this alternative would be mostly beneficial and long term.

Conclusion

Enhancing natural forest regeneration by quickly reducing deer browsing pressure under alternative C, and by maintaining a smaller deer population through direct reduction, would result in beneficial, long-term impacts because both woody and herbaceous vegetation throughout the park could recover. Over time as natural forest regeneration occurred, adverse, long-term, major impacts would be reduced to minor levels. Under alternative C less than 1% of the park's woody or herbaceous vegetation would be affected by trampling at bait stations, shooting sites, trapping locations, or disposal sites. Therefore, adverse impacts of these actions would be short term and negligible. Past, present, and future activities, when combined with the reduced pressure on woody and herbaceous vegetation and subsequent forest regeneration, would result in beneficial, long-term cumulative impacts. Vegetation resources would not be impaired under this alternative.

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

Under alternative D direct reduction as defined in alternative C would be implemented to reduce the size of the deer herd; once the goal of 15–20 deer per square mile was obtained and natural forest regeneration could occur, reproductive control and direct reduction (if needed) would be used to maintain the deer population at the reduced level.

WOODY VEGETATION. The repellents and small fenced areas described under alternative A would continue to be used and monitored under alternative D, but no additional fencing or repellent use would occur under this alternative. As described for alternative C, up to 468 deer (approximately half) would be removed during the first year of sharpshooting in the park. Roughly 50% of the population would be removed in subsequent years until the target density goal was achieved. It is expected with rapidly reduced deer browsing pressure (dropping from over 100 deer to about 15–20 deer per square mile) the number of tree and shrub seedlings would increase, and the number of seedlings surviving to sapling stage would also increase, providing the necessary growth for natural forest regeneration. The closer the deer density was to 15–20 deer per square mile, the higher the chance to achieve successful forest regeneration (Bowersox et al. 2003; Horsley et al. 2003; Stout 1999; Marquis et al. 1992).

For natural forest regeneration to occur, the number of seedlings surviving to sapling stage must be increased.

Providing immediate reduction and control of the deer population would result in beneficial, long-term impacts on the woody vegetation because deer browsing would be substantially reduced and the abundance and diversity of woody vegetation throughout the park could recover. As described for alternative C, it is expected that after approximately 10 years monitoring would show that less than 66% of the plots had fewer than 51 seedlings per plot; over time as fair to good

regeneration began to occur, the adverse impact level would be reduced from major to moderate and eventually minor.

As described for alternative C, a number of other actions would occur as part of implementing sharpshooting, such as setting up bait stations, occupying shooting areas, and dragging deer carcasses to locations for processing and transport. All of these actions would result in some trampling of woody vegetation; however, the area of impact would be small (less than 1% of vegetation), and the impact would be adverse, short term, and negligible given the small size of the affected area and the short duration of the impact. As forest regeneration increased, more woody stems might be affected by each action; however, the overall amount of vegetation affected would still be small, and the impact would be short term and negligible.

During the sharpshooting process the waste and/or carcasses of removed deer would need to be disposed of, which could result in the removal of some woody vegetation. However, sites selected for disposal would be in previously disturbed areas and free of trees. Therefore, the impact on woody vegetation would be adverse, short term, and negligible.

The actions related to capture and euthanasia could result in trampling of vegetation because of setting up traps (rather than setting up bait stations), with adverse, short-term, negligible impacts. Given that this method could be used at any time of the year, and that only up to 15 deer would be removed by this method, the waste and/or carcasses would likely be buried on site in a previously disturbed area where woody vegetation would not need to be removed or left to decompose naturally on the surface, so there would be no impact on the woody vegetation in the park.

Reproductive controls would be implemented after direct reduction efforts had initially reduced the population size in order to maintain the desired deer population level. However, the success of implementing reproductive controls on a deer population that has undergone several years of direct reduction efforts would depend on technological advances, the sensitivity of deer to humans, methods used by the sharpshooters, changes in immigration with reduced deer density, and general deer movement behavior (Porter et al. 2004; Naugle et al. 2002). It should be expected that getting close enough to administer remote injections would become increasingly difficult after direct reduction efforts due to deer behavior changes in response to previous human interaction (Underwood, pers. comm. 2005). If reproductive control could be successfully implemented, deer numbers could be kept low and impacts on vegetation would be adverse, long term, and minor.

Sex ratio is the proportion of males to females, in a population. A sex ratio of 50:50 would mean an equal number of does and bucks in a deer population.

Assuming a park deer population at a density of 15–20 deer per square mile when reproductive controls were initiated, there would be a maximum of 180 deer in the park (approximately 9 square miles). This number of deer would be close to the maximum size suggested for application of reproductive controls in free-ranging deer populations. Assuming that the sex ratio composition of the reduced deer population would be approximately 50:50, there would be 90 does in the population. The majority of the does (90%, or 81 does) would need to be treated so that they could be identified for retreatment in successive years. It is estimated

that up to 5 deer per day could be treated (taking 16 days), given the increased effort to locate deer with lower deer numbers. The population would continue to be monitored for growth. If the deer population increased during the reproductive control application under this alternative, periodic direct reduction would be initiated to maintain the population density at the identified goal.

Some of the actions involved in implementing reproductive control (similar to implementing constructing fences and sharpshooting) could result in trampling of woody vegetation; however, these actions would last only a few hours to a few days in any location, and the adverse effect on vegetation would be negligible.

Assuming that reproductive controls could be used at a parkwide level to maintain the deer population size, impacts on woody vegetation would be beneficial and long term because a substantial reduction in deer browsing would allow the abundance and diversity of woody vegetation throughout the park to recover.

HERBACEOUS VEGETATION. The impacts to herbaceous vegetation under alternative D would be the same as those described for woody vegetation. The primary impact would be the result of actions taken to immediately reduce deer numbers, thus quickly reducing deer browsing pressure and allowing adverse effects on herbaceous vegetation to be gradually reversed, as found in a number of exclosure studies conducted in the park (Backer and Boucher 1997; Boucher and Kyde 1999). Using direct reduction and/or reproductive controls to maintain the lowered deer population would allow herbaceous vegetation to continue regeneration through the life of the plan. Long-term impacts on herbaceous vegetation from reduced deer browsing would be beneficial.

Activities such as using bait stations, dragging deer carcasses, setting traps, shooting or treating deer, monitoring, maintaining fences, or applying repellents would not result in any measurable or perceptible change in herbaceous vegetation, so impacts would be adverse, short term, and negligible.

Cumulative Impacts

The same past, present, and future activity impacts described under alternative A would also occur under alternative D. Rapidly reducing the deer population would relieve browsing pressure on the majority of the park's vegetation, providing long-term beneficial impacts and reducing adverse impacts to minor levels. Some adverse impacts would affect woody and herbaceous vegetation as a result of trampling due to setting bait stations, occupying shooting locations, removing deer carcasses, and using traps. However, these impacts would be isolated, affecting less than 1% of the park, resulting in adverse, short-term, negligible impacts.

Rapid deer density reduction would give the forest the opportunity to regenerate, resulting in beneficial impacts that would combine with the beneficial effects of prescribed burning for research purposes and disease and pest control, resulting in cumulative impacts that would be primarily beneficial. These beneficial impacts would somewhat offset the adverse effects from increased development

and other cumulative adverse actions. Therefore, cumulative impacts to vegetation under this alternative would be mostly beneficial and long term.

Conclusion

Enhancing natural forest regeneration by quickly reducing deer browsing pressure under alternative D, and by maintaining a smaller deer population through the use of reproductive control and direct reduction (if needed), would result in beneficial, long-term impacts because both woody and herbaceous vegetation could recover throughout the park. Over time as natural forest regeneration occurred, adverse, long-term, major impacts would be reduced to minor levels. Under alternative D less than 1% of the park's woody or herbaceous vegetation would be affected by trampling at bait stations, shooting sites, trapping locations or disposal sites. Therefore, adverse impacts of these actions would be short term and negligible. Past, present, and future activities, when combined with the reduced pressure on woody and herbaceous vegetation (forest regeneration) expected under this alternative, would result in beneficial, long-term cumulative impacts. Vegetation resources would not be impaired under this alternative.

SOILS AND WATER QUALITY

GUIDING REGULATIONS AND POLICIES

The *Clean Water Act* (33 U.S.C. 1251 et seq.) protects and restores the quality of natural waters through the establishment of nationally recommended water quality standards. Under the oversight of the U.S. Environmental Protection Agency (EPA), states administer provisions of the *Clean Water Act* by establishing water quality standards and managing water quality. According to EPA regulations, water quality standards must (1) designate uses of the water, (2) set minimum narrative or numeric criteria sufficient to protect the uses, and (3) prevent degradation of water quality through antidegradation provisions.

In administering the *Clean Water Act*, Maryland identifies Big Hunting Creek and Owens Creek as Class III-P "natural trout waters," indicating that the waters are suitable for the growth and propagation of trout, are capable of supporting self-sustaining trout populations and their associated food organisms, and are suitable for use as a public water supply.

In supporting federal and state regulations the NPS *Management Policies 2001* state that the National Park Service will "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the *Clean Water Act* and all other applicable federal, state, and local laws and regulations" (NPS 2000c, sec. 4.6.3). The policies also instruct park units to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources (NPS 2000c, sec. 4.8.2.4).

Catoctin Mountain Park's purpose states that in addition to being administered as a public park and for recreational purposes, it will be administered to conserve all resources. Toward this end management goals for the park include protecting and enhancing native species populations, natural features and ecological processes in the park, as well as striving to maintain the natural abundance, biodiversity, and ecological integrity of the wildlife and plant populations.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Soils would be affected primarily by erosion resulting from loss of vegetative ground cover due to deer browsing. Vegetative cover is just one of several factors that determine how much and how quickly rainfall or snowmelt reaches surface waters in a forested area. Other factors include soil type, climate, topography, and the amount of time between precipitation events. Surface runoff is generally not common in forested areas (EPA 2005), and within the park the majority of water draining into the streams is from subsurface runoff (NPS 1998c). However, during wet periods when the soil becomes saturated, many small intermittent creeks become active in the park and deliver excess surface runoff to the creeks (NPS 1998c). There is very little storage of water that flows over a forest floor, and though obstacles on the ground such as leaf litter and woody debris help slow surface runoff, other factors such as loss of vegetative cover, topography, soil compaction, impervious surfaces, and cut slopes of roads can increase the

amount and velocity of surface runoff (EPA 2005). It is surface runoff during storm events that causes soil erosion.

Impact intensities for soils and water quality were derived from the available soils information and park staff observations of the effects on soils from loss of vegetation, and from water quality data available at the park. Park staff measure turbidity levels every month in Catoctin's streams in order to monitor sediment. This data and available information on water resources within the park were reviewed. Water quality is expected to be primarily affected by sedimentation related to lack of ground cover, assuming that removal of vegetation could result in increased soil erosion and stream flows, because less vegetation could result in greater stormwater flows during storm events. The thresholds for the intensity of an impact are defined as follows.

Negligible: A reduction in vegetative cover due to deer browsing would result in impacts to soils and water quality that would not be detectable or measurable. Water quality and stream flows would be within historical conditions.

Minor: A reduction in vegetative cover due to deer browsing would cause soil impacts that are detectable and occur within a small area. Resulting changes in soil erosion rates and stormwater flows would cause only detectable and localized impacts to water quality that are within historical or baseline water quality conditions and flows.

Moderate: A reduction in vegetative cover due to deer browsing would be readily apparent and result in impacts to soil character over a relatively wide area. Resulting changes in soil erosion rates and stormwater flows could cause occasional and temporary alterations to historical or baseline water conditions or flows during some storm events.

Major: A reduction in vegetative cover due to deer browsing would be readily apparent and widespread, and would impact a large area in and outside the park. Resulting changes in soil erosion rates and stormwater flows would cause frequent alterations in the historical or baseline water quality conditions and flows over a large area and could result in modifications to the natural stream channel and instream flow characteristics.

AREA OF ANALYSIS

The area of analysis for assessment of impacts of the various alternatives is the park. For cumulative impacts, the area of analysis is the Owens Creek and Big Hunting Creek watersheds, which include the streams in the park and their upstream drainage basins.

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE A: NO-ACTION ALTERNATIVE (EXISTING MANAGEMENT CONTINUED)

Analysis

Loss of vegetative cover under alternative A would continue to increase as a result of the expected increase in the deer population and associated deer browsing since no measures would be implemented to actively reduce the size of the deer population. Park staff would continue activities to protect native plants, such as creating and monitoring small fenced areas; however, there are currently only 20 such fenced areas and they are typically less than 44 square feet (4 square meters) in size. Such small exclosures would do little to protect against soil erosion.

Since the 1970s, when problems related to the overabundance of deer were first suspected, to the present, deer populations in the park have continued to grow to the point where their density has been estimated between 104 and 194 deer per square mile between 2002 and 2004. During this same period, water quality and turbidity values in the park's streams remained fairly constant, well below applicable standards and within the expected range of values based on historic water quality conditions in the watershed. Although the loss of vegetative ground cover from deer browsing is not currently documented as a problem relating to soils and water quality, it is expected that the deer population would continue to increase under alternative A over the life of the plan, albeit with periodic decreases that could occur due to variables such as herd health or weather conditions in any particular year. The expected loss of vegetative ground cover from increased deer browsing over time could eventually result in adverse, long-term, negligible to minor impacts on the soils and water quality of the park.

Cumulative Impacts

Only 7% of Big Hunting Creek's watershed and 14.5% of the Owens Creek watershed are within the park boundaries (NPS 1998c), so cumulative impacts on soil and water quality would arise not only from activities within the park, but would also be heavily influenced by past, present, and future actions in the areas adjacent to the park. Increased adverse impacts on the soils and water quality are expected from increased soil erosion due to greater vegetative ground cover loss as a result of increased deer browsing. Increased adverse impacts would also be expected from increased development within the park, which would increase surface runoff and contribute to increased soil erosion; fire suppression, which would cause adverse, short-term minor impacts; and logging that occurs along the park boundaries. Weather events such as thunderstorms and hurricanes would also adversely impact soils within the watershed. Cattle are excluded from the park, which offers a beneficial impact to the soil and water quality by limiting grazing, soil compaction, and disturbance, all of which can lead to increased soil erosion and sedimentation.

In addition to deer browsing, past actions inside and outside the park that have adversely contributed to the impacts on soil and water quality include the use of agricultural lands within the park, residential development, fires that occurred prior to the establishment of the park, and cattle farming both outside and inside

the park. Logging roads were built and timber was cut from 11,000 acres for the charcoal and barrel industry, which substantially impacted soils and water quality in the watershed. Other past actions have had impacts on the soil and water quality as well. After the sewage treatment plant near Camp Round Meadow at the head of Owens Creek was built, the abandoned sewage lagoon was converted into a wetland, offering beneficial impacts to both soil and water quality. Also, Hunting Creek Dam, built in 1972, affects downstream water quality. While flood control is not a significant function of the dam, it does act to regulate the streamflow, which helps alleviate erosion downstream of the dam. The 40-acre impoundment reservoir also serves as a silt trap, which can be beneficial by preventing excessive downstream sedimentation, but which can also disrupt the normal downstream sediment loading pattern.

The park's plan to implement limited prescribed burning for research purposes in the future would create adverse, short-term, minor impacts due to increased soil erosion from loss of vegetative cover. Other future actions that would cause adverse impacts include utility development and continued agricultural use, although the latter would decrease over time due to increasing residential development. Existing land use patterns are slowly changing as private residences are increasingly intermingled with traditionally agricultural areas. As more and more people seek a rural atmosphere and move out of the Washington, D.C., and Baltimore metropolitan areas, a growing population and infrastructure development would create greater pressures on adjacent natural areas. This increase in residential development would have an adverse, short- and long-term, minor to moderate impact on soil and water quality.

All of these activities, when combined with the continued deer browsing pressure under alternative A, would result in adverse, short- and long-term, minor to moderate impacts on soil and water quality.

Conclusion

Adverse, long-term, negligible to minor impacts on soils and water quality could result from soil erosion and sedimentation due to loss of vegetation from increased deer browsing, assuming continued growth of the deer population over the life of the plan. Past, present, and future activities both inside and outside the park, when combined with the continued pressure on forest resources expected under this alternative, would result in adverse, short- and long-term, minor to moderate impacts on soil and water quality. There would be no impairment of park soils or water resources under alternative A.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

Several non-lethal actions under alternative B would be implemented in combination to protect forest resources and reduce the park's deer population. Actions include the use of large-scale exclosures, increased use of repellents in limited areas, and reproductive control of does.

Under alternative B approximately 15 exclosures, each encompassing 23 acres (approximately 6% of the total park), would be used throughout the park to

exclude deer from those areas for at least 10 years to allow reforestation, after which time the exclosures would be relocated. The use of large exclosures could have both beneficial and adverse impacts on park soils and water quality. Revegetation within the exclosures would help minimize the potential for soil erosion in approximately 6% of the park at any one time. However, exclosures alone would not decrease overall deer browsing pressure within the park, and the benefits of the exclosures might initially be offset by adverse impacts in other areas or result in a change in browsing patterns. The exclosures would be spaced so as to prevent the funneling of deer into certain areas, and they would be relocated periodically. However, deer displaced from the exclosures might still concentrate in other areas of the park. This could have adverse impacts in those areas by further increasing the loss of vegetative ground cover, resulting in increased soil erosion and sedimentation into park streams. Adverse impacts would be long term and minor, gradually shifting to beneficial as more and more of the forest regenerated due to protection afforded by the exclosures.

Continued use of small fences and repellents would probably have little impact mitigating soil erosion and may cause deer to concentrate browsing elsewhere, resulting in increased loss of vegetation in those areas.

The use of reproductive control could reduce the deer population to a limited extent if it was successfully implemented. Even if all does targeted were treated, reproductive control would take several years to take effect, with a best case scenario of a 5% reduction in population over several years after 90% of the does were treated. However, any reduction in the deer population would help decrease the loss of vegetation due to deer browsing and would be beneficial in the long term.

Cumulative Impacts

The cumulative impacts under alternative B would be similar to those under alternative A because the same past, present, and future activities are expected under both alternatives. The beneficial long-term impacts on soil and water quality of alternative B would slightly offset some of the adverse cumulative impacts; however, the majority of the watersheds for the park's creeks lie outside the park, where impacts might or might not be mitigated. Therefore, actions under alternative B would offset only a very small part of the overall cumulative impacts, which would continue to be adverse, short and long term, and minor to moderate.

Conclusion

Adverse, long-term, minor impacts to soils and water quality could occur if deer displaced by the fenced exclosures concentrated in other areas of the park, resulting in increased loss of vegetation in those areas and a potential increase in soil erosion. These impacts would gradually shift to beneficial in the long term as reforestation occurred in the large exclosures, potentially reducing soil erosion. Beneficial long-term impacts would also result from decreased vegetation loss as reproductive control of the deer population would gradually reduce deer numbers over time. Cumulative impacts would be adverse, short and long term, and minor to moderate due to the large portion of the creeks' watersheds that are outside the

park boundary, and beneficial long-term impacts occurring inside the park would offset cumulative impacts only slightly. There would be no impairment of park soils or water resources under alternative B.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE)

Analysis

Sharpshooting and capture and euthanasia, where appropriate, would be used to immediately reduce the number of deer within the park and to maintain sustainable deer population of 15–20 deer per square mile after the third year of implementation. A smaller deer herd would allow reforestation to occur throughout the park because deer browsing pressure would be decreased. Regrowth of vegetative ground cover would reduce the potential for soil erosion and sedimentation of park streams, resulting in beneficial, long-term impacts on soils and water quality.

Continued use of small fences and repellents would probably have little impact mitigating soil erosion and may cause deer to concentrate browsing elsewhere, resulting in increased loss of vegetation in those areas.

Cumulative Impacts

The cumulative impacts from alternative C would be similar to those for alternatives A and B, but with a slightly greater beneficial effect from the immediate reduction of deer numbers and the maintenance of a smaller sustainable deer population (15–20 deer per square mile) after the third year of implementation. However, as with alternative B, the beneficial impacts of this alternative would only slightly offset some of the cumulative adverse impacts, since the majority of the watersheds affected lie outside the park where impacts may or may not be mitigated. Therefore the combined actions of alternative C with other past, present, and future activities would result in adverse, short- and long-term, minor to moderate impacts.

Conclusion

Beneficial, long-term impacts on soils and water quality would result from immediately reducing the number of deer in the park and maintaining a sustainable population of 15–20 deer per square mile after the third year of implementation. Vegetative ground cover would be able to reestablish itself, helping reduce soil erosion and sediment loading in the park's creeks. Cumulative impacts would be adverse, short and long term, and minor to moderate due to the large portion of the creeks' watersheds occurring outside the park boundary; the beneficial, long-term impacts of alternative C would offset cumulative impacts only slightly. There would be no impairment of park soils or water resources under alternative C.

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

Under alternative D direct reduction would be used to initially reduce the number of deer within the park, and reproductive control of does (and direct reduction if

needed) would then be used to maintain a sustainable population of approximately 15–20 deer per square mile after the third year of implementation. The reduction and long-term maintenance of a small herd would allow vegetative ground cover to reestablish itself throughout the park and potentially reduce soil erosion, providing beneficial, long-term impacts on the soils and water quality of the park.

Continued use of small fences and repellents would probably have little impact mitigating soil erosion and may cause deer to concentrate browsing elsewhere, resulting in increased loss of vegetation in those areas. Therefore, overall impacts under alternative D would be beneficial and long term.

Cumulative Impacts

Cumulative impacts to soils and water quality under alternative D would be very similar to those described for alternative C, with the beneficial, long-term effects on soils and water quality resulting from the relatively rapid reduction of deer numbers and the long-term maintenance of a smaller deer herd over the life of the plan. However, as with alternative C, these beneficial effects would only slightly offset the other adverse cumulative impacts occurring outside the park boundary, where the majority of the park watersheds occur. Adverse activities on adjacent lands might or might not be mitigated. Overall the cumulative impacts would be adverse, short and long term, and minor to moderate.

Conclusion

Impacts on soil and water quality would be beneficial and long term as a result of immediately reducing the number of deer in the park and maintaining a population of 15–20 deer per square mile after the third year of implementation. Vegetative ground cover would be able to reestablish itself, helping mitigate any soil erosion and sediment loading into the park's creeks. Cumulative impacts would be adverse, short and long term, and minor to moderate due to the large portion of the creeks' watersheds that occur outside the park boundary, where adverse actions might or might not be mitigated; the beneficial, long-term impacts of the alternative D actions in the park would only slightly offset cumulative impacts outside the park. There would be no impairment of park soils or water resources under alternative D.

WHITE-TAILED DEER HERD HEALTH

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act*, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the agency to mean that native animal life should be protected and perpetuated as part of the park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities. According to the NPS *Management Policies 2001*, the restoration of native species is a high priority (NPS 2000c, sec. 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Data from 1988 and 2002 deer herd health checks within the park were analyzed in relation to the existing management actions. The Maryland Department of Natural Resources does not actively monitor deer herd health (Eyler, pers. comm. 2005). Definitions for herd health are based on the physical description ratings used by the Southeastern Cooperative Wildlife Disease Study (SCWDS) during the herd health checks. The SCWDS system was established by Stockle et al. (1978) and used data collected from 440 white-tailed deer throughout the southeastern United States to determine relationships between specific fat indices and overall physical condition. Taking this data, physical condition ratings were categorized into four levels (Stockle et al. 1978):

Excellent: Heavy kidney fat, moderate to heavy heart and pericardial fat, padded tail, heavy subcutaneous fat, back fat extending from the tail into the lumbar region, which may be as much as 12 to 25 mm thick at the last sacral vertebrae.

Good: Moderate kidney fat, light to moderate heart and pericardial fat, lightly padded or padded tail, heavy subcutaneous fat, back fat extending from the tail into the lumbar region, which may be as much as 12 to 25 mm thick at the last sacral vertebrae.

Fair: Zero or light fat on kidney, heart, and pericardium. Tail bony. Adequate skeletal muscle. Light deposit of fat on the omentum, which may be pink in color.

Poor: No trace of fat on the kidney, heart, omentum, or intestines. Carcass approaching emaciation. Tail bony and backbone very prominent before skinning. Gelatinous material may be present on the heart and omentum where fat was mobilized.

The findings of the 1988 and 2002 deer herd health checks within the park indicate that the herd size at the time of each study exceeded the nutritional carrying capacity of the park, which suggests there is potential for substantial

Parasitism — A symbiotic relationship in which one species, the parasite, benefits at the expense of the other, the host.

losses to malnutrition and parasitism if the current deer density is maintained or increased. When deer density is high, signs of nutritional stress such as low body and internal organ mass, low fecal nitrogen levels, and high prevalence of parasitic infections occur. When deer density is reduced to the nutritional carrying capacity, all of these indicators show improved condition (Sams et al. 1998). Follow-up herd health checks are planned every five years, with the next check scheduled for 2007. The herd health checks will be performed on five randomly sampled individual deer. Also, CWD testing will be conducted as described in appendix D. Using the physical condition ratings categorized above, the thresholds for the intensity of an impact on deer herd health are defined as follows:

Negligible: Less than 10% of the deer sampled display a physical condition within the fair or poor rating during any one sampling event, and the rest are rated as good or higher.

Minor: Between 10% and 30% of the deer sampled display a physical condition with a fair or poor rating during any one sampling event.

Moderate: Between 30% and 50% of the deer sampled display a physical condition with a fair or poor rating during any one sampling event.

Major: More than 50% of the deer sampled display a physical condition with a fair or poor rating in any one sampling event.

AREA OF ANALYSIS

The area of analysis for assessment of impacts is Catoctin Mountain Park. The area of analysis for cumulative impacts is the park and the area within 0.5 mile of the park boundary, which is based on the average home range of deer within the park (Warren and Ford 1990).

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE A: NO-ACTION ALTERNATIVE (EXISTING MANAGEMENT CONTINUED)

Analysis

Under this alternative park staff would continue monitoring the deer population and use some controls to protect important resources, none of which would reduce the size of the deer population in the park. The actions under this alternative would be very limited and would reflect what is occurring today. With no control on the deer population, the population would continue to vary depending on conditions; however, the general trend toward increased numbers would continue. In addition, the park would continue to conduct activities to protect sensitive plant species. As additional rare understory plant species were found within the park, they would be protected with additional fencing, which would further limit potential food sources for park deer.

Under alternative A, the deer population in Catoctin Mountain Park would continue to exhibit declining population health. As detailed in the previous "Vegetation" section, the deer population would remain in excess of the recommended density for forest regeneration and would likely increase over time, adversely impacting woody and herbaceous vegetation. Deer herd health checks conducted in 1988 and 2002 indicate that the deer herd within Catoctin Mountain Park has exceeded the habitat's nutritional carrying capacity (Davidson 1988) and shows evidence of "significant deterioration of population health" (Davidson 2002). In 1988 the overall condition of all the sampled deer was fair; in 2002 the overall condition of 60% of the sampled deer was poor and 40% fair, indicating a major adverse impact.

These results were compared to similar herd health checks at nearby parks, with the Catoctin population showing much poorer health status. The differences in health were attributed to different habitat conditions at the other parks. The overall results suggest the potential for substantial losses to malnutrition and parasitism if the current deer density is maintained or increased.

Starvation and poor reproduction demonstrated by deer in overpopulated herds is not evidence that the herd is regulating itself. Starvation and disease are not acute mortality factors, such as predation, but rather provide only chronic control over a population (Eve 1981, as cited in Warren 1991). Under these conditions, deer herds can remain at high levels for many years until starvation, disease, or severe winter weather cause a reduction in population size typically lasting two to five years. By this time adverse ecological effects can already have occurred. Such reductions in the deer herd as a result of natural die-offs probably would not allow recovery of the natural community (Warren 1991).

Based on observations and research conducted within the park, the park's deer population has already experienced a decline in overall health (Davidson 1988, 2002). It is expected that alternative A would continue to result in major, adverse, and long-term impacts on the health of the population.

An exotic species is any introduced plant, animal or protist species that is not native to the area and may be considered a nuisance; also called non-native or alien species.

Cumulative Impacts

Increased adverse impacts to the deer population are expected from a decrease in the number of hunters outside the park (resulting in higher deer densities inside and outside the park). In addition to deer browsing, past actions within the park such as logging and fire suppression have adversely affected deer habitat. The park's past and proposed future increase in efforts to control invasive exotic species, along with efforts to control gypsy moths, chestnut blight, dogwood anthracnose, hemlock woolly adelgid, and other pests, offer beneficial impacts to deer habitat and, thus, impact overall herd health. The park's plans to implement limited prescribed burning for research purposes in the future would be expected to beneficially impact vegetation and deer habitat. All of these activities, when combined with the continued pressure on vegetative resources and deer habitat expected under alternative A from continued deer browsing, would result in adverse cumulative impacts to deer herd health. Adverse cumulative impacts would be major and long term, since the deer population would be expected to increase and potential habitats and food sources would continue to be restricted.

Conclusion

Under alternative A there would be no control on the growth of the deer population, which would result in adverse, long-term, major impacts on the health of the deer herd. These impacts would continue due to excessive deer browsing and the continued growth of the population. Past, present, and future activities, when combined with the continued pressure on vegetative resources and deer habitat expected under this alternative, would result in adverse, long-term, major cumulative impacts. Since alternative A would not reverse the expected long term continued increase in the deer population, adverse health effects would likely continue or worsen, and impairment of the white-tailed deer herd in Catoctin Mountain Park would occur over the long term.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

Several non-lethal actions would be implemented under alternative B to protect forest resources and reduce deer numbers in the park. Actions include the use of large-scale exclosures, increased use of repellents in limited areas, and reproductive control of does. Small fenced areas and repellents would be implemented, as under alternative A.

Use of large-scale exclosures and repellents would protect vegetation, but would exclude deer from potential food sources in approximately 6% of the park at any given time. Areas outside the exclosures would continue to be affected by heavy deer browsing. Impacts to deer herd health would be similar to those discussed under alternative A, resulting in adverse, long-term, major impacts.

If successfully implemented, reproductive control would help reduce the impact on deer herd health. However, the time required to see these results could be several years; researchers disagree on the amount of time needed to reduce a population size using reproductive controls (Hobbs et al. 2000; Nielsen et al. 1997; Rudolph et al. 2000). The actual amount of time needed to observe a decrease would depend on a number of factors, such as the type of treatment used, its effectiveness in stopping reproduction, the size of the population at the time of initial treatment, the actual mortality rate, and the percentage of the population treated. Other factors such as untreated deer moving into the park and treated deer leaving the park would also affect the time required to reduce herd numbers. The benefit of this action would be proportional to the amount of population reduction that it provided; therefore, a benefit could not actually be established until an improvement in herd health checks was observed. Hobbs et al. described a model where if 90% of the breeding does in the park were effectively treated annually, mortality would need to exceed the number of surviving offspring from the 10% of untreated does in order to achieve a population reduction. An average mortality rate in urban/suburban deer populations is 10% (Hobbs et al. 2000). Based on these factors, it is expected that reproductive controls could stop population growth, but the park would not be able to reach its initial deer density goal within the life of this management plan using current technology. Therefore, the impact to deer herd health would continue to be adverse, long term, and major.

Cumulative Impacts

The same past, present, and future activity impacts described under alternative A would also occur under alternative B. Implementation of the management actions identified in alternative B, where approximately 6%-12% of the park's vegetation would be protected from browsing, plus reproductive control, could reduce the deer density after more than 15 years of implementation. This would provide beneficial effects only over the long term, but not immediately. Combined with all other actions affecting deer herd heath, continued pressure on vegetative resources and deer habitat expected under alternative B from continued deer browsing would result in adverse, long-term, moderate to major cumulative impacts to deer herd health.

Conclusion

Impacts to deer herd health under alternative B would be adverse, long term, and major. Actions such as the use of large-scale exclosures and increased use of repellents would help with forest regeneration in only very limited areas, and since the effect of reproductive control on the deer population would not be seen for many years, the overall long-term effect of alternative B would be expected to remain at major adverse levels for the life of this plan. Past, present, and future activities, when combined with continued pressure on vegetative resources and deer habitat expected under this alternative, would result in adverse, long-term, moderate to major impacts. Since alternative B would provide for reproductive control of the deer herd and a potential for gradual reduction in deer herd numbers over an extended period of time, it is not expected that impairment of the white-tailed deer herd in Catoctin Mountain Park would occur under this alternative.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE)

Analysis

Sharpshooting would be used under this alternative, along with capture and euthanasia applied where appropriate, to reduce the deer herd size. The intent would be to rapidly reduce deer density within the park to allow for the herbaceous vegetation and tree seedlings to recover from browsing pressure. Small fenced areas and repellents would be implemented, as under alternative A.

The deer herd health checks conducted in 1998 and 2002 concluded that herd size at the time of each study exceeded the nutritional carrying capacity of the park. These results were compared to similar herd health checks at nearby parks, with the Catoctin population showing much poorer health status. The differences in health were attributed to different habitat conditions at the other parks. The overall results suggest the potential for substantial losses to malnutrition and parasitism if the current deer density was maintained or increased (Davidson 2002). Reducing deer density levels and maintaining these levels would allow vegetation to recover, providing better foraging habitat for the park deer population. Davidson (2002) concluded that "continuation of current herd density likely would result in a further decline in herd health and higher rates of disease-induced mortality; reduction and subsequent control of the population are appropriate measures to address this density-dependent health problem." With increased vegetation and improved foraging habitat, this alternative would have

Carrying capacity — The maximum number of organisms that can be supported in a given area or habitat.

beneficial, long-term effects, and adverse impacts to deer herd health would be reduced to negligible or minor over the long term as the deer population decreased. Adverse impacts would still range from minor to moderate during the short term while habitat recovered.

Cumulative Impacts

The same past, present, and future activity impacts described under alternative A would also occur under alternative C. Relieving deer browsing pressure through rapid reduction in the deer population under alternative C would allow the majority of the park's habitat to regenerate, resulting in beneficial effects and reducing adverse impacts over the long term to negligible or minor levels.

Rapid deer density reduction would give the forest the opportunity to regenerate, improving habitat for the park deer population, resulting in adverse, long-term, negligible to minor impacts that would combine with the beneficial effects of prescribed burning for research purposes and disease and pest control, resulting in cumulative impacts that would be primarily beneficial. These beneficial impacts would offset the adverse effects from increased development and other cumulative adverse actions. Therefore, cumulative impacts to deer herd health under this alternative would be mostly beneficial and long term.

Conclusion

The relatively rapid reduction of the deer herd and the resultant regeneration of forage under alternative C would result in beneficial effects on deer herd health and would reduce adverse impacts to negligible or minor levels over the long term as the deer population decreased. Adverse impacts would still range from minor to moderate while habitat recovered. Past, present, and future activities, when combined with the reduced browsing pressure expected under this alternative, would result in long-term, beneficial, cumulative impacts on deer herd health. There would be no impairment of the white-tailed deer population in the park under alternative C.

Habitat refers to the environment in which a plant or animal lives (includes vegetation, soil, water, and other factors).

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

Under alternative D direct reduction of the deer herd would be used to reduce the size of the deer herd, and reproductive control and direct reduction (if needed) would be used to maintain the deer population at the reduced size. Small fenced areas and repellents would be implemented, as under alternative A.

The intent of this alternative would be to rapidly reduce the deer density within the park to allow for the herbaceous vegetation and tree seedlings to recover from deer browsing pressure. As vegetation regenerated, better foraging habitat would be provided for the park deer population. Davidson (2002) concluded that "continuation of current herd density likely would result in a further decline in herd health and higher rates of disease-induced mortality; reduction and subsequent control of the population are appropriate measures to address this density dependent health problem." With increased vegetation and improved foraging habitat, this alternative would have long-term and beneficial effects, and

adverse impacts to deer herd health would be reduced to negligible or minor levels over the long term as the deer population decreased. Adverse impacts would still range in the minor to moderate level during the short term while habitat recovered.

Once implemented, the effect of reproductive control on the deer population would reduce the impact on deer herd health. The actual amount of time needed to observe a decrease would depend on the type of treatment used, its effectiveness in stopping reproduction, the size of the population at the time of the initial treatment, and the percentage of the population treated. In combination with direct reduction, adverse impacts would range from negligible to minor.

Cumulative Impacts

The same past, present, and future activity impacts described under alternative A would also occur under alternative D. Reducing deer density levels and maintaining these levels under alternative D would allow vegetation to recover, providing better foraging habitat for the park deer population and resulting in adverse, long-term, negligible to minor impacts.

Rapid deer density reduction would allow the forest to regenerate, resulting in beneficial impacts to deer habitat that would combine with the beneficial effects of prescribed burning for research purposes and disease and pest control, resulting in cumulative impacts that would be primarily beneficial. These beneficial impacts would offset the adverse effects from increased development and other cumulative adverse actions. Therefore, cumulative impacts to deer herd health under this alternative would be mostly beneficial and long term.

Conclusion

Implementing long-term deer population management through the use of direct reduction under alternative D would have long-term and beneficial effects, and adverse impacts to deer herd health would be reduced to negligible or minor levels over the long term as the deer population decreased. Reproductive controls, with the current technology, would help maintain adverse impacts at lower levels. Past, present, and future activities, when combined with the reduced pressure on deer habitat expected under this alternative, would result in beneficial, long-term cumulative impacts to deer herd health. There would be no impairment of the white-tailed deer population in the park.

OTHER WILDLIFE AND WILDLIFE HABITAT

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act of 1916*, NPS *Management Policies 2001* (NPS 2000c), and NPS *Reference Manual 77: Natural Resource Management* (NPS 1991b) direct NPS managers to provide for the protection of park resources. The *Organic Act* requires that wildlife be conserved unimpaired for future generations, which has been interpreted to mean that native animal life are to be protected and perpetuated as part of a park unit's natural ecosystem. Parks rely on natural processes to control populations of native species to the greatest extent possible; otherwise, they are protected from harvest, harassment, or harm by human activities. The NPS *Management Policies 2001* make restoration of native species a high priority. Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and ecological integrity of plants and animals (NPS 2000c, sec. 4.1). Policies in the NPS *Natural Resource Management Guideline* state, "the National Park Service will seek to perpetuate the native animal life as part of the natural ecosystem of parks" and that "native animal populations will be protected against . . . destruction . . . or harm through human actions."

The first management goal in Catoctin's 1996 *Statement for Management* applies to wildlife. It calls for the park to "identify, protect, and enhance native species populations, natural populations, natural features, and ecological process of the park" and to "strive to maintain natural abundance, biodiversity, and ecological integrity of the wildlife and plant populations."

Demographic — The intrinsic factors that contribute to a population's growth or decline: birth, death, immigration, and emigration. The sex ratio of the breeding population and the age structure are also considered demographic factors because they contribute to birth and death rates.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

The evaluation of wildlife (other than deer) was based on a qualitative assessment of how expected changes to park vegetation (as a result of increased or decreased deer browsing pressure) would affect the habitat of other wildlife. The park's wildlife species are directly affected by the natural abundance, biodiversity, and the ecological integrity of the vegetation that comprises their habitat.

Available information on known wildlife, including unique or important wildlife or wildlife habitat, was compiled and analyzed in relation to the management actions. The thresholds for the intensity of an impact are defined as follows:

Negligible: There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.

Minor: Impacts would be detectable, but would not be outside the natural range of variability. Small changes to population numbers, population structure, genetic variability, and other demographic factors might occur. Occasional responses to disturbance by some individuals could be expected, but

without interference to factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside critical reproduction periods for sensitive native species.

Moderate: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to population numbers, population structure, genetic variability, and other demographic factors would occur, but species would remain stable and viable. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to factors affecting population levels. Sufficient habitat would remain functional to maintain the viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Population numbers, population structure, genetic variability, and other demographic factors might experience large declines. Frequent responses to disturbance by some individuals would be expected, with negative impacts to factors resulting in a decrease in population levels. Loss of habitat might affect the viability of at least some native species.

Genetic variability — The amount of genetic difference among individuals in a population.

AREA OF ANALYSIS

The study area for this analysis (including cumulative impacts) is primarily Catoctin Mountain Park and the habitat surrounding the park, including Cunningham Falls State Park to the south, and agricultural lands to the north and west.

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE A: NO-ACTION ALTERNATIVE (EXISTING MANAGEMENT CONTINUED)

Analysis

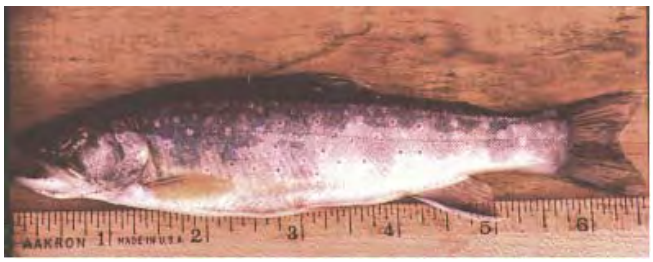
Under this alternative park staff would continue monitoring the deer population and conduct activities to protect native plants, such as creating and monitoring small fenced areas and applying repellents in landscaped areas (such use is currently minimal). Maintaining small fenced areas or applying repellents to protect individual or groups of plants from deer browsing could restrict other wildlife from using these plants. However, these actions would have little effect on other wildlife because of their small scale, and their impact would not be measurable. Therefore, the impact of small fenced areas and repellent use under this alternative would be adverse, short term, and negligible.

The vegetation/habitat conditions described in "Chapter 3: Affected Environment," for both vegetation and other wildlife and wildlife habitat indicates that deer have already affected the vegetation, and thus habitat, for other wildlife species within the park. The herbaceous and woody seedling layers of the forest have been heavily browsed by deer, suggesting that the abundance and diversity of other wildlife using this understory habitat today is less than what it would be if deer browsing pressure was lower. With no control on deer population growth, vegetation for food and cover would become less abundant for other wildlife.

Species that use deer as a food source, including coyotes, bobcats, and bears (which are opportunistic predators of fawns) could benefit from high deer density or open understory conditions. Other animals may also feed on deer carcasses, like box turtles, vultures, crows, and chickadees. Small predators, such as foxes, hawks, owls, skunks, and raccoons, would also benefit from a more open understory because prey would be easier to find. However, if the habitat of the prey species deteriorated to the point where prey (mice, rabbits, ground-nesting birds) could no longer maintain viable populations within the park, then predator species would also decline.

As previously described, a breeding bird density study conducted in 2005 within Catoctin Mountain Park and the Frederick City Watershed found that the watershed had a lower deer density and more forest regeneration than did Catoctin, which was reflected in many of the bird species observed (NPS 2005h). The watershed has a denser understory and ground cover, resulting in a higher occurrence of bird species that nest on or close to the ground (ovenbirds, black-and-white warblers, worm-eating warblers), whereas Catoctin has a more open ground and lower canopy habitat due to a higher deer density, resulting in more upper canopy birds (wood thrushes, American redstarts, tufted titmice, Carolina chickadees, and northern cardinals).

Heavy deer browsing also results in lack of cover for small mammals, as well as snakes, frogs, and small ground-nesting or feeding birds, making them increasingly vulnerable to predation from hawks, owls, coyotes, foxes, skunks, and raccoons.



Fish populations may be indirectly affected by high deer numbers.

Species that depend primarily on other habitats are less affected by high deer numbers. Some frogs, snakes, salamanders, and turtles (e.g., bullfrogs, northern water snakes, snapping turtles) live close to water during much of their lives and are therefore less affected by deer. Similarly, heavy deer browsing would not directly change fish habitat. However, other species (e.g., box turtles, wood turtles, hognose snakes, American toads, and gray tree frogs) are dependent on vegetation, fruits, and insects found within the understory of the forest, and their habitat is affected by high deer numbers.

Therefore, animals such as wild turkeys, box turtles, rabbits, mice, and ground-nesting birds, which require ground vegetation to maintain viable populations within the park, would be adversely affected by high deer densities (greater than

20 deer per square mile) because available food and cover would be greatly reduced by browsing. As browsing impacts increased, more and more wildlife species would be adversely affected by these changes. For example, during winter wild turkeys depend on acorns, nuts, seeds, and fruits. When deer reduce the availability of these food sources, turkeys and other species could eventually decline and could even cease to exist within the park.

Therefore, the impact of alternative A to other wildlife would be adverse, long term, and negligible to major, depending on the species. Species that depend on ground cover and young tree seedlings for food or cover could severely reduced or eliminated from the park, while impacts on species that depend primarily on other habitats (not woodlands) or on the upper canopy for food and cover would be negligible.

Cumulative Impacts

Actions resulting in cumulative impacts to wildlife would be similar to those described for vegetation, since vegetation comprises the habitat that affects wildlife species to a great extent. Adverse impacts to the forest are expected from fewer hunters outside the park (resulting in a higher deer density outside the park and more browsing), development within the park, road widening and construction projects, and greater visitor trampling. In addition to deer browsing, past actions within the park, such as logging and fire suppression, have adversely affected wildlife habitat. Blowdowns from weather events have altered habitat in localized areas, benefiting some species and adversely affecting those more dependent on taller, mature trees. Disease has also affected some species (e.g., rabies and West Nile virus), and cell towers may result in bird collisions. Park efforts to control invasive exotic species, gypsy moths, chestnut blight, dogwood anthracnose, hemlock woolly adelgid, and other pests would have beneficial impacts to wildlife habitat and forest regeneration. Limited prescribed burning for research purposes in the future would also beneficially affect the park's forest habitat. All of these activities, when combined with the continued pressure on forested wildlife habitat and limited natural regeneration from continued deer browsing, would result in both adverse and beneficial impacts to vegetation and therefore to wildlife habitat. The overall cumulative impact would be adverse, long term, and major since the very high densities of deer would continue to restrict habitat conditions for many wildlife species.

Conclusion

Under alternative A, habitat for wildlife species other than white-tailed deer would continue to be adversely affected by a large deer population and related browsing, resulting in decreased plant diversity, increased nonnative plants, and an absence of forest regeneration (as long as the deer population remained high or increased). A few predator species would tend to benefit from a large deer population and an open understory, enabling them to better see and catch prey. However, the impacts of large numbers of deer browsing on vegetation would adversely affect a large percentage of habitats for other wildlife (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles), resulting in adverse, long-term, and potentially major impacts, depending on the species. Past, present, and future activities, when combined with the continued pressure

on forest regeneration expected under this alternative, would result in both adverse and beneficial impacts, with adverse, long-term, major cumulative impacts. Since alternative A would not reverse the expected long-term continued growth in the deer population, and wildlife habitat would likely continue to be degraded, it is expected that impairment of certain wildlife species and habitat would occur under this alternative over the long term.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

Bark stripping of slippery elm trees.

Under this alternative, several non-lethal actions would be implemented in combination to protect wildlife habitat and reduce deer numbers in the park. Actions include the use of large, fenced exclosures, increased use of repellents in limited areas, and reproductive control of does. Small fenced areas and repellents would be implemented, as under alternative A.

Large, fenced exclosures would be constructed to allow forest regeneration within localized areas of the park. As explained previously in this chapter under "Vegetation," approximately 6% of the park would be protected from deer browsing in this manner at a given time, and 6–12% of the woody vegetation would be protected over the life of the plan. The size of the openings in the fence (4 inches square) would allow small birds and mammals (e.g., songbirds, rabbits, raccoons) to pass in and out of these exclosures. The added fence posts and fence would also provide perches for some birds, including hawks and owls. The fence could be an obstacle to others (e.g., birds hitting the fence). This action would make more ground/shrub layer habitat available to other wildlife than alternative A. However, because only 6% of the park would be fenced off from browsing deer at any one time, and because deer density outside the protected areas would continue to remain high for many years, the beneficial impact to other wildlife would be limited. Similar to alternative A, a continued high degree of deer browsing throughout a majority of the park would reduce the availability of food for species that depend on ground/shrub layer vegetation for survival. These species would decline and could even be lost from the park. This would be an adverse, long-term, major impact on these species. Other species that have a more diverse diet or that spend more time in other habitat or the upper canopy (versus the ground/shrub layer) would be less affected by high or increased deer density. The overall impact to wildlife throughout the park would continue to be adverse, long term, and negligible to potentially major, depending on the species.

The use of repellents to protect individual plants or groups of plants from deer would have little effect on other wildlife, as it would be implemented at such a small scale that the impact would not be measurable. Therefore, the use of repellents would have adverse, short-term, negligible impacts.

The use of reproductive controls could help reduce the impact on other wildlife. However, the time required to see these results could be several years; researchers disagree on the amount of time needed to reduce a population size using reproductive controls (Hobbs et al. 2000; Nielsen et al. 1997; Rudolph et al. 2000). The actual amount of time needed to observe a decrease would depend on a number of factors, such as the type of treatment used, its effectiveness in stopping reproduction, the size of the population at the time of initial treatment, the actual mortality rate, and the percentage of the population treated. Other factors such as untreated deer moving into the park and treated deer leaving the park would also affect the time required to reduce herd numbers. The benefit of this action would be proportional to the amount of population reduction that it achieved, and a corresponding improvement to understory habitat.

Hobbs et al. (2000) described a model where if 90% of the breeding does in the park were effectively treated annually, mortality would need to exceed the number of surviving offspring from the 10% of untreated does in order to achieve a population reduction. An average mortality rate in urban/suburban deer populations is 10% (Hobbs et al. 2000). Based on these factors, it is expected that reproductive controls could stop population growth, but it would not be possible to achieve a meaningful population reduction within the park during the life of this management plan.

Similar to alternative A, a continued high degree of deer browsing throughout the majority of the park would reduce the availability of food for species that depend on ground/shrub layer vegetation for survival (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles). These species would decline and could be eliminated from the park. This would be an adverse, long-term, major impact on these species. Other species that have a more diverse diet or that spend more time in other habitat (e.g., snapping turtles, copperheads, spotted salamanders) or the upper canopy (e.g., woodpeckers, barred owls, cerulean warblers) would be less affected by high or increased deer density. The overall impact to wildlife throughout the park would continue to be adverse, long term, and negligible to potentially major, depending on the species.

Human presence associated with the installation of fenced exclosures or the application of repellents and reproductive control techniques could adversely affect wildlife while the actions were being carried out. However, such small areas of the park would be affected for a short period that the adverse impact would be short term and negligible.

Cumulative Impacts

The same past, present, and future actions described under alternative A would also occur under alternative B. Under alternative B protecting approximately 6%–12% of the park's vegetation from deer browsing and using reproductive control that could reduce deer density and related browsing impacts after more than 15 years of implementation. Combined with the effects of prescribed burning for research purposes and disease and pest control, this would provide some beneficial, long-term impacts. However, these beneficial effects would not be large enough to offset the adverse effects from increased development and

other cumulative adverse actions, in conjunction with the continued deer browsing pressure on the majority of the woody and herbaceous vegetation in the park. Therefore, overall cumulative impacts to wildlife habitat, and thus to other wildlife species, under this alternative would be adverse, long term, and moderate to major.

Conclusion

Under alternative B, approximately 6% of the herbaceous vegetation and up to 12% of the woody vegetation in the park would benefit from the construction of large, fenced exclosures and the increased use of repellents over the life of the plan. The remaining habitat, however, would continue to be subject to a high degree of deer browsing, adversely impacting both ground and shrub layer habitat for many other species of wildlife until reproductive controls took effect and reduced the deer population (more than 15 years). Overall, impacts to other wildlife would be adverse, long term, and negligible (e.g., snapping turtles, spotted salamanders) to potentially major (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles), depending on the species. Past, present, and future activities, when combined with the continued pressure on wildlife habitat expected under this alternative, would result in both adverse and beneficial impacts, with adverse, long-term, moderate to major cumulative impacts on other wildlife. Since alternative B would provide continued protection of certain areas of the park over the long term and would introduce reproductive controls that could reduce deer numbers over an extended period of time, it is not expected that impairment of other wildlife species or habitat would occur under this alternative.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE)

Analysis

Under this alternative sharpshooting would be used to reduce the deer herd size, along with capture and euthanasia where appropriate. The intent of this alternative would be to rapidly reduce deer density within the park to allow for the herbaceous vegetation and tree seedlings to recover from deer browsing pressure. Small fenced areas and repellents would be implemented, as under alternative A.

Unlike alternative A, a reduced degree of deer browsing throughout the majority of the park would increase the availability of food for species that depend on ground/shrub layer vegetation for survival (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles). These species would be able to maintain viable populations within the park. As the vegetation became more diverse and abundant with reduced browsing pressure, the number of wildlife species that would benefit from these changes would increase. This would be a beneficial, long-term impact on these species. Other species that have a more diverse diet or that spend more time in other habitat (e.g., snapping turtles, copperheads, spotted salamanders) or the upper canopy (e.g., woodpeckers, barred owls, cerulean warblers) would be less affected by a reduced deer density.

Predators that use deer as a food source, such as bears, coyotes or bobcats, would be adversely affected by a lower deer density or denser understory conditions.

Other animals that feed on deer carcasses, such as coyote, vultures, crows, and raccoons, would also be adversely affected. However, none of these species solely depend on deer as a food source, so the adverse impacts to these species would be long term and minor. Predators such as foxes, hawks, owls, skunks and raccoons would find a denser understory more difficult for hunting small prey than the current open condition. However, better habitat conditions and an increase in the abundance of prey species would also benefit these predators.

Wildlife, other than deer, would be temporarily disturbed by the presence of humans placing bait stations, shooting deer, setting traps, and observing deer behavior. Bait could provide a beneficial food source to other wildlife during the time reduction activities were conducted; however, the small quantity and short time periods that bait would be available would have a negligible impact on any species. The surface disposal of deer waste and/or carcasses would provide a beneficial food source to scavengers like the coyotes, crows, and raccoons; however, under this alternative it is expected that the majority of carcasses would be disposed of through burial. The small number of carcasses left for natural decomposition would not be substantially different than what occurs through natural mortality (e.g., disease, old age, car collisions). These human disturbances would be adverse, but temporary (less than 30 days per year), and negligible, as they would not cause any measurable change to the habitat or responses by other wildlife species.

Long-term reduction and controls on deer population growth would allow vegetation used as food and cover for other wildlife to become more abundant. Therefore, the impact of alternative C to other wildlife would be mostly beneficial and long term, depending on the species. Species that depend on ground cover and young tree seedlings for food or cover would benefit the most (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles), while there would be little or no benefit to species that depend primarily on other habitats (e.g., snapping turtles, copperheads, spotted salamanders) and no immediate benefit to species that depend on the upper canopy for food and cover (e.g., woodpeckers, barred owls, cerulean warblers). A long-term benefit to upper canopy species would be gained in the future as forest regeneration maintained the upper canopy.

With increased habitat available to wildlife for food and cover, this alternative would result in beneficial, long-term effects, and existing adverse impacts to other wildlife would be reduced to negligible or minor levels.

Contractor — For the purposes of this plan, a contractor is a fully-insured business entity, nonprofit group, or other governmental agency engaged in wildlife management activities that include trapping, immobilization, and lethal removal through sharpshooting and chemical euthanasia.

Cumulative Impacts

The same past, present, and future actions described under alternative A would also occur under alternative C. Management actions identified in alternative C, where deer browsing pressure would be drastically reduced through a rapid reduction of the deer population would provide beneficial, long-term impacts to other wildlife (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles). Some adverse impacts would result to habitat as a result of trampling when qualified federal employees or contractors were setting traps, placing bait stations, occupying shooting locations, and removing deer carcasses. However,

these impacts would be temporary and isolated, causing little interference with other species activities, resulting in adverse, short-term, negligible impacts.

Rapid deer density reduction would allow the forest to regenerate, improving habitat for other wildlife and resulting in beneficial impacts that would combine with the beneficial effects of prescribed burning for research purposes and disease and pest control. These beneficial impacts would offset adverse effects from increased development and other cumulative adverse actions. Therefore, cumulative impacts to wildlife habitat, and thus other wildlife species, under this alternative would be mostly beneficial and long term.

Conclusion

Under alternative C impacts on other wildlife species and habitat would be beneficial and long term as a result of rapid reductions in deer numbers in the park, thereby reducing deer browsing pressure on woody and herbaceous vegetation and allowing increased abundance and diversity of other wildlife that depend on understory vegetation, such as turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles. Adverse, long-term impacts would be reduced to negligible or minor levels over time. Human disturbances from trampling at bait stations, shooting sites, trapping locations, or deer carcass disposal sites would be temporary and isolated within the park. Therefore, adverse impacts of these actions on other wildlife species would be short term and negligible. Past, present, and future activities, when combined with the reduced browsing pressure on understory habitat expected under this alternative, would result in long-term, beneficial, cumulative impacts to other wildlife. There would be no impairment of other wildlife species or habitat under this alternative.

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

Under alternative D the size of the deer herd would be directly reduced through sharpshooting and capture and euthanasia, and reproductive control or direct reduction (if needed) would be used to maintain the population at the desired level. Small fenced areas and repellents would be implemented, as under alternative A.

The impacts of each method (sharpshooting, euthanasia, or reproductive control) on other wildlife would be essentially the same, as long as habitat was improved by reducing deer browsing pressure. Potential differences in impacts would relate to the time required for implementation and the resulting deer population size.

Similar to alternative C, a reduced degree of deer browsing throughout the majority of the park would increase the availability of food for species that depend on ground/shrub layer vegetation for survival (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles). These species would be able to maintain viable populations within the park. As the vegetation became more diverse and abundant with reduced browsing pressure, the number of wildlife species that would benefit from these changes would increase. This would be a beneficial, long-term impact on these species. Other species that have a more diverse diet or that spend more time in other habitats (e.g., snapping

turtles, copperheads, spotted salamanders) or the upper canopy (e.g., woodpeckers, barred owls, cerulean warblers) would be less affected by a reduced deer density.

Also similar to alternative C, a few species that use deer as a food source, such as bears, coyotes or bobcats, might be adversely affected by fewer deer or denser understory conditions. Other animals that feed on deer carcasses, such as box turtles, vultures, crows, and chickadees, would also be adversely affected. However, none of these species depends solely on deer as a food source, so the adverse impacts would be minor. Predators such as foxes, hawks, owls, skunks, and raccoons would find a denser understory more difficult to hunt in than the current open condition. However, better habitat conditions and resulting increases in the abundance of prey species would also benefit these predators.

Wildlife other than deer would be temporarily disturbed by the presence of humans placing bait stations, shooting deer, setting traps, implementing reproductive control techniques, and observing deer behavior, similar to alternative C. Bait could provide a beneficial food source to other wildlife during the time that reduction activities were conducted; however, the small quantity and short time periods that bait would be available would have a negligible impact on any species. Surface disposal of deer waste and/or carcasses would provide a beneficial food source to scavengers like the coyotes, chickadees, and box turtles; however, under this alternative it is expected that the majority of carcasses would be disposed of through burial. The small number of carcasses left for natural decomposition would not be substantially different than what occurs today through natural mortality (e.g., disease, old age, car collisions). These human disturbances would be adverse, but temporary (less than 30 days per year), and negligible, as they would not cause any measurable change to the habitat or responses by other wildlife species.

Long-term reduction and controls on deer population growth would allow vegetation used as food and cover by other wildlife to become more abundant. Therefore, the impact of alternative D to other wildlife would be mostly beneficial and long term, depending on the species. Species that depend on ground cover and young tree seedlings for food or cover would benefit the most (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles), while there would be little or no benefit to species that depend primarily on other habitats (e.g., snapping turtles, copperheads, spotted salamanders) and no immediate benefit to species that depend on the upper canopy for food and cover (e.g., woodpeckers, barred owls, cerulean warblers). A long-term benefit to upper canopy species would be gained in the future as forest regeneration maintained the upper canopy.

With increased vegetation available to wildlife for food and cover, this alternative would result in beneficial, long-term effects, and existing adverse impacts would be reduced to negligible or minor levels.

Cumulative Impacts

The same past, present, and future actions described under alternative A would also occur under alternative D. Rapidly reducing the deer population and

alleviating browsing pressure on the majority of park habitat under alternative D would provide long-term beneficial impacts to other wildlife species (e.g., turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles).

Some adverse impacts would result to other wildlife as a result of trampling by humans setting traps and bait stations, occupying shooting locations, and removing deer carcasses. However, these impacts would be temporary and isolated, causing little interference with other species' activities, resulting in adverse, short-term, negligible impacts.

Rapid deer density reduction would give the forest the opportunity to regenerate, improving habitat for other wildlife and resulting in beneficial impacts that would combine with the beneficial effects of prescribed burning for research purposes and disease and pest control, resulting in primarily beneficial cumulative impacts. These beneficial impacts would offset the adverse effects from increased development and other cumulative adverse actions. Therefore, cumulative impacts to wildlife under this alternative would be mostly beneficial and long term.

Conclusion

Under alternative D impacts on other wildlife would be long term and beneficial because of rapidly reduced deer numbers in the park, resulting in decreased browsing pressure and natural forest regeneration, allowing increased abundance and diversity of other wildlife that depend on understory vegetation, such as turkeys, ovenbirds, wood frogs, eastern hognose snakes, and box turtles. Long term management of the deer population would be implemented through the use of direct reduction, followed by reproductive control, or direct reduction (if needed), resulting in continued, long-term, beneficial impacts by maintaining the population at desired levels. Over time present adverse impacts would be reduced to negligible or minor levels. Other wildlife would be temporarily affected by trampling at bait stations, shooting sites, trapping locations, reproductive control techniques, or deer carcass disposal sites. The adverse impacts of these isolated actions on other wildlife would be short term and negligible. Past, present, and future activities, when combined with the reduced pressure on understory habitat expected under this alternative, would result in beneficial, long-term cumulative impacts to other wildlife. There would be no impairment of other wildlife species or habitat under this alternative.

SENSITIVE AND RARE SPECIES (INCLUDING RARE PLANT HABITATS)

GUIDING REGULATIONS AND POLICIES

The *Endangered Species Act* (16 U.S.C. 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the National Park Service determines that an action may adversely affect a federally listed species, consultation with the U.S. Fish and Wildlife Service is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. No federally listed plant or animal species occur in Catoctin Mountain Park.

The NPS *Management Policies 2001* state that potential effects of agency actions will also be considered on state or locally listed species (NPS 2000c). The National Park Service is required to control access to important habitat for such species and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend. In addition, one of Catoctin Mountain Park's management goals is to provide protection for rare plants that occur within the park and that suffer population reductions as a result of overbrowsing by white-tailed deer or other natural or man-caused actions. Therefore, an analysis of the potential impacts to state-listed plant species is included in this section. As explained in "Chapter 1: Purpose of and Need for Action," impacts to the common raven were not analyzed in detail, since deer management actions would have negligible to minor effects on this species.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

To assess impacts on listed species, the following process was used:

- identification of which species are in areas likely to be affected by management actions described in the alternatives
- analysis of habitat loss or alteration caused by the alternatives
- analysis of disturbance potential of the actions and the species' potential to be affected by the actions

The information in this analysis was obtained through best professional judgment of park staff and experts in the field (as cited in the text), and by conducting a literature review. The following thresholds were used to determine impacts to sensitive and rare species.

Negligible: Impacts would result in no measurable or perceptible changes to a population or individuals of a species or its habitat.

Minor: Impacts would result in measurable or perceptible changes to individuals of a species, a population, or its habitat, but would be localized within a relatively small area. The overall viability of the species would not be affected.

Moderate: Impacts would result in measurable and/or consequential changes to individuals of a species, a population, or its habitat; however, the impact would remain relatively localized. The viability of the species could be affected, but the species would not be permanently lost.

Major: Impacts would result in measurable and/or consequential changes to a large number of individuals of a species or a population or a large area of its habitat. These changes would be substantial, highly noticeable, and permanent, occurring over a widespread geographic area, resulting in a loss of species viability.

AREA OF ANALYSIS

The area of analysis for assessing impacts on sensitive or rare plant species is Catoctin Mountain Park. The area of analysis for cumulative impacts includes the park and the immediately surrounding area, approximately 0.5 mile from the park boundary.

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE A: NO-ACTION ALTERNATIVE (EXISTING MANAGEMENT CONTINUED)

Analysis

Palatability — The property of being acceptable to the taste or sufficiently agreeable in flavor to be eaten.

Based on correspondence with the MD DNR Wildlife and Heritage Service and input from park staff, 16 plant species of special concern are known to occur in the park (see table 14, page 129). Based on reviews of park information on the effects of deer on these species (NPS 2000f) and additional available local information on plant resistance or palatability, six of the listed plants have been identified as palatable or frequently browsed by deer — long-bracted orchid, leatherwood, large-leaved white violet, American ginseng, large purple-fringed orchid, and nodding trillium. Listed plants considered resistant to deer browsing include Herb-robert, Torrey's mountain-mint, whorled milk weed, red turtlehead, pale corydalis, and basil balm. No information on deer palatability was found on the remaining four plants listed for the park, but it likely that some of these are palatable to deer.

Under alternative A the impacts to state- and park-listed species and sensitive habitats would be similar to what was described for herbaceous vegetation. The primary impact to these species in the park would be the result of not taking action to control deer numbers. Based on observations and research conducted within the park, deer browsing has already caused noticeable changes to the vegetation, including eliminated or reduced numbers of certain plant species,

decreased plant diversity, increased nonnative plants, and decreased native plant abundance (Backer and Boucher 1997; Boucher and Kyde 1999).

Providing no control on the growth of the deer population would result in adverse, long-term, moderate to major impacts on the listed plant species not currently being protected. Browsing impacts to those sensitive species palatable or preferred by deer could result in a reduction of the species in the plant community, either as a result of mortality resulting directly from browsing or due to impacts to overall plant health and its ability to produce seed stock or otherwise spread. Continuous browsing of preferred plants over time could result in the loss of individual species from the community. A summary of deer-related impacts to Catoctin Mountain vegetation prepared by Langdon (1985) documented both foliage and reproductive impacts to leatherwood, American ginseng, large purple-fringed orchid, and long-bracted orchid (NPS 2000f). Similar impacts to sensitive species considered to be less palatable to deer would also be expected if food resources were limited due to deer population growth, seasonal or climate variations (e.g., drought), or reductions in plant abundance resulting from disease or insect impacts.

Under alternative A, the park would continue to conduct activities to protect sensitive plant species. The park currently fences all known locations of the state-listed large purple-fringed orchid and American ginseng. As additional rare understory plant species are found within the park, they would also be protected by additional fencing. In 1990 park staff placed small wire cages around all known specimens of the large purple-fringed orchid to protect them from impacts associated with deer browsing. As a result, the known number of the plants in the park increased to a high of 44 by 1995 (NPS 2000f). The park also fenced all known leatherwood shrubs in 1983 to protect them from deer-related impacts (NPS 2000f). Placing and maintaining fencing around known locations of listed species protect these plants from deer browsing, resulting in beneficial, long-term impacts.

The Owens Creek and Hog Rock wetlands are both considered to be rare plant habitats by park staff. The Owens Creek wetland includes at least three state-listed plant species, and fencing was erected to protect these plants from deer browsing. Park staff have also erected fencing around the Hog Rock wetland to protect that habitat from deer-related impacts. Because this fencing would minimize deer browsing in the habitats, the resulting impacts would be beneficial and long term.

Protecting a blight-resistant dogwood from deer browsing by erecting fencing around the new planting.

Cumulative Impacts

Increased impacts to state- and park-listed sensitive and rare plant species are expected from a decrease in the number of hunters outside the park as a result of changing social habits (the hunting population has steadily decreased since the 1980s), which would result in higher deer densities inside and outside the park and greater browsing impacts. In addition to deer browsing, past actions such as plant collection, logging, fire and fire suppression have adversely affected sensitive and rare plant species in and

around the park. The park's past and proposed future increase in efforts to control invasive exotic species, along with efforts to control gypsy moths, chestnut blight, dogwood anthracnose, hemlock woolly adelgid, and other pests, would result in beneficial impacts to sensitive resources. Plans to implement limited prescribed burning for research purposes in the future would be expected to also benefit native plant communities over the long term. Natural conditions, such as drought and microbursts, have affected and can affect the viability of sensitive species. All of these activities, when combined with the continued pressure on sensitive resources expected under alternative A from continuing deer browsing, would result in both adverse and beneficial cumulative impacts to state- and park-listed sensitive and rare species. Adverse cumulative impacts would be moderate and long term, since deer would continue to impact forest regeneration.

Conclusion

Impacts to state- and park-listed species and rare plant communities under alternative A would be both beneficial and adverse. Beneficial impacts would result from maintaining fencing around known individual plants and rare plant communities and from establishing fencing around newly discovered plants in the park. Overall, adverse, long-term, moderate to major impacts to sensitive and rare plant species due to excessive deer browsing and the resulting suppression of new viable populations in the park would be expected. Past, present, and future activities, when combined with the continued pressure on state- and park-listed species and rare plant communities expected under this alternative, would result in both adverse and beneficial impacts. Adverse cumulative impacts would be long term and moderate. Since alternative A would not reverse the expected long-term continued growth in the deer population, and damage to vegetation would likely continue, it is expected that impairment of sensitive and rare species would occur over the long term.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

Several non-lethal actions would be implemented under this alternative to protect forest resources and reduce deer numbers in the park. Actions include the use of large-scale exclosures, increased use of repellents in limited areas, and reproductive control of does.

The use of large exclosures, along with small fenced areas to protect selected plants, and the use of repellents in selected areas would protect some populations or individual state- and park-listed species and rare plant communities if they were inside the exclosures or treated with repellents. The natural reestablishment of native vegetation within the exclosures could promote the growth of sensitive species if suitable habitat characteristics and seed stock were present, resulting in a beneficial, long-term impact. However, exclosures would only provide protection for about 6% of the park's herbaceous species at any one time. Areas outside the exclosures would continue to be affected by heavy deer browsing, and impacts to state- and park-listed species would be similar to those discussed under alternative A.

Implementing reproductive controls would, over an extended period of time, reduce the deer population and browsing pressure on native plant communities throughout the park, resulting in the reestablishment of natural communities and an increase in their extent, which would potentially promote the reestablishment of sensitive and rare plant species in suitable areas. This would reduce adverse, long-term impacts to sensitive plant species to minor to moderate.

Cumulative Impacts

The same past, present. and reasonably foreseeable actions described under alternative A would also occur under alternative B. All of these actions, when combined with an extended use of large-scale exclosures and a long term reduction in deer browsing pressure resulting from the use of reproductive controls, would result in both beneficial and adverse cumulative impacts to state- and park-listed species. Adverse cumulative impacts would be long term and minor.

Conclusion

Impacts to state- and park-listed sensitive and rare plant communities under alternative B would be adverse, long term, and moderate, until reproductive controls on the park deer herd were effective. Randomly placing and maintaining large exclosures would protect herbaceous vegetation in about 6% of the park at any one time, and woody vegetation in up to 12% of the park over the life of the plan. These areas would possibly include sensitive and rare plants, resulting in beneficial, long-term impacts. However, adverse, long-term, minor to moderate impacts due to deer browsing would continue outside the exclosures. Past, present, and future activities, when combined with the continued pressure on species of special concern and rare plant communities expected under this alternative, would result in both beneficial and adverse impacts. Adverse cumulative impacts would be long term and minor. No impairment of sensitive and rare species is expected under this alternative because known populations would be protected from deer browsing pressure.

Alternative C: Combined Lethal Actions (Preferred Alternative)

Analysis

Use of sharpshooting, as well as capture and euthanasia where appropriate, would reduce deer density and browsing pressure on native plant communities and promote the growth of sensitive species if suitable habitat characteristics and seed stock were present. Some browsing of preferred sensitive plant species (see table 14) occurring outside small, fenced exclosures would be expected to occur, even with a reduced deer herd density (15–20 deer per square mile). A smaller deer herd density would reduce browsing pressure on native plant communities over time, resulting in a reestablishment and an increase in the extent of natural communities in the park. Increased areas of native vegetation would be expected to promote the reestablishment of special concern species. Reducing deer herd density would decrease the potential for deer browsing impacts to sensitive species, resulting in beneficial, long-term impacts. Some deer browsing would continue, however, even with herd density maintained at target levels. Potential

impacts to palatable sensitive plant species occurring outside exclosures would be adverse, long term, and minor.

Cumulative Impacts

The same past, present. and reasonably foreseeable actions described under alternative A would also occur under alternative C. All of these actions, when combined with an immediate reduction in deer browsing pressure, would result in both beneficial and adverse cumulative impacts to state- and park-listed species. Adverse cumulative impacts would be long term and minor.

Conclusion

Impacts to species of special concern and rare plant communities under alternative C would be both beneficial and adverse. Beneficial impacts would be expected as a result of a relatively rapid reduction in deer density and browsing pressure on native plant communities and state- and park-listed species. Some deer browsing would continue even when the herd density was maintained at targeted levels. Potential impacts to palatable sensitive plant species occurring outside small fenced areas would be adverse, long term, and minor. Past, present, and future activities, when combined with the continued pressure on state- and park-listed species and rare plant communities expected under this alternative, would result in both beneficial and adverse impacts. Adverse cumulative impacts would be long term and minor. No impairment of rare or sensitive plant species in the park would occur under alternative C.

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

Direct reduction followed by reproductive control and direct reduction (if needed) would be used under alternative D to reduce the size of the deer herd. These actions would reduce deer density and browsing pressure on native plant communities and promote the growth of sensitive and rare plant species if suitable habitat characteristics and seed stock were present. Placing and maintaining small fencing around known locations of certain state- and park-listed species would protect the plants from deer browsing, with beneficial, long-term impacts. Some browsing of preferred sensitive plant species (see table 14) occurring outside exclosures would be expected to occur even with a reduced deer herd density (15–20 deer per square mile). Overall impacts would be beneficial and long term. Potential impacts to palatable sensitive plant species outside the small exclosures would be adverse, long term, and minor.

Cumulative Impacts

The same past, present. and reasonably foreseeable actions described under alternative A would also occur under alternative D. All of these actions, when combined with a reduction in deer browsing pressure resulting from a smaller deer herd, would result in both beneficial and adverse cumulative impacts to sensitive and rare plant species in the park. Adverse cumulative impacts would be long term and minor.

Conclusion

Impacts to state- and park-listed species and rare plant communities under alternative D would be both beneficial and adverse. Beneficial impacts would be expected as a result of a reduction in deer density and browsing pressure on native plant communities and species of special concern in the park. Some deer browsing would continue, even with herd density maintained at targeted levels, but vegetation recovery would occur more rapidly than it would under alternative B. Potential impacts to palatable sensitive plant species occurring outside small fenced areas would be adverse, long term, and minor. Past, present, and future activities, when combined with the continued pressure on state- and park-listed species and rare plant communities, would result in both beneficial and adverse impacts. Adverse cumulative impacts would be long term and minor. No impairment of rare or sensitive plant species in the park would occur under alternative D.

CULTURAL RESOURCES

GUIDING REGULATIONS AND POLICIES

Federal actions that have the potential to affect cultural resources are subject to a variety of laws. The *National Historic Preservation Act* (1966, as amended) is the principal legislative authority for managing cultural resources associated with NPS projects. Generally, Section 106 of the act requires all federal agencies to consider the effects of their actions on cultural resources listed on or determined eligible for listing on the National Register of Historic Places. Such resources are termed historic properties. Agreement on how to mitigate effects to historic properties is reached through consultation with the state Historic Preservation Officer; the tribal Historic Preservation Officer, if applicable; and the Advisory Council on Historic Preservation, as necessary. In addition, federal agencies must minimize harm to historic properties that would be adversely affected by a federal undertaking. Section 110 of the act requires federal agencies to establish preservation programs for the identification, evaluation, and nomination of historic properties to the National Register of Historic Places.

Cultural landscape — A geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values.

Other important laws or Executive Orders designed to protect cultural resources include the following:

Archeological Resources Protection Act, 1979

Executive Order 11593, "Protection and Enhancement of the Cultural Environment," 1971

Through legislation the National Park Service is charged with the protection and management of cultural resources in its custody. This is furthered implemented through *Director's Order 28: Cultural Resource Management* and its supplement, *Director's Order 28A: Archeology* (NPS 1998a), NPS *Management Policies 2001* (NPS 2000c), and the 1995 "Servicewide Programmatic Agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers." These documents charge NPS managers with avoiding, or minimizing to the greatest degree practicable, adverse impacts on park resources and values. Although the National Park Service has the discretion to allow certain impacts in parks, that discretion is limited by the statutory requirement that park resources and values remain unimpaired, unless a specific law directly provides otherwise.

ASSUMPTIONS AND METHODOLOGY

The National Park Service categorizes cultural resources as archeological resources, cultural landscapes, historic structures, museum objects, and ethnographic resources. As noted under "Issues and Impact Topics" in "Chapter 1: Purpose of and Need for Action," only impacts to archeological resources and cultural landscapes are of potential concern for the deer management plan. There would be no impacts to the other cultural resource topics considered.

The descriptions of effects on cultural resources that are presented in this section are intended to comply with the requirements of both the *National Environmental Policy Act* and Section 106 of the *National Historic Preservation Act*. In accordance with the regulations of the Advisory Council on Historic Preservation implementing Section 106 (36 CFR Part 800, "Protection of Historic Properties"), impacts on cultural resources are to be identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that are either listed on or eligible to be listed on the National Register of Historic Places; (3) applying the criteria of an adverse effect to affected cultural resources either listed on or eligible to be listed on the national register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the Advisory Council's regulations, a determination of either *adverse effect* or *no adverse effect* must also be made for affected cultural resources eligible for listing on the National Register of Historic Places. An *adverse effect* occurs whenever an impact alters, directly or indirectly, any of the characteristic that qualifies the resource for inclusion on the national register (for example, diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the proposal that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5, "Assessment of Adverse Effects"). A determination of *no adverse effect* means there would either be no effect or that the effect would not diminish in any way the characteristics that qualify the cultural resource for inclusion on the National Register of Historic Places.

CEQ regulations and the NPS *Director's Order #12* also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g., reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in the intensity of an impact due to mitigation, however, is an estimate of the effectiveness of mitigation under the *National Environmental Policy Act* only. Cultural resources are non-renewable resources, and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under Section 106 of the *National Historic Preservation Act* may be mitigated, the effect remains adverse.

A Section 106 summary is included in the impact analysis sections for archeological resources and cultural landscapes. The Section 106 summary is an assessment of the effect of the undertaking (implementation of the alternative) only on cultural resources listed on or eligible for the National Register of Historic Places, based on the criteria of effect and criteria of adverse effect found in the regulations of the Advisory Council on Historic Preservation.

ARCHEOLOGICAL RESOURCES

METHODOLOGY AND INTENSITY THRESHOLDS

Park staff and contracted archeologists have conducted archeological resource assessments in areas of disturbance for specific projects. No parkwide archeological inventory has been completed; therefore, archeological information is limited. Information used in this analysis was gathered from the park website, and from the park's "Cultural Landscapes Inventory" (NPS 2000a) and "Historic Resource Study" (Wehrle 2000).

Certain important research questions about human history can only be answered by the actual physical material of cultural resources. Archeological resources have the potential to answer, in whole or in part, such research questions. An archeological site or sites can be eligible to be listed on the National Register of Historic Places if the site has yielded, or may be likely to yield, information important in prehistory or history. An archeological site(s) can be nominated to the National Register in one of three historic contexts or levels of significance: local, state, or national (see National Register Bulletin #15, *How to Apply the National Register Criteria for Evaluation*, NPS 2002c). For purposes of analyzing impacts to archeological resources, the following thresholds of change for the intensity of an impact are based on the potential of the site to yield information important in prehistory or history, as well as the probable historic context of the affected site:

Negligible: The impact would be at the lowest level of detection with neither adverse nor beneficial consequences. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be a *no adverse effect*.

Minor: Adverse impact – An archeological site would be disturbed, resulting in little, if any, loss of integrity. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *no adverse effect*.

Beneficial impact – A site would be maintained and preserved in its natural state. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be a *no adverse effect*.

Moderate: Adverse impact – An archeological site would be disturbed, resulting in a loss of integrity. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be an *adverse effect*. A memorandum of agreement would be executed among the National Park Service and the state Historic Preservation Officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the memorandum of agreement to minimize or mitigate adverse impacts would reduce the intensity of impact under the *National Environmental Policy Act* from major to moderate.

Beneficial impact – The site would be stabilized. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *no adverse effect*.

Major: Adverse impact – An archeological site would be disturbed, resulting in loss of integrity. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be an *adverse effect*. Measures to minimize or mitigate adverse impacts could not be agreed upon, and the National Park Service and the state Historic Preservation Officer and/or the Advisory Council on Historic Preservation would be unable to negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

Beneficial impact – Active intervention would be taken to preserve the site. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be a *no adverse effect*.

AREA OF ANALYSIS

For the purpose of this analysis, the area of potential effect is defined as Catoctin Mountain Park.

IMPACTS OF THE ALTERNATIVES

Alternative A: No-Action Alternative (Existing Management Continued)

ANALYSIS. Park staff would continue monitoring the deer population and would conduct activities to protect native plants, such as creating and monitoring small fenced areas and applying repellents to landscaped areas. No known archeological impacts are currently associated with deer or their browsing activity. Installing small fences around rare plant species throughout the park or landscaping trees in the cabin camps and other developed areas could cause minimal ground surface disturbance and potentially disturb unknown archeological resources. The cabin camps and other developed areas have been previously disturbed, reducing the likelihood that archeological resources would be discovered. Fences would be located so as to avoid direct impacts to any archeological resources. However, as the deer population grows over time, more and more small fences could be required, increasing the likelihood that some archeological resources could be disturbed. The monitoring of sensitive areas would aid in mitigating potential adverse effects, resulting in adverse, long-term, negligible impacts.

CUMULATIVE IMPACTS. Because there are no identifiable adverse or beneficial impacts associated with alternative A, there would be no cumulative impacts.

CONCLUSION. Installing small fences to protect individual plant groupings would result in adverse, long-term, negligible impacts to park archeological resources; however, the limited extent and location of potential disturbance associated with the fences would minimize this likelihood. Furthermore, fences would be located so as to avoid direct impacts to archeological resources. There would be no cumulative impacts, and no impairment of park archeological resources would occur.

Alternative B: Combined Non-Lethal Actions

ANALYSIS. Non-lethal actions would be implemented in combination to protect forest resources. Actions would include the use of large exclosures, increased use of repellents in limited areas, and reproductive control of does. Each of 15 exclosures would be approximately 1,000 feet square, with metal posts every 12 feet, as well as concrete-reinforced 4- by 4-inch wooden posts every 100 feet and as corner supports.

Lithic — Of or relating to stone.

Installing small fences would result in the same impacts as described in alternative A. Installing the large exclosures, particularly the placement of concrete-reinforced wooden posts, could result in some ground surface disturbance at the base of the posts. However, the perimeter of the exclosures would not be placed in the vicinity of known archeological resources, such as rhyolite quarries, rock shelters, lithic (stone) processing sites, lithic scatters, or sites related to agriculture and rural industry (e.g., house foundations, road traces, charcoal hearths, and colliers' huts). Of particular concern are those resources throughout the park that have not yet been identified, recorded, and protected by the National Park Service. Monitoring would occur in potentially sensitive areas, and installation would stop should any archeological resources be discovered. As a result, large-scale fence installation would result in adverse, long-term, negligible to minor impacts.

Rhyolite — A fine-grained extrusive volcanic rock used by Native Americans.

CUMULATIVE IMPACTS. Because the park lacks a systematic parkwide archeological survey, there is ongoing potential for adverse impacts to archeological resources from any park project that causes ground disturbance. Examples include the addition or upgrade of new utilities within the park; landfills or small dumps around the park and at Camp Round Meadow; and roads and trails, including social trails at Camp Misty Mount. These existing and subsequent future projects could have and could continue to result in long-term negligible to minor adverse impacts to park archeological resources due to ground disturbance. However, the planned surveys would result in long-term, minor, beneficial impacts because areas within the park that could contain archeological resources would be identified and valuable information would be provided to assist in project location.

Overall, the adverse impacts of past and ongoing park projects and the benefits of potential future surveys in combination with alternative B would result in adverse, long-term, negligible cumulative impacts. Alternative B would contribute minimally to the total cumulative impact.

CONCLUSION. Installing large exclosures with multiple support posts could result in some ground disturbance that could impact unknown archeological resources. Locating fences away from known resources and monitoring in potentially sensitive areas would result in adverse, long-term, negligible to minor impacts. Similar to alternative A, installing small fences around individual plant groupings could result in adverse, long-term, negligible impacts to park archeological resources. Cumulative impacts would be adverse, long term, and negligible, and no impairment of park archeological resources would occur under this alternative.

Alternative C: Combined Lethal Actions (Preferred Alternative)

ANALYSIS. Under this alternative sharpshooting activities would reduce the herd size, along with capture and euthanasia in certain circumstances. Bait stations and trapping locations would not be set on known archeological resources. Small-scale fenced areas and repellents would also be used similar to alternative A. Herd size would be substantially reduced in the short term under this alternative. Because deer populations do not directly impact archeological resources, potential impacts would be related to fencing small areas and would be the same as alternative A.

Some minimal ground surface disturbance could occur with the placement of fencing and the burial of deer carcasses. However, the cabin camps and other developed areas have been previously disturbed, and fencing around landscape plants would occur in these areas. Burial sites for deer waste and carcasses would be in open, previously disturbed areas, such as the Camp Misty Mount field, the Camp Round Meadow bulk storage area, and other similar locations that do not contain archeological resources. The monitoring of sensitive areas would aid in mitigating potential adverse effects, resulting in adverse, long-term, negligible impacts.

CUMULATIVE IMPACTS. Because no identifiable adverse or beneficial impacts would be associated with alternative C, there would be no cumulative impacts.

CONCLUSION. Direct reduction of deer populations from lethal controls would have no impact on archeological resources. Bait stations and trapping locations would not be set on known archeological resources. Similar to alternative A, the installation of small fences could result in adverse, long-term, negligible impacts to park archeological resources. There would be no cumulative impacts, and no impairment of park archeological resources would occur.

Alternative D: Combined Lethal and Non-Lethal Actions

ANALYSIS. Under alternative D direct reduction would be implemented to reduce the size of the deer herd, and reproductive control with direct reduction (if needed) would be used to maintain the herd at lower numbers. Bait stations and trapping locations would not be set on known archeological resources. Small fenced areas and repellents would be used, similar to alternative A.

Herd size would be substantially reduced under this alternative. Because deer populations do not directly impact archeological resources, potential impacts would be related to small fenced areas and disposal pits for deer waste and/or carcasses. Some minimal ground surface disturbance could occur with the placement of fencing around individual plants and the burial of deer carcasses. However, the cabin camps and other developed areas where fencing would occur are in previously disturbed areas, and the burial sites would be located in already disturbed areas, reducing the likelihood that archeological resources would be discovered. Monitoring sensitive areas would aid in mitigating potential adverse effects, resulting in adverse, long-term, negligible impacts.

CUMULATIVE IMPACTS. Because there are no identifiable adverse or beneficial impacts associated with alternative D, there would be no cumulative impacts.

CONCLUSION. Direct reduction of deer populations from lethal controls and the use of reproductive controls would have no impact on archeological resources. Bait stations and trapping locations would not be set on known archeological resources. Similar to alternative A, installing small fences around individual plant groupings could result in adverse, long-term, negligible impacts to park archeological resources. There would be no cumulative impacts, and no impairment of park archeological resources would occur.

Section 106 of the National Historic Preservation Act requires that every federal agency "take into account" how each of its undertakings could affect historic properties in order to balance historic preservation concerns with the needs of federal undertakings and to best represent the public interest while preventing arbitrary destruction of historic resources.

National Historic Preservation Act, Section 106 Summary

This *Draft White-tailed Deer Management Plan / Environmental Impact Statement* analyzes impacts on archeological resources of four alternatives (the no-action alternative and three action alternatives). Potential impacts could result from ground surface disturbance under any alternative because of constructing small fences around individual groups of plants or trees. However, such a disturbance would be highly unlikely because the fences generally enclose very small areas and are used to protect landscaping or other plants. Most of the landscape vegetation is in previously disturbed landscape beds around structures. Thus, there would be *no adverse effect (no effect)* related to these small fences.

Larger fences or exclosures would be constructed in alternative B, which could have a negligible to minor adverse impact. Fifteen exclosures would be constructed within the park that would be approximately 1,000 feet square and would include metal posts every 12 feet, as well as concrete-reinforced 4- by 4-inch wooden posts every 100 feet and as corner supports. Installing these large exclosures, particularly the placement of concrete-reinforced wooden posts, could result in some surface disturbance at the base of the posts. However, exclosures would not be constructed in areas with known or potential archeological resources, and mitigation measures would be taken to ensure that adverse impacts would not exceed minor intensity, resulting in *no adverse effect* to archeological resources.

Burial of deer waste and carcasses could occur in alternatives C and D as a result of sharpshooting activities and euthanasia. Disposal pits approximately 8 feet wide, 8 feet long, and 4 feet deep would be constructed in previously disturbed areas that contain no archeological resources. Therefore, the construction of these pits would result in *no adverse effect* to archeological resources.

Cumulative impacts would only occur with alternative B, which involves ground disturbance during exclosure construction. Past projects within the park have caused some ground disturbance, but they have resulted in no more than minor disturbance to archeological resources. When combined with alternative B, cumulative impacts would result in *no adverse effect* on archeological resources.

In accordance with Section 106 of the *National Historic Preservation Act*, implementation of any of the four alternatives would have *no adverse effect* on archeological resources. No adverse impact to archeological resources would occur because the National Park Service would mitigate to avoid any major adverse impacts to archeological resources associated with the construction of small or large exclosures. In cases where impacts have not been identified as part of this analysis, potential adverse impacts (as defined in 36 CFR 800) on archeological resources listed on or eligible for listing on the National Register of Historic Places would be coordinated between the National Park Service and the state historic preservation office to determine the level of effect on the property and to determine any necessary mitigation measures. If necessary, additional mitigation measures would be developed in consultation with the state Historic Preservation Officer. Continuing implementation of the *Cultural Resource Management Guideline* (NPS 1997b) and adherence to the NPS *Management Policies 2001* (NPS 2000c) and the 1995 Servicewide programmatic agreement with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers would all aid in reducing the potential to adversely impact historic properties.

Copies of this *Draft White-tailed Deer Management Plan / Environmental Impact Statement* have been distributed to the Maryland State Historic Preservation Officer and the Advisory Council on Historic Preservation for review and comment related to compliance with Section 106 of the *National Historic Preservation Act*.

CULTURAL LANDSCAPES

Catoctin Mountain Park has two historic districts — Camp Greentop and Camp Misty Mount, which are also designated as cultural landscapes (or in accordance with the "Cultural Landscapes Inventory" as component cultural landscapes). The National Park Service is considering whether to nominate the entire park as a cultural landscape, and the forest is an important character-defining feature for the park's cultural landscape, as well as for the two cultural landscapes associated with the historic districts.

METHODOLOGY AND INTENSITY THRESHOLDS

Cultural landscapes are landscapes that have been adapted for or influenced by human use. Cultural landscapes that are so designated within national parks have been determined to have historic significance and integrity.

In analyzing how alternative approaches for deer management would affect the cultural landscape of Catoctin Mountain Park, attention was paid to the program's effect on vegetation as a character-defining feature of the cultural landscape and on views and vistas.

For the assessment of potential impacts to cultural landscapes, the principal sources reviewed were the park's "Cultural Landscapes Inventory" (NPS 2000a), the forms nominating Camp Misty Mount Historic District and Camp Greentop Historic District to the National Register of Historic Places (NPS 1996a), and information on the historic districts from the Maryland Historical Trust.

For purposes of analyzing potential impacts to cultural landscapes, the thresholds of change for the intensity of an impact are defined as follows:

Negligible: The impact would be at the lowest level of detection, with neither adverse nor beneficial consequences. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *no adverse effect*.

Minor: Adverse impact – Alteration of a pattern(s) or feature(s) of the cultural landscape listed on or eligible for listing on the National Register of Historic Places would not diminish the overall integrity of the landscape. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *no adverse effect*.

Beneficial impact – Preservation of landscape patterns and features would be in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*, therefore maintaining the integrity of the cultural landscape. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *no adverse effect*.

Moderate: Adverse impact – The impact would alter a pattern(s) or feature(s) of the cultural landscape, diminishing the overall integrity of the landscape. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *adverse effect*. A memorandum of agreement would be executed among the National Park Service and the state Historic Preservation Officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the memorandum of agreement to minimize or mitigate adverse impacts would reduce the intensity of impact under the *National Environmental Policy Act* from major to moderate.

Beneficial impact – The landscape or its features would be rehabilitated in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for the Treatment of Cultural Landscapes* (NPS 1996c), to make possible a compatible use of the landscape while preserving its character-defining features. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *no adverse effect*.

Major: Adverse impact – The impact would alter a pattern(s) or feature(s) of the cultural landscape, diminishing the overall integrity of the resource. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *adverse effect*. Measures to minimize or mitigate adverse impacts could not be agreed upon, and the National Park Service and the state Historic Preservation Officer and/or Advisory Council on Historic Preservation would be unable to negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

Beneficial impact – The cultural landscape would be restored in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for the Treatment of Cultural Landscapes* (NPS 1996c) to accurately depict the features and character of a landscape as it appeared during its period of significance. For purposes of Section 106 of the *National Historic Preservation Act*, the determination of effect would be *no adverse effect*.

AREA OF ANALYSIS

All of Catoctin Mountain Park is a cultural landscape that is considered eligible by the National Park Service for listing on the National Register of Historic Places. It has significance during two historic periods and under two criteria for significance. Camp Misty Mount and Camp Greentop are component landscapes of the overall landscape, and they have been individually listed on the National Register of Historic Places. For the purpose of this analysis, the area of potential effect is all of Catoctin Mountain Park.

IMPACTS OF THE ALTERNATIVES

Alternative A: No-Action Alternative (Existing Management Continued)

ANALYSIS. According to the "Cultural Landscapes Inventory" (NPS 2000a), one of the greatest impacts on park vegetation is the explosive growth in the deer population that has occurred over the last 50 years and subsequent deer browsing. Deer browsing has caused a severe depletion in the forest's herbaceous and shrub vegetation, preventing the forest from regenerating because seedlings of native species are consumed by deer.

Under alternative A park staff would continue monitoring the deer population and would conduct activities to protect native plants, such as creating and monitoring small fenced areas and applying repellents to a small number of landscaped areas. However, deer populations would be expected to increase over the long term, and browsing would continue throughout the park, causing a decline in the long-term abundance and diversity of native plant species and contributing to further establishment of invasive exotic species within the park. As a result, the plant species and populations that have existed historically in the park would continue to be reduced and in some cases could be lost. The decline in these plant communities would result in an adverse, long-term, minor impact to the park cultural landscape because native plant communities comprise one component of the cultural landscape's character-defining vegetative features. The degree of impact would depend on the size of the future deer population and the degree of continued decline in park plant communities.

Gypsy moths lay their eggs in bark furrows.

Small fenced areas and repellents could be used to protect individual trees and other vegetation from deer browsing in the vicinity of the cabin camps and elsewhere. The park's "Cultural Landscapes Inventory" states that forest vegetation is a contributing feature to the historic districts of Camp Greentop and Camp Misty Mount. Thus, protection of these landscapes would result in beneficial, long-term, minor impacts.

CUMULATIVE IMPACTS. Various past and present actions and events have affected the vegetation at Catoctin Mountain Park. Forest species that existed during periods of historical significance are now being impacted by diseases. The fungal disease anthracnose has devastated the native dogwoods, and the woolly adelgid is decreasing the number of hemlocks, which at one time lined Big Hunting Creek. Gypsy moths, which cause large-scale tree defoliation and can lead to mortality, are a serious concern throughout northern Maryland, and they have been monitored and treated within the park. Fire suppression has also reduced the number of fire-dependent native species. In the decades before the recreational demonstration area was established, a blight destroyed the American chestnut, at one time a major element of the Catoctin forest, as well as most of the eastern deciduous forest. All diseases and activities that affect the native woodlands would also affect the historic character of the site, resulting in adverse, long-term, minor impacts.

Invasive exotic vegetation is a problem inside and outside the park. Disturbance from natural events or from human activities can make conditions favorable for invasive exotic plant species. An intensive program to prevent the spread of invasive exotic vegetation in the park over the long term would result in beneficial, minor impacts to the park's cultural landscape.

Land use change in areas adjacent to Catoctin Mountain Park affect views and vistas, gradually eroding the sense of place that used to surround the park.

Particularly affected is land along U.S. 15, at the foot of Catoctin Mountain, where suburban tracts have sprung up in the last 10 years. Foxville, a crossroads village on the mountain and where an historic tavern is located, is another vulnerable site on the immediate boundary of the park.

Overall, impacts from the actions described above, coupled with the ongoing decline of native plant communities, would result in adverse, long-term minor cumulative impacts to the cultural landscape.

CONCLUSION. Continued growth of the deer population and the associated ongoing decline in the abundance and diversity of the native plant communities would result in an adverse, long-term, minor impact to the park's cultural landscape. The use of small fences and repellents to protect naturally occurring trees and other vegetation at the cabin camps could result in beneficial, long-term, minor impacts to these parts of the park's vegetation. Adverse, long-term, minor cumulative impacts would result from the ongoing decline of native plant communities as a result of disease processes and deer browsing, despite benefits from the use of small fences and repellents and exotic species control. No impairment of cultural landscapes would occur under alternative A.

Alternative B: Combined Non-Lethal Actions

ANALYSIS. Several non-lethal actions would be implemented under this alternative to protect forest resources, including the use of large-scale exclosures, increased use of repellents in limited areas, and reproductive control for does. The large-scale exclosures would be approximately 1,000 feet square and enclose approximately 23 acres. Assuming 15 exclosures were erected, 345 acres or about 6%-12% of woody vegetation would be protected from deer browsing over the life of the plan, allowing for the regeneration of forest vegetation within the exclosures. Studies have shown that areas outside the research exclosures generally had 90% to 99% leaf litter with limited plant cover, whereas plants inside the exclosures were 100% covered with a variety of herbaceous, shrub, and tree seedlings (NPS 2003d). Plant abundance, percentage of cover, and actual and estimated total species richness were considerably higher in exclosures (Backer and Boucher 1997). Although habitat is becoming limited within the park, deer browsing would be more concentrated outside the exclosures and could cause some continued decline in native plant populations in these areas. In addition, the woven-wire, 8-foot fenced exclosures would introduce new structural elements into the park's cultural landscape and the component landscapes at Camp Misty Mount and Camp Greentop that would be inconsistent with the park's other contributing buildings and structures that reflect the significance of the New Deal era. To mitigate potential impacts to the cabin camps, the exclosures could be located some distance from the camps so that they would not intrude on these landscapes. The exclosures might also be visible during the winter and spring from locations within the park such as Chimney Rock, Hog Rock, Thurmont Vista, and Wolf Rock, where the views are contributing features to the cultural landscape. However, due to their materials and construction, they would be difficult to see.

Species richness — The number of species present in a community.

In summary, the regeneration of native vegetation within the exclosures would begin to rehabilitate portions of the cultural landscape. Although the fences would introduce a new structural element into the cultural landscape, they would be constructed with unobtrusive woven wire and supporting posts in locations that are not easily viewed. As described in alternative A, small fences and repellents could also be used to protect other character-defining vegetation features. Combined, these large- and small-scale fences would result in beneficial, long-term, minor impacts to the cultural landscape because of vegetation regeneration.

Using reproductive control techniques for does would gradually limit deer population growth over the long term and allow for regeneration of native plant communities outside the exclosures. This would result in further beneficial, long-term, minor impacts to the park's cultural landscape.

CUMULATIVE IMPACTS. The impacts of past, present, and reasonably foreseeable actions identified in alternative A would be the same for alternative B. Overall, the adverse, long-term, minor impacts from vegetative changes and adjoining land use changes and beneficial impacts of exotic species removal (explained in the cumulative impact analysis for alternative A), in combination with the impacts of alternative B, would result in beneficial, long-term, minor cumulative impacts.

CONCLUSION. The large exclosures would allow regeneration of native woody plant populations within 6%–12% of the park over the life of the plan, a character-defining vegetative feature, and small fenced areas and repellents would be used to protect specific landscaped areas and landscape plantings, resulting in beneficial, long-term, minor impacts. The use of reproductive controls could also result in further beneficial, long-term, minor impacts over the long term by reducing the deer population and subsequent browsing. Beneficial, long-term, minor cumulative impacts would result from some regeneration of native plant populations and the control of nonnative species, although disease and continued deer browsing would offset this impact. There would be no impairment of cultural landscapes under alternative B.

Alternative C: Combined Lethal Actions (Preferred Alternative)

ANALYSIS. Under this alternative sharpshooting activities would reduce the herd size, along with capture and euthanasia where appropriate. Similar to alternative A, placing small fences around individual or small groups of plants or landscaping would also be part of this alternative.

Reducing the deer population from 104 deer per square mile (as of 2004) to 15–20 deer per square mile within approximately three years would result in diminished browsing pressure. This reduced pressure would allow park plant populations to regenerate and would improve the abundance and diversity of native species within the park over the long term. Decreased browsing, as well as small fenced areas and repellent use, would also help protect landscape plantings associated with farmstead remnants. Because native plant populations are character-defining vegetation features of the park's cultural landscape, the

re-establishment or rehabilitation of this feature would result in beneficial, long-term, moderate impacts to the park and component landscapes.

Sharpshooting activities related to deer reduction, including setting up bait stations, occupying shooting areas, and dragging deer to locations for processing and transport, would have some temporary effects on vegetation and, as a result, the cultural landscape. Sharpshooting could require portable tree stands to be temporarily hung in trees. Removing deer carcasses from the kill site could require dragging over vegetation, which would temporarily trample some woody vegetation. However, the area of impact from these actions would be small (less than 1% of park vegetation), resulting in an adverse, short-term, negligible impact to the park and component landscapes.

Sharpshooting — The authorized shooting of animals by specially trained professionals using appropriate weapons for means of effective and efficient lethal control.

Where one to a few deer were shot or euthanized, the waste or carcasses could either be scattered and left aboveground to be naturally scavenged and decompose or would be buried if meat is unsuitable for donation to charity or surface disposal. Surface disposal methods would occur in areas that would not be visible from or within easy access of trails, roads, or facilities, resulting in adverse, short-term, negligible impacts. Similarly, disposal pits would be located in areas outside historic districts, previously disturbed, and free of trees. These areas would be fully covered and reseeded when the weather and season are appropriate. Although some disposal pits might be visible from the cabin camps, privacy fencing would be used to reduce visibility until the disposal pits are filled and the surface reseeded. The impact to the component landscapes would be temporary, adverse, short term, and negligible.

CUMULATIVE IMPACTS. The impacts of the past, present, and reasonably foreseeable actions identified in alternative A would be the same for alternative C. Overall, the adverse, long-term, minor impacts from vegetative changes and adjoining land use changes, in combination with the beneficial, long-term, moderate impacts and adverse, short-term, negligible impacts of alternative C, would result in beneficial, long-term, moderate cumulative impacts.

CONCLUSION. Reduced browsing pressure from direct reduction in deer populations would allow native plant populations to regenerate throughout the park, and small fenced areas and repellents would help protect other character-defining vegetation. These actions would result in beneficial, long-term, moderate impacts to the park and component cultural landscapes. There would be some adverse, long-term, negligible impacts related to sharpshooting activities and deer waste disposal. Cumulative impacts would be beneficial, long term, and moderate due to the regeneration of native plant populations, which would benefit the forested landscape. There would be no impairment of cultural landscapes under alternative C.

Alternative D: Combined Lethal and Non-Lethal Actions

ANALYSIS. Direct reduction would be implemented under alternative D to quickly reduce the size of the deer herd, and reproductive control and direct reduction (if needed) would be used as a maintenance tool to keep the deer herd at reduced numbers. Small fenced areas and repellents would be used as described under

alternative A, and deer waste and carcasses would be disposed of as described under alternative C. Impacts under this alternative would be the same as alternative C. Native plant populations would be rehabilitated by the direct reduction in deer populations, and other character-defining vegetation features would be potentially protected through some small-scale fencing and repellent use, resulting in beneficial, long-term, moderate impacts to the park and component landscapes. Some adverse, short-term, negligible impacts could also result from sharpshooting and deer waste disposal activities.

CUMULATIVE IMPACTS. The impacts of the past, present, and reasonably foreseeable actions identified in alternative A would be the same for alternative D. Overall, the adverse, long-term, minor impacts from vegetative changes and adjoining land use changes, in combination with the beneficial, long-term, moderate impacts and adverse, short-term, negligible impacts of actions under alternative D, would result in beneficial, long-term, moderate cumulative impacts.

CONCLUSION. Reduced browsing pressure from direct reduction and reproductive control of the deer population would allow regeneration of native plant populations throughout the park, plus the use of small fenced areas and repellents would help protect other character-defining vegetation. These actions would result in beneficial, long-term, moderate impacts to the park and component landscapes. There would also be some adverse, negligible, long-term impacts related to sharpshooting activities and deer waste disposal. Regeneration of native plant populations would benefit the forested landscape, resulting in beneficial, long-term, moderate cumulative impacts. There would be no impairment of cultural landscapes under alternative D.

NATIONAL HISTORIC PRESERVATION ACT, SECTION 106 SUMMARY

The *Draft White-tailed Deer Management Plan / Environmental Impact Statement* analyzes the impacts of four alternatives on cultural landscapes in Catoctin Mountain Park. The alternatives include a no-action alternative and three action alternatives. All of Catoctin Mountain Park is potentially eligible for listing on the National Register of Historic Places as a historic cultural landscape, but it has not been nominated. Two camps within the park — Camp Misty Mount and Camp Greentop — have already been listed on the National Register of Historic Places as historic districts. The 2000 “Cultural Landscape Inventory” for the park classified the two camps as component landscapes of the larger park cultural landscape.

Continued growth in the existing deer population and excessive deer browsing under alternative A would continue to limit successful regeneration of native plant communities within the park, resulting in an adverse, long-term, minor impact to the park’s cultural landscape. Potential beneficial impacts to the park’s cultural landscape and the two component landscapes could result from the use of small fenced areas to protect small groups of native plants and, if threatened by deer browsing, to protect landscape plantings, reducing the need for replanting trees to maintain the desired landscape. Because there would be a continued decline of native plant communities and little natural tree regeneration due to

continued deer browsing, implementation of alternative A would result in an *adverse effect* on the park's cultural landscape.

Deer population control measures would take several years to be effective under alternative B, and large fenced exclosures would be constructed to allow up to about 6%–12% of the park's forest, a character-defining vegetation feature in the park's cultural landscape, to regenerate over the life of the plan, resulting in beneficial impacts. Even though the fences would be a new structural element within the landscape, they would be temporary and would be placed in areas not easily visible to visitors. Reproductive controls on female deer would also be initiated, controlling the park deer population and their impact on vegetation over a longer period of time. Therefore, *no adverse effect* would result from actions taken under alternative B.

The quick reduction of the deer population under alternative C would cause a significant decline in overbrowsing of native plant populations. Native plants would begin to regenerate, resulting in long-term benefits to native plants, a character-defining vegetation feature in the park's cultural landscape. Therefore, *no adverse effect* would result from actions taken under alternative C.

Alternative D would be a combination of reproductive controls described in alternative B, and lethal controls described in alternative C. These combined actions would result in a direct reduction in the deer population and the protection of vegetation that is an identifying characteristic of the cultural landscape, resulting in a *no adverse effect* under alternative D.

Diseases and insect pests of vegetation, such as anthracnose and woolly adelgid have also adversely impacted the cultural landscape. Continued deer browsing under alternative A in combination with these other impacts would result in a *no adverse effect* because, despite cumulative changes in vegetation, the overall integrity of the cultural landscape would not be changed. Additionally, beneficial actions taken to control deer populations or their effects on park vegetation through large-scale exclosures in alternative B would cumulatively result in *no adverse effect*.

In accordance with Section 106 of the *National Historic Preservation Act*, potential adverse impacts (as defined in 36 CFR 800) on cultural landscapes listed on or eligible for listing on the National Register of Historic Places would be coordinated between the National Park Service and the state historic preservation office to determine the level of effect on the property and to determine any necessary mitigation measures. Continuing implementation of the *Cultural Resource Management Guideline* (NPS 1997b) and adherence to NPS *Management Policies 2001* (NPS 2000c) and the 1995 Servicewide programmatic agreement with the Advisory Council on Historic Preservation and National Conference of State Historic Preservation Officers would all aid in reducing the potential to adversely impact historic properties.

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VISITOR USE AND EXPERIENCE

GUIDING REGULATIONS AND POLICIES

The NPS *Management Policies 2001* (NPS 2000c) state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the National Park Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. Catoctin Mountain Park's purpose states that it will be administered as a public park and for recreational purposes. Management goals include making available to the public traditional outdoor recreational opportunities that are not detrimental to the natural or cultural resources of the park.

While preservation and conservation are key components of the NPS *Management Policies*, they also instruct park units to provide for recreational opportunities. The National Park Service achieves its preservation and conservation purposes by working to maintain all native plants and animals as parts of the natural ecosystem, emphasizing preservation and conservation over recreation. The National Park Service will achieve this by preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur (NPS 2000c, sec. 4.4.1).

The goals of providing recreational opportunities and protecting the natural systems at Catoctin are evident in the objectives of this *Draft White-tailed Deer Management Plan / Environmental Impact Statement.* With regard to recreation and conservation, the objectives state that this plan should

- Educate the public regarding the deer population and the forest regeneration process and diversity, including the role of deer as part of a functioning park ecosystem.

- During implementation of any management action, minimize disruption to visitor use and experience or adverse impacts to visitor and community safety.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Past visitor use data, comments from the public, and personal observations of visitation patterns were used to estimate the effects of the alternative actions on visitors. The impact on the ability of visitors to experience a full range of park resources was analyzed by examining resources mentioned in the park's significance statement. It is assumed that visitation will increase approximately 3% per year in the immediate future. The thresholds for the intensity of an impact are defined as follows:

Negligible: The impact would be barely detectable and/or would affect few visitors. Visitors would not likely be aware of the effects associated with management actions.

Minor: The impact would be detectable and/or would only affect some visitors. Visitors would likely be aware of the effects associated with management actions. The changes in visitor use and experience would be slight but detectable; however, visitor satisfaction would not be measurably affected.

Moderate: The impact would be readily apparent and/or would affect many visitors. Visitors would be aware of the effects associated with management actions. Visitor satisfaction might be measurably affected (visitors could be either satisfied or dissatisfied). Some visitors would choose to pursue activities in other available local or regional areas.

Major: The impact would affect the majority of visitors. Visitors would be highly aware of the effects associated with management actions. Changes in visitor use and experience would be readily apparent. Some visitors would choose to pursue activities in other available local or regional areas.

AREA OF ANALYSIS

The area of analysis is the entire park for all alternatives, including cumulative assessments. Neighboring landowners outside the park boundaries are also included in this area of analysis.

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE A: NO-ACTION ALTERNATIVE (EXISTING MANAGEMENT CONTINUED)

Analysis

VISITOR EXPERIENCE IMPACTS. Park staff would continue monitoring the deer population under alternative A and would conduct activities to protect native plants, such as creating and monitoring small fenced areas and applying repellents to landscaped areas (such use is currently minimal).

The most common activity visitors engage in at Catoctin is viewing wildlife and scenery (82% participation rate), followed by driving through the park (61%), and hiking for an hour or more (46%). Depending on the method visitors use to view wildlife and scenery, they could be adversely impacted by the sight of approximately 20 small fenced areas (5 feet high) throughout the park, and another 250 around recently planted trees at campgrounds and picnic areas. Conversely, the fenced areas protect rare plants, such as the large purple-fringed orchid, that visitors would not otherwise see due to excessive deer browsing. Visitors who primarily experience wildlife and scenery by driving through the park would be the least affected, as fenced areas would be difficult to detect while driving. Visitors who primarily experience wildlife and scenery by hiking and backpacking to shelters would be affected to a greater degree, depending on the location of the trail and the number of fences encountered. Visitors who participate in the park's spring flower walks or who come to the park primarily to

view flowers would be the most affected under this alternative, as impacts to such plants from excessive deer browsing would continue under this alternative, diminishing the likelihood of encountering a variety of flower species. Adverse impacts would be long term, localized, and range from minor to moderate.

Of the 82% of park visitors who engage in viewing wildlife and scenery, the majority rated viewing birds the most important type of wildlife, and 93% of all visitors rated viewing birds as moderately to extremely important. Under this alternative the deer population would continue to increase, adversely impacting habitat that supports the park's bird species, particularly ground-dwelling birds. Birds occupying the forest canopy would not be as affected by deer browsing. Therefore, the majority of park visitors who value bird-watching could experience adverse, minor to moderate impacts as the diversity and abundance of birds in the park potentially declined over the long term. Visitors who rated viewing other wildlife (not including deer) as moderately to extremely important (94%) would also experience adverse, moderate impacts due to reduction in habitat and species diversity from increased deer browsing. A reduction in visitors' ability to view a diversity of animal species would be counter to the park's goal of providing visitors with the "opportunity to see wildlife in a natural setting."

The majority of visitors who engage in viewing wildlife and scenery rated viewing birds the most important type of wildlife.

As part of Catoctin's ecosystem, deer play an important role and are valued by wildlife viewers. Just under half (46%) of Catoctin's visitors ranked viewing deer as extremely important, and 43% ranked viewing deer as moderately to very important. Currently, visitors have a high chance of viewing deer in the park, depending on the time of day and year. Such chances are likely to increase as the deer population increases. However, an increase in deer numbers could also adversely affect the health of the herd, and if the deer population drastically declined due to disease or malnutrition, or if visitors saw ill or emaciated deer, visitor experience could be adversely affected.

Viewing native scenery is just as important to park visitors as viewing wildlife, with 97% of Catoctin's visitors saying that viewing native plants was moderately to extremely important. As an increasing deer population continues to overbrowse Catoctin's native plants, the diversity and abundance of these species would also diminish. A browse line, a visible delineation at approximately six feet below which most or all vegetation has been uniformly browsed, is evident through much of the park. Currently, vegetation is uniformly browsed to non-existence below the four-foot browse line throughout the park. In addition, overbrowsing by deer gives invasive exotic plant species an opportunity to become established, which could potentially outcompete native plants. Such impacts would affect the forest's natural ability to regenerate, which would be counter to the park's interpretive sub-theme, which states "Catoctin is an example of the natural regeneration of disturbed lands," and "the natural resources of Catoctin Mountain Park provide a dynamic demonstration of nature's ability to regenerate, and represent an important step in our understanding of natural processes, nature's reactions to unbalanced species

populations and alien species, and man's relationship to his environment." In addition, visitors who value native scenery and natural conditions would be adversely affected by manmade fences that would disrupt views and overall visitor experience. These impacts would adversely affect a large percentage of the park's visitors, resulting in adverse, long-term, moderate impacts.

Picnickers, photographers, and visitors who use the park's cabins or who visit historic or cultural sites would also be adversely affected by the sight of small fences and the effects of deer browsing on native vegetation and wildlife, particularly the approximately 250 fences around trees at campgrounds and picnic areas. However, these visitors are primarily focused on specific activities or areas, and they would be less likely to see fences or notice browsing impacts.

Impacts of alternative A would not likely adversely affect cross-country skiers, rock climbers, anglers, or horseback riders to a measurable extent. Most of these visitors comprise a small percentage of overall visitation and engage in specific activities in areas that may not be as affected by deer management activities or the impacts of overbrowsing.

Minimal application of repellents at the park would also result in negligible adverse impacts to visitors, as use would be limited primarily to landscaped areas.

Educational efforts included under this alternative, such as communication with the public about deer management activities as described in "Chapter 2: Alternatives," would help offset adverse impacts to all park visitors, who would be informed of the reasons for implementing the management activities. Monitoring efforts described under this alternative, such as deer population surveys and vegetation monitoring, would have little to no impact on visitors since surveys would be conducted at night when the park is closed, and most visitors would likely interpret vegetation monitoring as consistent with scientific efforts expected at a unit of the National Park System.

NOISE IMPACTS. Catoctin's soundscapes are predominantly natural and are not typically interrupted by noise. Under this alternative visitors would continue to be affected by noise related to nearby hunting and Catoctin's shooting range. However, very few visitors would be affected by noise from the shooting range, as no visitor trails or overlooks are close to the range and the activity occurs on weekdays, not weekends when visitation is highest. No management activities proposed under this alternative would measurably affect noise at Catoctin.

Although not technically considered visitors, Catoctin's neighbors could experience noise impacts from implementation of management activities. Agricultural landowners who live near the park's northern boundary may be exposed to occasional noise from the park's shooting range. However, no noise would be generated specifically from deer and vegetation monitoring activities under this alternative.

Cumulative Impacts

Staff at Catoctin expect a 3% yearly increase in visitation in future years, as well as increased pressure for various recreational uses, which could adversely affect visitor experience. However, park staff also anticipate an increase in scenic driving as opposed to walking, which could ease the burden on park resources from increased recreational activities.

Hunting occurs seasonally at Cunningham Falls State Park, and noise from this area would affect visitors and landowners closest to Catoctin's southern boundary, primarily during the fall. However, no management activities proposed under alternative A would result in noise increases that would combine with noise from nearby hunting.

Increased impacts to the forest are expected from increased development within the park, increased road widening and construction projects, and increased visitor trampling. In addition to deer browsing, past actions within the park, such as logging and fire suppression, have adversely affected forest resources. The park's efforts to control invasive exotic plant species, gypsy moths, chestnut blight, dogwood anthracnose, hemlock woolly adelgid, and other pests would benefit forest resources and their ability to naturally regenerate. The park's plans to implement limited prescribed burning for research purposes in the future would also benefit Catoctin's forest. All of these activities, when combined with the continued pressure on forest resources expected under alternative A from continued deer browsing, would result in both adverse and beneficial cumulative impacts to visitors' ability to enjoy scenic views and species diversity. Adverse cumulative impacts would be long term and moderate.

Conclusion

Impacts to visitors under alternative A would be both beneficial and adverse to those visitors who are primarily interested in viewing deer (beneficial in that there would be more deer to see, adverse in that the health of the herd could be poor). However, overall impacts related to a decreased ability to view scenery (including native vegetation) and other wildlife, which a large majority of visitors rated as important, would be adverse. Because these adverse impacts would affect visitors interested in viewing native plants, other wildlife, and scenery, overall impacts to visitor use would be adverse, long term, and moderate as these values continued to decline. Past, present, and future activities, when combined with the continued pressure on forest resources expected under this alternative, would result in both adverse and beneficial impacts (depending on an individual visitor's goals). Adverse cumulative impacts would be long term and moderate.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

VISITOR EXPERIENCE IMPACTS. Several non-lethal actions under alternative B would be implemented to protect forest resources and reduce deer numbers in the park. Actions include the use of large-scale exclosures, increased use of repellents in limited areas, and reproductive control of does.

Repellents and the small fenced areas described under alternative A would continue to be used under alternative B, but large fenced exclosures would also be implemented to allow reforestation. Approximately 15 exclosures encompassing 23 acres each (1,000 feet square and 8 feet high) would be used throughout the park; a maximum of 6% of the park's land area would be affected at any one time, and the exclosures would be relocated after 10 years. The use of such large exclosures would adversely impact most visitors in the short term in that these 8-foot-high fenced areas would be obvious and closed to visitation. Visitors hiking in the park to view wildlife and scenery would be most affected (89% of survey respondents rated "views without development" as "extremely" and "very" important, and 85% rated viewing native plants and the forest at the same level). Backpackers, orienteerers, cross-country skiers, and nature photographers who may desire a more natural, primitive park experience would also be adversely affected. Visitors to the park's historic or cultural sites might also be adversely affected by intrusions on the cultural landscape. Those who primarily experience the park by car might not be as affected by the sight of the exclosures, which would probably not be detectable from vehicles. To protect park resources and minimize visual impacts of the exclosures, park staff would consider locating them in areas not visible from visitor use areas.

Visitors would also be affected by fence construction activities and the application of repellents with backpack sprayers. Both activities would result in visual intrusions, such as the presence of work crews and employees spraying vegetation in certain areas of the forest. Not all visitors would be impacted, only those in areas where the activities occurred. These impacts would be short term (e.g., spraying would occur during the growing season), but would occur repeatedly over the life of the plan.

Rut — An annually recurring condition or period of sexual excitement and reproductive activity in deer; the breeding season.

The use of reproductive controls on does would be based on available technology. Approximately 590 deer would need to be treated each year during September and October (the two months prior to the rut). Treatment would occur at approximately this level over the life of the plan (15 years). Park staff would give preference to conducting treatment activities during weekdays to the extent possible, and approximately 10 deer would need to be treated each day over a 60-day period. As described in the "Affected Environment," both September and October are popular months for visitors. Although treatment would occur during off-peak visitor hours (early morning and evening) to the extent possible, given the high level of use during these two months, it is likely some visitors would be exposed to treatment activities. To reduce this likelihood, visitor access would be restricted around areas where bait piles were placed to attract deer for treatment; these areas would be chosen to minimize visitor inconvenience. However, area closures could concentrate visitors in other popular park locations, diminishing the quality of visitor experiences. To ensure that visitors would understand the nature of the treatment efforts, the park would conduct educational programs to inform visitors about the procedures and explain why the treatments are necessary.

Deer would likely need to be captured and manually treated with reproductive controls. Given the large number of deer that would need to be treated in a short time frame, it is unlikely that park staff could limit the action to off-peak visitor hours (early morning and evening). Therefore, more visitors would be exposed to treatment efforts than if a biobullet and dart gun was used. Visitor access would also be restricted for longer periods of time, extending the amount of time visitors would be concentrated in other park areas during the fall color season. To ensure that visitors would understand the nature of the treatment efforts, educational programs would be provided if funding is made available.

Biobullet — A single dose, biodegradable projectile comprised of an outer methylcellulose casing containing a solid, semi-solid, or liquid product propelled by a compressed-air gun.

The park plans to implement deer management educational and interpretive efforts under all alternatives, and visitors would be made aware of the reasons for the exclosures and their benefit to forest regeneration, which would beneficially impact visitors with the knowledge that the natural environment would eventually improve. Such information could offset adverse impacts related to visual aesthetics caused by the exclosures. In addition, the increased educational and interpretive activities would provide visitors opportunities to leave the park with an "understanding of natural processes," as well as "nature's reactions to unbalanced species populations and alien species," which are sub-themes of Catoctin's primary interpretive theme. Adverse impacts would be short term, gradually changing to beneficial in the long term as the forest regenerates due to protection afforded by the exclosures.

With reproductive control, deer would be marked with ear tags. Visitors could be troubled by the sight of deer with artificial markings, particularly those who primarily come to Catoctin to see deer. Again, educational material would alert visitors to deer management activities and explain their purpose and expected outcomes.

As reproductive controls eventually took effect and the deer population began to decrease over time, some park visitors might notice reductions in the excessive browsing pressure that has been damaging forest resources. There would be an increased ability to view native plants and animals, including birds, wildflowers, and other wildlife. This would support the park's goal of providing visitors with the "opportunity to see wildlife in a natural setting." Visitors would experience an increased ability to view fall foliage and spring wildflowers — two popular activities at the park. Visitors would be able to experience Catoctin as an example of the natural regeneration of disturbed lands, and experience the dynamic demonstration of nature's ability to regenerate, two components of the park's primary interpretive theme. However, many years would be required to achieve these beneficial impacts. Overall, short-term impacts would be adverse and minor, gradually becoming beneficial in the long term.

A viable white-tailed deer population is a population of deer that allows the forest to naturally regenerate, while maintaining a healthy deer population in the park.

The ability to see deer would decrease, and those visitors who are interested primarily in seeing deer would be adversely affected. However, the herd size would not be reduced to the extent that deer became rare in the park, rather they would still be visible, but they would be more in balance with other elements of the ecosystem. The herd might be healthier under this alternative as compared to alternative A. Many park visitors understand that deer management actions are necessary, as controlling the white-tailed deer population was one of three management activities that visitors ranked with the highest "always appropriate"

rating. Furthermore, less than half (46%) of Catoctin's visitors ranked viewing deer as extremely important, compared to 67% who ranked viewing native plants and forest at the same level. Therefore, visitors who value seeing deer might also prefer seeing fewer deer if it means maintaining a healthy, viable herd, which could lessen the intensity of the adverse impact to these visitors to negligible or minor.

NOISE IMPACTS. As under alternative A, some visitors would continue to be affected by noise from Catoctin's shooting range; however, increased vegetative growth may provide a beneficial impact to noise. If dart guns were used to implement reproductive controls, noise from the guns would be heard, adding to the overall noise levels in the park during the busy months of September and October.

Neighboring landowners would also be exposed to increased noise levels during September and October from the use of dart guns. Neighbors would also hear noise during the construction or relocation of large exclosures. Neighbors would be affected more than visitors because they live in the area year-round. Noise from the use of dart guns would continue each year during September and October for the life of this plan. These impacts would be adverse, short and long term, and minor. Up to 15 large exclosures would be placed in scattered locations throughout the park, at least 0.25 mile from the park boundary, with five in each of the west, central, and eastern areas. Based on the "Land Use Areas Map" (see page 151), neighboring landowners would be most affected by construction of exclosures in the park's west and east areas. The exclosures would be relocated after approximately 10 years. Given the distance from the park boundary and the short-term nature of construction activities, noise impacts would be adverse, short term, and negligible.

Fence construction would also increase noise impacts in localized areas. Any noise associated with spraying repellents would be negligible.

Impacts from additional monitoring efforts under this alternative are not expected to measurably affect visitors.

Cumulative Impacts

The same past, present, and future activities expected under alternative A would also occur under alternative B. Increased visitation expected in the long term would result in even more visitors during September and October, when area closures would further concentrate a larger number of visitors in other areas of the park. The construction of large exclosures would combine with other park area closures, such as periodic security closures and seasonal closures of campgrounds. However, when defining exclosure locations, park staff would consider the locations in relation to visitor use areas. Therefore, an increase in closed areas would primarily affect mushroom and berry pickers, who may pursue their activities off-trail. Noise from nearby hunting (which would occur during the fall), would combine with noise from Catoctin's shooting range and the increased noise during September and October from the use of dart guns at Catoctin. This would affect neighboring landowners more than visitors. However, when activities such as prescribed burning for research purposes and

disease and pest control were combined with the beneficial effects on forest regeneration expected under alternative B, cumulative impacts would be primarily beneficial. Adverse effects from increased development and other actions described under alternative A would be somewhat offset by the beneficial effects of this alternative. Therefore, cumulative impacts to visitors would be mostly beneficial and long term due to combined forest regeneration activities, which would enhance the overall visitor experience.

Conclusion

Overall, visitors under alternative B would experience adverse, short-term impacts primarily due to aesthetics and closures of certain areas of the park, as well as a slight increase in noise levels during reproductive control efforts that would take place primarily during September and October. These impacts would be offset by the educational and interpretive information that would explain the purpose of deer management activities, which would reduce adverse impacts to minor. Short-term impacts would eventually give way to beneficial, long-term impacts as the need for exclosures diminished and the deer population declined, resulting in a restored forest ecosystem throughout the park. However, many years would be required to achieve these beneficial results. Visitors focused primarily on seeing deer could be adversely impacted by the reduction in the herd size, but such an impact would be negligible to minor, as opportunities to view deer would still exist. Cumulative impacts to visitors would be mostly beneficial and long term due to the effects of combined forest regeneration activities.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE)

Analysis

VISITOR EXPERIENCE IMPACTS. Under this alternative sharpshooting activities would occur to reduce the herd size, and capture and euthanasia of individual deer would be used where appropriate. Visitors would be affected primarily by closures required to conduct the direct reduction activities. Sharpshooting would occur during late fall and winter, when deer are more visible and visitation is low. Few visitors would be affected because most campgrounds are closed, climbing permits are not issued in snow and ice conditions, and the weather is less conducive to picnicking, fishing, horseback riding, or hiking. To lessen impacts to those winter visitors who do use the park, such as cross-country skiers, sharpshooting would primarily occur at night (between dusk and dawn) when the park was closed. Noise suppression equipment would be used to decrease impacts to the soundscape, and visitors would only be affected by noise if sharpshooting occurred during the day, and in areas that were not restricted or closed to visitor use. The public would also be notified of any park closures in advance of the activities. Information would be provided to the public on the park website and at exhibits at the visitor center.

Because sharpshooting activities would occur when visitation is low (during winter months), and primarily at night (when the park is closed), and outside developed areas, adverse impacts to visitors related to closures or noise from high-power, small caliber rifles would be negligible. Impacts would be both short and long term, as limited sharpshooting activities would continue beyond the

initial three-year reduction period in order to maintain the target population in the future.

Visitors could be adversely affected by deer being captured and euthanized in certain circumstances. If necessary, deer would be captured as humanely as possible using methods such as nets or box traps, which visitors could see if hiking or backpacking. However, capture and euthanasia would primarily be used in special circumstances, and activities would occur at dawn or dusk when visitation is low. In most cases, euthanasia would apply to individual deer. If this method was required to remove several deer at one time, the area would be temporarily closed to visitors. Under either circumstance, capture and euthanasia would occur when needed, rather than as a scheduled activity. Because this method would be used only in limited circumstances, the likelihood of visitors being exposed to deer being captured and euthanized would be low. Impacts to visitor use would be sporadic over the life of this plan, adverse, and negligible.

Forest regeneration — For the purposes of this plan, the regrowth of forest species and renewal of forest tree cover such that the natural forest sustains itself without human intervention.

The waste and/or carcasses of the shot deer would be disposed of by either leaving them on the ground surface to decompose naturally or by burying them at selected locations in the park. Because the priority would be to donate meat, disposal would only include the few carcasses that might be unsuitable for donation. Surface disposal would only occur in remote areas not far from the bait stations (which would be unlikely to be seen or smelled by visitors). Whenever several deer were unsuitable for donation to charities, the carcasses would be collected and buried in previously disturbed, open areas, such as the Camp Round Meadow bulk storage area. Burial would occur soon after shooting, when the park is closed to visitors. In addition, sharpshooting would occur during winter months when few people visit Catoctin. Therefore, few, if any, visitors would be exposed to deer remains or burial activities under this alternative, although the presence of additional fenced areas used for carcass disposal could detract from the park's natural setting.

The park plans to implement deer management educational and interpretive efforts under all alternatives, and visitors would be made aware of the reasons for the direct reduction activities and their benefit to forest regeneration. The increased educational and interpretive activities would provide visitors opportunities to leave the park with an "understanding of natural processes," as well as "nature's reactions to unbalanced species populations and alien species," which are sub-themes of Catoctin's primary interpretive theme.

As under alternative B, long-term beneficial impacts would occur to most visitors because the forest would regenerate, creating increased ability to view fall foliage and spring wildflowers, and providing improved habitat for a variety of species. Visitors would have the "opportunity to see wildlife in a natural setting," which is one of Catoctin's goals. Forest regeneration would help ensure that visitors would be able to experience Catoctin as an example of the natural regeneration of disturbed lands, and to experience the dynamic demonstration of nature's ability to regenerate — two components of the park's primary interpretive theme. Beneficial impacts and forest regeneration would be realized fairly quickly, as direct reduction would have an immediate impact on the size of the deer herd. Maintaining a viable herd size would help ensure a more balanced ecosystem into the future.

Also as mentioned under alternative B, there would be a decreased ability to view deer. However, viewing deer was not ranked as high as viewing the park's other natural resources, such as birds, and controlling the white-tailed deer population was one of three management activities that visitors ranked with the highest "always appropriate" rating. Therefore, visitors who value seeing deer might also prefer seeing fewer deer if it meant maintaining a healthy, viable herd, which could lessen the intensity of the adverse impact to negligible or minor.

NOISE IMPACTS. Noise from Catoctin's shooting range would be augmented by noise from sharpshooting efforts; however, increased vegetative growth may provide a beneficial impact to noise. The firing range is used throughout the year, but only a few weekdays each month, and only four to five people can shoot at a time. No visitor trails or overlooks are close to the range. Noise from the firing range is most audible at the Poplar Grove group campsites. In addition, sharpshooting activities for deer removal would occur primarily at night and with noise suppression devices. Therefore, the increase in noise levels would be very slight, localized, and limited to fall and winter, primarily affecting overnight visitors camping at Poplar Grove.

Noise impacts would be more intense for neighboring landowners, since sharpshooting would occur at night. Noise intrusions late at night or during times of relaxation and leisure could result in a more noticeable impact than a constant flow of intrusive sound when people are fully occupied with other activities (Truax 1999). Noise suppression devices would be used on firearms to decrease the impact intensity. Sharpshooting activities would occur during the fall or winter months, and primarily for the first three years of this plan, decreasing in scope as the deer population became smaller. After the third year sharpshooting would only be used to maintain the herd size, not to reduce it further, so impacts would be less frequent. In addition, neighboring landowners have already been exposed to hunting in the area, either from activities conducted at Cunningham Falls State Park, or on their own or their neighbor's lands.

Cumulative Impacts

The same past, present, and future activities expected under alternative A would also occur under alternative C. Increases in visitation, combined with area closures required to conduct direct reduction activities, could adversely affect visitors by concentrating them in certain areas of the park. An increase in area closures for conducting sharpshooting would combine with other closures, such as periodic security closures, and would likely coincide with other seasonal closures. In addition, noise from hunting on neighboring lands would combine with the increased noise levels in the park from sharpshooting activities called for under this alternative. However, these noise impacts would be negligible and isolated, particularly since Catoctin's sharpshooting activities would occur primarily at night. Nighttime shooting activities would affect neighboring landowners more than visitors. As under alternative B, effects under alternative C from allowing the forest to regenerate would combine with those of other park activities, such as prescribed burning for research purposes and disease and pest management, resulting in cumulative impacts that would be primarily beneficial. Adverse effects from increased development and other actions described under alternative A would be somewhat offset by the beneficial effects of this

alternative. Therefore, cumulative impacts to visitors from combined forest regeneration activities would be mostly beneficial and long term.

Conclusion

Few visitors under alternative C would see lethal deer management actions occur, since they would primarily occur during winter and at night, when few, if any, visitors are in the park. These impacts would be offset by the educational and interpretive information that would explain the purpose of the deer management activities. Therefore, adverse impacts would be long term and negligible. Long-term beneficial impacts would occur as a result of forest regeneration, which would have a moderate effect on visitors due to the restoration of natural resources. Visitors focused primarily on seeing deer could be adversely impacted by the reduction in herd size, but such impacts would be negligible to minor as opportunities to view deer would still exist. As under alternative B, cumulative impacts to visitors would be mostly beneficial and long term due to combined forest regeneration activities.

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

VISITOR EXPERIENCE IMPACTS. Direct reduction would be used under alternative D to reduce the size of the deer herd, and reproductive control (with direct reduction, if needed) would be used to maintain reduced deer herd numbers. Small fenced areas and repellents would be implemented as under alternative A. Adverse impacts related to sharpshooting activities would be long term and negligible, since they would primarily occur during winter and at night, but beneficial impacts would result from a relatively rapid reduction in deer herd size, which would result in enhanced forest regeneration. Disposal of deer carcasses and waste would occur as described under alternative C. Visitors would only be slightly affected by the continued use of small fenced areas and repellents, a negligible impact. Reproductive control would be applied after direct reduction efforts had reduced the deer population. Therefore, reproductive control activities would augment direct reduction to reduce deer browsing pressure and allow forest regeneration, increasing the quality of Catoctin's scenery and the diversity of its plants and animals. Resulting impacts to visitors would be beneficial and long term. Adverse impacts could occur from visitors being exposed to reproductive control activities and associated area closures (it is estimated that approximately 5 deer per day would be treated over a period of 16 days). Educational and interpretive activities would help explain why deer management is needed. Alternative D would support Catoctin's visitation goals and interpretive themes, such as providing opportunities to see wildlife in a natural setting and demonstrating nature's ability to regenerate, as described under alternatives B and C.

As under the other action alternatives, visitors interested primarily in seeing deer could be adversely affected by the long-term reduction in the deer population. However, adverse impacts to these visitors would be negligible for the reasons mentioned under alternatives B and C.

NOISE IMPACTS. Noise from sharpshooting activities and the use of dart guns for reproductive control would combine with noise from Catoctin's shooting range,

slightly increasing noise levels in the park during fall and winter; however, increased vegetative growth may provide a beneficial impact to noise. Reproductive control and sharpshooting would not occur during the same months. Because sharpshooting would occur primarily at night, visitors would be exposed to noise levels resulting mostly from the use of dart guns to administer reproductive controls (no noise from the construction of large exclosures would occur).

Neighboring landowners would experience more noise impacts than described under alternative C because they would be exposed to firearm noise for a greater length of time (September and October for reproductive control, and fall and winter months for sharpshooting). Noise from remotely administered reproductive controls and/or sharpshooting would occur at night, when neighbors might be more susceptible to loud impulse sounds. Use of noise suppression devices would help offset these impacts. Although the amount of sharpshooting being conducted would decline after the third year of this plan, noise from the use of dart guns would continue each year throughout the life of the plan.

Cumulative Impacts

Cumulative impacts would be similar to those expected under alternatives B and C. Increases in visitation, combined with area closures required to conduct direct reduction and reproductive control activities, could adversely affect visitors by concentrating more of them in certain areas of the park. As under alternative C, short-term closures for conducting sharpshooting activities would combine with other area closures. Visitors would also continue to be affected by noise from hunting on neighboring lands, which would combine with sharpshooting and the use of dart guns for reproductive control. These impacts would be negligible for visitors, and more intense for neighboring landowners. When combined with the beneficial effects of other ongoing park actions, such as disease and pest management, as well as future use of prescribed fire, beneficial impacts of deer management activities under alternative D would result in beneficial, long-term, cumulative impacts. Some adverse impacts would continue as the park's forest recovers from the effects of past logging, and from pressures of expected increased visitation and recreational use. However, impacts of alternative D on visitors' ability to enjoy Catoctin's scenery and species diversity, in combination with the effects of other actions, would result in primarily beneficial, long-term, cumulative impacts.

Species diversity — The variety of different species present in a given area; species diversity takes into account both species richness and the relative abundance of species.

Conclusion

Adverse, short-term impacts could occur if visitors were exposed to direct reduction or reproductive control actions described under this alternative. These impacts would be offset by educational and interpretive information that would explain the purpose of the deer management actions, resulting in negligible adverse impacts. Beneficial impacts would occur in the long term, as the forest regenerated and visitors could see increased plant and animal diversity, and enjoy enhanced scenery. Visitors focused primarily on seeing deer could be adversely impacted by the reduction in the herd size, but such impact would be negligible to minor, as opportunities to view deer would still exist. Cumulative impacts to visitors' ability to enjoy Catoctin's scenery and species diversity, regardless of the type of activity involved, would be primarily beneficial and long term.

VISITOR AND EMPLOYEE SAFETY

The safety of both visitors and NPS employees at Catoctin Mountain Park could be affected by implementation of the proposed deer management actions. Impacts to visitor safety would be related to the presence of fences and the use of dart guns under alternative B, and the use of firearms under alternatives C or D, as well as any additional associated deer management activities. Impacts to employee safety would be related to the use of firearms and dart guns, and the potential for any accidents that could result from implementation of the other proposed actions.

GUIDING REGULATIONS AND POLICIES

The NPS *Management Policies 2001* state that, "while recognizing that there are limitations on its capability to totally eliminate all hazards, the Service . . . will seek to provide a safe and healthful environment for visitors and employees." The policies also state that "the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education" (NPS 2000c, sec. 8.2.5.1).

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

The purpose of this impact analysis is to identify the level of impact that implementing each of the proposed alternatives would have on the safety of visitors and employees at Catoctin Mountain Park. Past accident data, park goals, and personal observations of safety issues were used to assess the effects of the alternative actions on the safety of visitors and employees.

VISITOR SAFETY

The impact thresholds for visitor safety are defined below.

Negligible: There would be no discernible effects to visitor safety; slight injuries could occur, but none would be reportable.

Minor: Any reported visitor injury would require first aid that could be provided by park staff.

Moderate: Any reported visitor injury would require further medical attention beyond what was available at the park.

Major: A visitor injury would result in permanent disability or death.

AREA OF ANALYSIS

The study area for this analysis, including analysis of cumulative impacts, is Catoctin Mountain Park.

IMPACTS OF THE ALTERNATIVES

Alternative A: No-Action Alternative (Existing Management Continued)

ANALYSIS. Park staff would continue to erect small fences around sensitive plants and apply repellents to landscaped areas under alternative A. They would also continue monitoring activities and deer population surveys. No accidents or injuries have occurred to visitors as a result of such activities, and no accidents are anticipated from their continuation, as Catoctin has been meeting its visitor safety goal of two accidents per 100,000 visitor days. Therefore, adverse, long-term, negligible impacts are expected, with visitors experiencing no or only slight, unreported injuries.

CUMULATIVE IMPACTS. Visitation at Catoctin is expected to increase 3% in future years, increasing pressure for various recreational uses and the potential for accidents as more people become concentrated in popular locations. In addition, some visitors engage in certain activities at Catoctin that are inherently more dangerous than others, such as rock climbing. However, only 25 people are permitted to climb in the park at any one time, and permits are not issued during periods of high visitor use or unsafe conditions (NPS 2005d). Few park visitors engage in rock climbing, as the majority come to Catoctin to view wildlife and scenery (82%), drive through the park (61%), and hike for one hour or more (46%). Therefore, accidents related to high-risk activities such as climbing are very infrequent, resulting in only negligible impacts to visitor safety. Accidents that may occur as a result of other visitor activities, such as tripping, would combine with the negligible impacts expected under this alternative, resulting in adverse, long-term, negligible cumulative impacts.

CONCLUSION. Adverse, long-term, negligible impacts could occur under this alternative, as it is expected that no discernible effects to visitor safety would result from deer management actions. Cumulative impacts would primarily be related to other injuries that visitors could sustain in the park; these impacts would also be adverse, long term, and negligible.

Alternative B: Combined Non-Lethal Actions

ANALYSIS. Several non-lethal actions would be implemented under alternative B, including the use of large exclosures, increased use of repellents, and reproductive control of does, which would most likely be administered using a dart gun. Actions described under alternative A (e.g., use of small fences) would continue.

Large exclosures would be constructed throughout the park and would be relocated as vegetation regrowth exceeded deer browsing height (60 inches or 150 centimeters). Visitors would not be able to use the fenced areas during or after construction, which would ensure no one would get hurt trying to get into or out of the exclosures. Park staff would place exclosures in locations in relation to visitor use areas, offsetting any related safety issues. Some visitors could walk off-trail and into an exclosure. However, the likelihood of this happening would be very slight. No accidents or injuries related to the increased use of repellents are anticipated because they would be applied with backpack sprayers, rather than all-terrain vehicles, during the spring growing season, when visitation is less than in summer and fall.

Under this alternative does would be treated with a reproductive control agent that would most likely be administered remotely with a dart gun. The application of annual treatments would also be required. Bait piles would be placed to lure does to certain locations chosen to minimize visitor inconvenience. These areas would be closed to public use for the duration of the activity. Treatment would occur during September and October, which are high visitor use months, but during off-peak visitor hours (early morning and evening). To reduce impacts to visitor safety, preference would be given to conducting the treatment on weekdays. If dart guns were not used, does would be lured into a trap site so that they could be treated with the drugs and tagged. Again, these areas would be closed to visitor use, and precautions would be taken to minimize safety impacts.

No impacts to visitor safety from increased monitoring are expected, as such activities would apply primarily to monitoring exclosures, which would be closed to visitors, and open forested areas, where park staff would exercise safety precautions.

Any adverse impacts related to the safety of visitors under this alternative would be both short term (such activities would occur for only short periods of time) and long term (activities would recur over several years), and negligible because no discernible effects to visitor safety are expected from deer management actions.

CUMULATIVE IMPACTS. The actions described under the cumulative scenario for alternative A would also apply to alternative B. An increase in overall visitation could lead to an increase in visitor accidents or injuries. Accidents that might occur as a result of high-risk or other visitor activities, such as climbing or hiking, would combine with the additional impacts expected under this alternative (e.g., walking into a fence). However, the combined effects of these actions are expected to remain negligible, as few visitors engage in high-risk activities, and the likelihood of walking into a fence is remote. Therefore, cumulative impacts would be adverse, long term, and negligible.

CONCLUSION. This alternative includes measures to protect visitors from accident or injury, such as closing deer-treatment areas to visitor use. In addition, reproductive control activities would be conducted by qualified federal employees or contractors, whose training and experience with such activities would help ensure safety. Therefore, any adverse impacts to visitors would be short and long term and negligible. Cumulative impacts would also be adverse, long term, and negligible.

Alternative C: Combined Lethal Actions (Preferred Alternative)

ANALYSIS. Qualified federal employees or contractors would conduct direct reduction of the deer herd through sharpshooting, and capture and euthanasia of individual deer would be used where appropriate.

Deer would be shot with high-power, small caliber rifles at close range. Measures taken to ensure the safety of Catoctin's visitors would include shooting at night during late fall or winter months when visitation is low, closing areas to visitors if shooting is required, notifying the public in advance of any park closures,

providing exhibits regarding deer management actions in the visitor center, and posting information on the park's website. Park law enforcement personnel would also patrol the perimeter areas where sharpshooting would occur, and sharpshooting would not occur within 100 feet of any building or within 400 feet of the park boundary. Bait stations would be used to attract deer to safe removal locations. Park staff would approve the location of bait stations before sharpshooting took place. The park would comply with all federal firearm laws administered by the Bureau of Alcohol, Tobacco, and Firearms. The majority of deer reduction activities would occur during the first three years of this plan, decreasing in scope (and the potential for accident) during ensuing years as the deer population declined.

The safety of visitors could also be affected by capturing and euthanizing deer. It is unlikely that visitors would be exposed to such action, which would occur primarily at dawn or dusk. If this method was required to remove multiple deer, the area would be temporarily closed to visitors.

The safety measures used under this alternative would ensure the safety of all visitors. Therefore, adverse impacts would be primarily negligible, with no discernible effects on visitor safety. Impacts would be mostly short term, as the activities would occur for a short period of time each year over primarily a three-year period. However, long-term impacts would also occur as annual deer removal would be required following the initial herd reduction in order to maintain the herd at the desired level.

CUMULATIVE IMPACTS. The cumulative scenario described under alternative A would also apply to alternative C. An increase in park visitation would lead to an increase in the number of visitors potentially exposed to lethal removal activities. Accidents that might occur as a result of high-risk or other visitor activities would combine with the negligible impacts expected under this alternative. However, few visitors engage in high-risk activities at Catoctin, and park staff would implement precautions to ensure the safety of park visitors. Therefore, cumulative impacts would be adverse, long term, and negligible.

CONCLUSION. Although this alternative includes actions that could be dangerous to visitors, the extent of safety measures would result in adverse, short- and long-term, negligible impacts, as it is expected that no discernible effects to visitor safety would occur. Cumulative impacts would also be adverse, long term, and negligible.

Alternative D: Combined Lethal and Non-Lethal Actions

ANALYSIS. Under alternative D direct reduction would be implemented to reduce the size of the deer herd, and reproductive control (with direct reduction, if needed) would be used to maintain reduced herd numbers. Small fenced areas and repellents would be used as under alternative A.

As described under alternative A, visitors could experience negligible, short- and long-term, adverse impacts as a result of park staff erecting small fenced areas and applying repellents. Sharpshooting and capture and euthanasia would be implemented over the first three years of the plan to reduce the size of the deer

herd. Reproductive controls would then be administered, most likely through remote injection with a dart gun. However, in both cases, qualified federal employees or contractors trained in safety measures would perform these activities, and areas of the park would be closed to visitation, reducing the potential for injury to visitors under this alternative. Sharpshooting would occur primarily at night during off-peak seasons (fall and winter), and darting would occur primarily on weekdays during off-peak hours (early morning and evening). Sharpshooting would not occur within 100 feet of a building or within 400 feet of the park boundary. Treatment areas would be closed to the public, and educational material would inform visitors of deer management actions and the reasons for them. Bait stations would be used to attract deer to safe treatment locations. Park staff would approve the location of bait stations before sharpshooting took place. The park would comply with all federal firearm laws administered by the Bureau of Alcohol, Tobacco, and Firearms.

If dart guns were not used to administer reproductive controls, deer would be lured into a trap site so they could be treated and tagged. These areas would be closed to visitor use, and precautions would be taken to minimize safety impacts. However, this type of treatment would be more time-consuming than the remote dart gun, likely extending the period of time for performing activities to weekends and times of high visitation. In addition, deer would be more sensitive to either type of reproductive control treatment, as they would have become sensitized to human presence and noise after three years of sharpshooting. This would increase the amount of time required to treat the animals, which could increase the amount of visitor exposure to safety risks.

The safety of visitors could also be affected by capturing and euthanizing deer, similar to alternative C. It is unlikely that visitors would be exposed to such action, which would occur primarily at dawn or dusk. If this method was required to remove multiple deer, the area would be temporarily closed to visitors.

No impacts related to additional monitoring called for under this alternative are expected to affect visitor safety.

Despite increased safety risks under this alternative, overall impacts to visitors would be adverse, long term, and negligible due to the extent of the safety measures that would be implemented.

CUMULATIVE IMPACTS. The cumulative scenario described under alternative A would also apply to alternative D. An increase in park visitation would increase the number of visitors potentially exposed to firearm and dart gun activities. Accidents that might occur as a result of high-risk or other visitor activities would combine with the negligible impacts expected under this alternative. However, few visitors engage in high-risk activities at Catoctin, and the park would implement safety measures to ensure visitor welfare. Therefore, cumulative impacts would be adverse, long term, and negligible to minor.

CONCLUSION. While deer management actions under this alternative could be dangerous to park visitors, the extent of safety measures that would be used, such as area closures and periods of action, would result in adverse, short- and long-term, negligible impacts, as it is expected that no discernible effects to visitor

safety would occur. Cumulative impacts would also be adverse, long term, and negligible.

EMPLOYEE SAFETY

The impact thresholds for employee safety are defined below.

Negligible: There would be no discernible effects to employee safety; slight injuries could occur but none would be reportable.

Minor: Any reported employee injury would require first aid provided by the park and would involve less than eight hours of lost work time.

Moderate: Any reported employee injury would require medical attention beyond what is available at the park and would result in eight or more hours of lost work time.

Major: An employee injury would result in permanent disability or death.

AREA OF ANALYSIS

The study area for this analysis, including the cumulative impact analysis, is Catoctin Mountain Park.

IMPACTS OF THE ALTERNATIVES

Alternative A: No-Action Alternative (Existing Management Continued)

ANALYSIS. Park staff would continue to erect small fences around sensitive plants and apply repellents to landscaped areas under alternative A. They would also continue monitoring activities and surveys. No accidents or injuries have occurred to employees as a result of such activities, and no accidents are anticipated from their continuation, as the park is currently meeting its employee safety goal. No discernible effects to employee safety are expected, and impacts would be adverse, long term, and negligible.

CUMULATIVE IMPACTS. Park staff would engage in other maintenance-related activities that could potentially cause injury. From July 2004 to July 2005, three employees experienced non-serious injuries performing other tasks. Other actions anticipated for the future, such as implementation of prescribed burns for research purposes, could increase risks to employees. Impacts from such activities would combine with the negligible impacts expected under this alternative. Since the park is currently meeting its employee safety goal and staff engage in a variety of safety-related training activities, impacts are expected to remain adverse, long term, and negligible.

CONCLUSION. Impacts would be adverse, long term, and negligible under this alternative, as it is expected that no discernible effects to employee safety would occur as a result of deer management actions. Cumulative impacts would be

related to other injuries that employees could sustain while working in the park; these impacts would also be adverse, long term, and negligible.

Alternative B: Combined Non-Lethal Actions

ANALYSIS. Several non-lethal actions would be implemented under alternative B, including the use of large exclosures, increased use of repellents, and reproductive control for does. Actions described under alternative A (e.g., use of small fences) would continue.

Large exclosures would be constructed throughout the park and would be relocated as vegetation regrowth exceeded 60 inches or 150 centimeters (deer-browsing height). Employees could be injured while constructing the exclosures; however, park staff typically exercise caution and apply safety techniques in all construction projects, as defined by the park's training and awareness activities (identified in "Chapter 3: Affected Environment"). In addition, no discernible effects to employee safety are expected as a result of the increased use of repellents, as no injuries from this activity have occurred to date.

Under this alternative qualified federal employees or contractors would treat does with a reproductive agent, which would most likely be remotely administered with a dart gun. Bait piles would be placed to lure does to treatment locations, concentrating efforts in safe areas. A large number of does (approximately 10–15 per day over the course of 60 days) would need to be treated during September and October. This activity would increase the potential of employee accident or injury. However, safety precautions would be followed, and training in the use of treatment methods would help ensure employee safety. If more than one shooting location was used to administer reproductive controls with dart guns, these areas would be adequately separated. If dart guns were not used, does would be captured and reproductive controls applied manually. No injuries to employees are expected from this method since the capture and treatment of deer would be conducted by qualified federal employees or contractors who are professionally trained to perform these tasks. In addition, federal employees or contractors would also be qualified to handle live deer in order to prevent disease transmission and prevent harm to employees.

Although the level of employee involvement in deer management activities under this alternative would increase compared to alternative A, impacts would remain negligible due to the safety precautions that would be taken. Any adverse impacts to employees would also be short and long term for the reasons described above.

No impacts to park staff are expected from increased monitoring defined under this alternative.

CUMULATIVE IMPACTS. The cumulative scenario described under alternative A would also apply to alternative B. Accidents that might occur to employees conducting other park tasks would combine with the negligible impacts expected under this alternative. Because the park is currently meeting its employee safety goal, cumulative impacts are expected to be adverse, long term, and negligible.

CONCLUSION. Employees could be injured while constructing exclosures; however, park staff are trained to exercise caution and apply safety techniques in all construction projects. Reproductive control activities described under this alternative would be conducted by qualified federal employees or contractors, whose training and experience would help ensure their safety. Therefore, any adverse impacts to government employees would be short and long term and negligible. Cumulative impacts would also be adverse, long term, and negligible.

Alternative C: Combined Lethal Actions (Preferred Alternative)

ANALYSIS. Qualified federal employees or contractors would conduct direct reduction of deer through sharpshooting, and capture and euthanasia of individual deer would be used where appropriate. Small fenced areas and repellents would be used as under alternative A.

As described under alternative A, adverse, short- and long-term, negligible impacts related to erecting small fenced areas and applying repellents would apply to this alternative as well.

The safety of park employees could be affected by sharpshooting and capture and euthanasia activities proposed under this alternative. Qualified federal employees or contractors would conduct the sharpshooting activities, and their experience in such efforts would help ensure the safety of park employees. If more than one shooting location was used to administer reproductive controls with dart guns, these areas would be adequately separated. Qualified federal employees or contractors would also capture and euthanize deer, as such actions would occur sporadically on an as-needed basis. Therefore, impacts to the safety of employees could increase. Every precaution would be taken to ensure the safety of employees, and employees would apply safety training and awareness activities designed to reduce safety risks. Activities would be in compliance with all federal firearm laws administered by the Bureau of Alcohol, Tobacco, and Firearms. Although more risks would be involved due to the use of firearms, adverse impacts to the safety of employees would be short and long term and negligible to possibly minor due to the safety precautions park staff would follow. Any injuries or accidents that could occur under this alternative would be treatable at the park and would result in less than eight hours of lost work time.

CUMULATIVE IMPACTS. The cumulative scenario described under alternative A would also apply to alternative C. Accidents that could occur to employees conducting other park tasks would combine with the negligible to minor impacts expected under this alternative from increased employee involvement in potentially dangerous deer management activities. Therefore, cumulative impacts would be adverse, long term, and negligible to minor.

CONCLUSION. Although this alternative includes actions that could be dangerous to employees, adverse, short- and long-term, negligible impacts would occur, as it is expected that no discernible effects to employee safety would occur. Cumulative impacts would also be adverse, long term, and negligible.

Alternative D: Combined Lethal and Non-Lethal Actions

ANALYSIS. Under alternative D direct reduction would be implemented to reduce the size of the deer herd, and reproductive control (with direct reduction, if needed) would be used to maintain reduced deer herd numbers. Small fenced areas and repellents would be used as under alternative A.

As described under alternative A, adverse, short- and long-term, negligible impacts related to erecting small fenced areas and applying repellents would apply to this alternative as well. In addition, as described under alternative C, sharpshooting and capture and euthanasia would be used to reduce the deer herd during the first three years of this plan, which would increase the potential risk of injury due to the use of firearms and the need to capture and euthanize some deer. However, safety precautions taken by park staff would offset these risks, as described under alternative C. Reproductive controls would be implemented as described under alternative B to maintain the lowered deer population level after direct reduction efforts had reduced the population size. This would most likely involve remotely injecting deer with a reproductive control agent using a dart gun. This type of treatment could take more time than under alternative B because deer would probably become sensitive to the presence of humans and guns during the initial sharpshooting activities. The use of dart guns and the longer time required to administer treatment could also increase the potential risk of injury to employees. If dart guns were not used, deer would need to be captured and manually treated with reproductive controls, which might slightly reduce risks. Again, safety precautions would be followed to limit the potential for injury. Therefore, overall impacts to employees would be adverse, long term, and negligible to minor as park staff would engage in more potentially dangerous deer management tasks under this alternative. It is expected that any injuries sustained would be treatable by park staff and would result in less than eight hours of lost work time.

CUMULATIVE IMPACTS. The cumulative scenario described under alternative A would also apply to alternative D. Accidents that might occur to employees conducting other park tasks would combine with the negligible to minor impacts expected under this alternative. Therefore, adverse, long-term, negligible to minor cumulative impacts would result assuming that any injuries requiring first aid could be treated by the park and would involve less than eight hours of lost work time.

CONCLUSION. Like alternative C, this alternative includes activities that would be potentially dangerous to employees. However, the extent of safety measures that would be employed would result in adverse, short- and long-term, negligible to minor impacts, as it is expected that any injuries sustained would be treatable by park staff and would result in less than eight hours of lost work time. Cumulative impacts would also be adverse, long term, and negligible to minor.

SOCIOECONOMIC EFFECTS

GUIDING REGULATIONS AND POLICIES

The *National Environmental Policy Act* requires that economic and social impacts be analyzed in an environmental impact statement when they are interrelated with natural or physical impacts. Economic impacts would potentially result from deer browsing damage to crops and landscaping on private lands adjacent to the park as a result of changes in deer populations at Catoctin Mountain Park; therefore, they are addressed in this document.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Because of the expected increase in deer populations over time and the limited supply of deer forage within the park, deer that frequent the park may also browse on grain crops and landscaping plants outside the park on adjacent public and private lands. As presented in the "Deer Health" section of the "Affected Environment," the home range for deer within the park may extend 0.5 mile from the park boundary (Warren and Ford 1990). It is assumed that deer that are habituated to the park may seek food sources outside the park as the quality and quantity of browse within the park decreases. The Maryland Department of Natural Resources indicates that the sex and age of the deer and habitat types will result in home ranges of varying sizes. Yearling males will move many miles, whereas adult females usually have smaller, more consistent annual home ranges (see page 117 for more information on home ranges). Deer in quality habitat will travel less than deer in poorer quality habitat (MD DNR 2005d). In addition, the Iowa Department of Natural Resources indicates that white-tailed deer ranges may expand seasonally based on breeding activity and food availability (Iowa Department of Natural Resources 2005).

Home range — The geographic area in which an animal normally lives.

Damage to both agricultural plants and private landscaping is an issue beyond the park and is a common problem throughout the northeastern United States. Economic losses associated with deer damage to alfalfa, grain crops, orchards, and landscaping plants have been estimated through studies in a number of northeastern states, including Maryland and New York. Some of the methodologies and crop damage estimates presented in these studies and outlined below are applicable to agricultural lands surrounding the park and have been used to determine potential impacts to landowners from the deer management alternatives considered in this document.

McNew and Curtis (1997) estimated the extent of deer damage to grain crops in Maryland by multiplying farmer-reported acreage losses due to deer by grain prices at harvest. They then used regression analysis of reported damage estimates and local deer populations to calculate a deer population elasticity of crop damage. This elasticity measure enables an approximate estimation of the additional crop damage that would occur given an increase in the deer population.

Based on research by McNew and Curtis (1997), table 26 shows that for a 10% increase in the local deer population, there would be a 3.4% bushel per acre damage increase in crop damage to corn, a 3.0% bushel per acre damage increase to soybeans, and a 6.5% bushel per acre damage increase to wheat. Using harvest season prices for corn from 1996 and the total statewide acreage planted in corn, McNew and Curtis estimated that over $420,000 in additional losses would occur to corn farmers in the state with each 10% increase in the deer population. The estimated annual loss statewide in 1996 for all three grain crops would total approximately $1.16 million. In 2005 dollars, this loss would be substantially greater.

These percentage increases in crop damage that could result from a 10% change in deer population can be applied to agricultural lands surrounding Catoctin Mountain Park as an example of how crop damage might change. Using this elasticity of crop damage, the estimated yield per acre for a farmer's crop and the average yield loss due to deer (presented in "Chapter 3: Affected Environment"), the additional damage loss a farmer might incur given a potential increase in the local deer population can be estimated. However, this estimate can only be used to compare the relative magnitude of the economic impact between alternatives, because it is unknown whether a 10% increase in the park's deer population would cause deer to expand or shift their home range outside the park, causing a similar 10% increase in deer populations outside the park. Impacts to crops would most likely be less because some deer could remain in the park, rather than shifting their home range and browsing adjacent private lands.

Mean damage per acre (in dollars) for grain crops, alfalfa, tree fruits, and berries by New York farmers was $136 per acre for tree fruits and $152 per acre for berries, compared to $10 per acre for grain crops (Brown et. al. 2004). This study and statistics from the National Agricultural Statistics Service are used to broadly identify the costs associated with deer damage in orchards that are found northeast and east of the park.

The estimates of crop damage presented in the impact analysis are just examples based on the studies identified above. As previously discussed, the crop damage and its economic value under each deer management alternative could vary substantially from the estimates provided, depending on the actual deer population, average deer damage per acre for different crops in the vicinity of the park, crop prices, and other factors. Thus, any economic costs or benefits presented are most useful for relative comparison between alternatives rather than as absolute costs.

TABLE 26: ECONOMIC LOSS FROM A 10% INCREASE IN THE LOCAL DEER POPULATION

Crop	Deer Population Elasticity of Crop Damage	Crop Damage Sample Mean* (bushels per acre)	Local Deer Population (sample mean)[a]	Additional Damage from a 10% Increase in Deer Population (× $1,000)
Corn	0.34	8.45	61.6	429
Soybeans	0.30	5.38	68.4	633
Wheat	0.65	1.44	67.9	94
			Total	**$1,156**

Source: McNew and Curtis 1997

Note:

a. Sample means are the means from the sample used in the regression analysis.

Impact threshold definitions for socioeconomic conditions focus on crop and landscaping depredation to neighboring lands and the number of complaints related to deer damage received by the park, and were defined as follows:

Negligible: No effects would occur, or the effects on neighboring landowners or other socioeconomic conditions would be below or at the level of detection.

Minor: The effects on neighboring landowners or other socioeconomic conditions would be small but detectable. The impact would be slight, but would not be detectable outside the neighboring lands and would affect only a few adjacent landowners.

Moderate: The effects on neighboring landowners or other socioeconomic conditions would be readily apparent. Changes in economic or social conditions would be limited and confined locally, and they would affect more than a few landowners.

Major: The effects on neighboring landowners or other socioeconomic conditions would be readily apparent. Changes in social or economic conditions would be substantial, extend beyond the local area, and affect the majority of landowners.

Area of Analysis

The area of analysis includes those private agricultural and resource conservation lands adjacent to the park that are within the approximate 0.5-mile home range of the deer herd in Catoctin Mountain Park.

Depredation — Damage or loss.

Impacts of the Alternatives

Alternative A: No-Action Alternative (Existing Management Continued)

Analysis

Under this alternative park staff would continue monitoring the deer population and would conduct activities to protect native plants, such as creating and monitoring small fenced areas and applying limited repellents to landscaped areas. These controls would serve to protect important resources, but they would not affect the size of deer populations in the park. Deer populations would continue to grow over time, although numbers would fluctuate annually due to winter temperatures, snow depths and duration of snow cover, food availability, reproduction and mortality rates due to herd health, and other factors. Some deer would continue to use their existing home range, which may extend up to 0.5 mile outside the park. However, other deer, such as young bucks, might expand their home range beyond the park boundary as browse became scarcer in the park. As a result, some increased browsing could occur outside the park, where food may be more plentiful. Crops grown on private lands adjacent to the park could be browsed more heavily, resulting in adverse economic impacts to landowners. Crops that would be affected include orchards, fruit crops such as

strawberries and blueberries, corn, soybeans, hay, and alfalfa. The degree of physical and economic damage on adjacent lands would be dependent on anticipated growth in deer populations, the types of crops and number of acres in each crop, the market value of current crops, and the protections that landowners use to manage deer.

CROP DAMAGE. As noted in the "Assumptions, Methodology, and Impact Thresholds" section above, it is assumed that each 10% increase in the park's deer population could result in an approximate 3.4% bushel per acre increase in damage to corn and an approximate 3.0% bushel per acre increase in damage to soybeans. For example, a central Maryland farm that is planted in corn yields approximately 98.2 bushels per acre when harvested; damage from deer browsing would result in a loss of approximately 9.6 bushels per acre or 9.8% of the harvested yield to deer damage (MASS 2002). For a 100-acre farm, this loss would amount to 960 bushels of corn; assuming a 2004 market price for corn of $2 per bushel (MASS March 2005), the total economic loss for this farm would be $1,920 or $19.20 per acre. With each 10% increase in deer populations, this loss would increase.

Orchards and other fruit crops north and east of the park would most likely sustain greater economic impacts per acre due to increasing deer populations than would other farmers. Based on a statewide survey of New York farmers, Brown et al. (2004) reported than the statewide mean per acre damage to tree fruits was $136 and for berries $152 per acre, in comparison to grain crops ($10 per acre) and alfalfa ($20 per acre). These figures may be high because of significant damage incurred by fruit growers on Long Island and in southeastern New York; a more average figure (eastern New York) was $76 per acre for tree fruits. Assuming a 100-acre orchard and these figures, deer-related damage could range from approximately $7,600 to $15,000 annually. According to the survey, the mean damage reported was $2,207 for berries and $9,318 for tree fruits.

Crops such as hay and alfalfa would most likely incur per acre damages that are less than corn and soybeans. Blueberry and strawberry damages per acre damage increase would be greater than those calculated for apples (Brown et al. 2004). In New York, the adjusted mean estimated deer damage per farm for all crops was $2,306 or $13 per acre (Brown et al. 2004).

Based on historical increases in deer population within Catoctin Mountain Park, it can be assumed that in the long-term deer populations would most likely increase at least 10%. Multiple factors affect deer populations and have caused considerable fluctuations over time; therefore, the population growth percentage is difficult to predict. Assuming that some increase in deer population would occur and that deer would include private lands within 0.5 mile of the park boundary within their home range, farmers could anticipate that soybean and corn crop damage due to deer browsing could increase by approximately 3% and 3.4%, respectively, with each 10% increase in the deer population. Orchard damage would be upwards of 10% or more of the crop value, or $76 to $152 per acre based on available statistics. This additional damage would result in adverse, long-term, minor to moderate impacts to farmers, with the extent of damage and the degree of impact dependent on the specific crop, the location relative to the park, and other factors. These percentages are rough estimates based on available

research and could vary substantially depending on deer population fluctuations, how deer adjust their home range in response to food scarcity, and other factors.

In any given year deer populations could also increase rapidly due to increased reproduction, decreased mortality, and other factors, and then subsequently decline in a later year. A growing deer population would most likely have a non-linear effect on crop damage, meaning that crop damage costs could increase proportionately more than increases in the deer population (McNew and Curtis 1997). Thus, a short-term increase in the deer population, as exhibited between 2002 and 2003, could escalate costs associated with crop damage, assuming that deer would use private lands within their home range and/or shift or expand their home range due to the scarcity of browse within the park. Thus, in the short term, farmers could anticipate that crop damage due to a potentially substantial deer population would increase. These costs could result in adverse, short-term, moderate impacts to farmers surrounding the park.

LANDSCAPING DAMAGE. Similar to the crop damage discussed above, private landowners adjacent to the park could anticipate increased deer browsing on plants in landscaped areas over the short and long term as food sources decreased within the park due to population pressures. These increases could result in adverse, short- and long-term, moderate impacts.

PROTECTION MECHANISMS AND COSTS. In a 1996 survey conducted by the Maryland Department of Natural Resources, approximately 40% of farmers that reported deer-related damage used some form of preventive measure to protect crops, yards, and gardens (Lynch 1997). Farmer's costs to prevent deer damage averaged $144 per farmer statewide in New York in 2002, ranging from $47 in western New York to $1,382 on Long Island (Brown et al. 2004).

Landowners would most likely incur additional costs for fencing, repellents, and other forms of deer control to protect their crops and landscaping as the deer population grows under this alternative. Increased deer browsing could also encourage landowners to incur additional monetary and time costs associated with harvesting deer on their lands through control mechanisms such as a MD DNR damage permit. McNew and Curtis (1997) found that the higher the loss due to deer damage, the more likely that a farmer would request a deer damage permit.

The time and monetary costs associated with acquiring additional protection measures would result in adverse, long-term, minor impacts to private landowners, depending on the number of landowners that used such measures. Increases in requests for MD DNR deer damage permits could also result in more labor hours for MD DNR staff, resulting in adverse, long-term, negligible impacts on the state agency.

Cumulative Impacts

The continued growth in suburban areas in Maryland, such as increased residential development in areas such as Thurmont, has created habitat that is suitable for deer and has enabled them to reproduce at relatively high rates, while at the same time providing a safe haven from hunters (McNew and Curtis 1997).

Continued conversion of agricultural land to residential or commercial uses in Frederick County, as well as the lack of predators within the county, could further encourage deer populations to grow, resulting in adverse, minor impacts. However, Frederick County's emphasis on the preservation of agricultural lands should help regulate deer populations to a small degree by curbing this conversion potential and minimizing the potential for crop damage.

State-regulated hunting in areas such as Cunningham Falls State Park and Frederick Watershed Forest helps regulate local and regional deer populations in the vicinity of the park. Hunting in these areas most likely provides some degree of benefit to landowners adjacent to the park by reducing regional deer population numbers and potentially minimizing the degree of crop damage caused by non-park deer. Other deer control mechanisms used by farmers to control regional deer populations include allowing hunters to hunt for free on their lands or allowing hunters to lease their land for a price to help recover some of the economic losses incurred due to deer damage. McNew and Curtis (1997) determined that leasing hunting rights would be unlikely to economically compensate for crop losses, but this option could alleviate some of the burden from deer damage. In addition, the opportunity to hunt deer is a non-monetary benefit for those farmers who choose to hunt on their own lands. These hunting activities, while benefiting the local economy due to hunting-related expenditures and providing non-monetary benefits to farmers, also provide long-term benefits to landowners adjacent to the park and in the region by helping reduce the deer population and related crop damage.

Other wildlife also damage crops and landscaping, including bears, groundhogs, mice, voles, raccoons, starlings, and robins (Brown et al. 2004; National Agricultural Statistics Service 1999). These species can cause as much damage as deer, depending on the crop, and are most likely causing adverse, long-term, minor impacts to crops on private lands adjacent to the park.

The benefits of hunting on state and private lands and the adverse impacts of continued development and other wildlife damage, in combination with the adverse impacts of alternative A, would result in adverse, moderate cumulative impacts in the short-term and adverse, minor cumulative impacts in the long term relating to crop damage.

Conclusion

Increases in long-term park deer populations would result in additional landscaping and crop damage to corn, soybeans, hay, alfalfa, fruit trees, and other crops on agricultural and other private lands adjacent to the park due to increased deer browsing. This additional damage would result in adverse, long-term, minor to moderate impacts to farmers, with the extent of damage and the degree of impact dependent on the farmer's crop, location relative to the park, and whether deer would use private lands within their existing home range and/or expand or shift their home range as browse became scarcer within the park. Large fluctuations in annual deer populations could result in varying impacts. Landowners would also incur additional costs for fencing, repellents, and other forms of deer control to protect their crops and landscaping. Cumulative impacts would be adverse, short and long term, and moderate due to crop damage.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

Several non-lethal actions would be implemented under this alternative to protect forest resources and reduce deer numbers in the park. Actions include the use of large-scale exclosures, increased use of repellents in limited areas, and reproductive controls. Repellents and small fenced areas described under alternative A would continue to be used under alternative B.

Reproductive controls — A method or methods used to limit the numbers or animals in a population by decreasing the reproductive success of the animals, such as contraception or sterilization.

Reproductive control of deer, if successful, would gradually reduce the population over the long term. However, deer numbers within the park would not be immediately reduced, and numbers would fluctuate annually. The home range of the deer within the park could expand, resulting in greater deer browsing outside the park where food may be more plentiful. However, the number of deer that would seek food sources outside the park could be slightly greater under this alternative because the large-scale exclosures in the park would exclude deer from browsing on about 345 acres or about 6% of park lands at any given time.

CROP DAMAGE. Deer displaced by the exclosures could slightly increase per acre damage to corn, soybeans, hay, alfalfa, and orchard fruits compared to alternative A, adversely impacting adjacent farmers. Repellents would also exclude deer, with the same effects as under alternative A. The amount of additional crop damage that could result from exclosures is unknown, but could be greater than the 3% to 3.4% increase in soybean and corn crop damages estimated under alternative A, with each 10% increase in deer population, assuming that the park deer population would browse on private lands within 0.5 mile of the park boundary and/or expand or shift their home range. This additional deer damage would result in adverse, long-term, minor to moderate impacts to farmers, with the extent of damage and degree of impact dependent on factors such as the particular crop, the location of the crop relative to the park, and existing protection measures.

The occasional large annual increases in park deer populations and the reduced availability of forage could also cause a larger rise in crop damage in the short term. If the deer population experienced dramatic population increases (e.g., between 2002 and 2003 deer increased from 155 per square mile to 194) and exclosures prevented browsing in about 6% of the park, the potential for short-term damage to crops for that year could increase proportionately. To mitigate for potential deer impacts related to exclosures, the park would construct any exclosures at least 0.25 mile from the park boundary. As indicated in alternative A, crop damage costs could increase proportionately more than increases in the deer population (McNew and Curtis 1997). If such a scenario occurred in the short-term, adverse impacts to farmers could be moderate because more than a few farmers in the local area would likely be affected and the change in crop damage would be readily apparent. Alternatively, the deer population could also decline, as it did between 2003 and 2004, resulting in fewer, less severe impacts.

The implementation of reproductive controls would limit deer population increases in the long term and would moderate the impacts associated with the exclosures. A reduced deer population would result in less browsing pressure on private land, with adverse impacts reduced to minor over the long term. Short-

term adverse impacts would remain minor to moderate because of potential population fluctuations and the continued growth of the deer population in the short term.

LANDSCAPING DAMAGE. Similar to crop damage impacts, private landowners adjacent to the park could anticipate increased deer browsing on plants within landscaped areas over both the short and long terms. The degree of impact on landscaping could be greater than under alternative A because exclosures would prevent browsing on about 6% of park lands at any one time. Adverse impacts would likely be moderate. The introduction of reproductive controls could reduce long-term impacts on landscaping to minor, similar to crop damage.

PROTECTION MECHANISMS AND COSTS. Landowners adjacent to the park would continue to incur additional costs for fencing, repellents, and other forms of deer control to protect their crops and landscaping. Because deer would be displaced from the park due to the exclosures, these costs would most likely be greater than in alternative A. Increased deer browsing could also encourage landowners to acquire MD DNR deer damage permits and incur the additional monetary and time costs associated with harvesting deer on their lands. Educational efforts on the part of the park would help inform adjacent landowners of deer management activities in the park and their potential effects, as well as provide information on management mechanisms, such as the deer damage permits, that are available to landowners.

The time and monetary costs associated with additional protection measures would result in adverse, long-term, minor to moderate impacts to farmers and other private landowners because protection costs could increase, similar to alternative A. Increases in requests for additional deer damage permits could also result in more labor hours for MD DNR staff, resulting in adverse, long-term, minor impacts on the state agency. The availability and effectiveness of reproductive controls in the future could reduce the intensity of these impacts because the deer population would decrease gradually, minimizing crop and landscaping damage and reducing the need for protection mechanisms.

Cumulative Impacts

The cumulative impacts for alternative B would be similar to alternative A, except that actions associated with alternative B could result in more adverse cumulative impacts because deer would be displaced by exclosures on 345 acres of park land. Thus, the benefits of hunting and adverse impacts of development and other wildlife damage in combination with the adverse impacts of alternative B would result in adverse, short- and long-term, moderate cumulative impacts.

Conclusion

Under alternative B reproductive controls (if successful) would allow for only a gradual reduction in the number of deer, and there could be some displacement of deer from the park due to exclosures, which could result in slightly greater per acre damage to landscaping and field crops such as corn, soybeans, hay, alfalfa, and orchard fruits on adjacent private lands than under alternative A. Adverse,

long-term impacts to farmers would be moderate, with the extent of damage and degree of impact dependent on factors such as the farmer's crop, the location of the crop relative to the park, deer feeding habits, and whether deer would use private lands within their existing home range and/or expand or shift their home range as browse became scarcer within the park. Over the long-term reproductive controls would lessen adverse browsing impacts. Due to large annual fluctuations in the deer population and the exclosures, short-term crop impacts could be more severe than under alternative A, resulting in adverse, short-term, moderate impacts to farmers and other landowners. Landowners would also incur additional costs for fencing, repellents, and other forms of deer control to protect their crops and landscaping. Cumulative impacts to crops would be adverse and moderate over the short and long terms.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE)

Analysis

Under this alternative sharpshooting activities would quickly reduce the herd size, along with capture and euthanasia where appropriate. This approach would continue into year three or until the park deer density was approximately 15–20 deer per square mile. Additional deer would be removed in subsequent years to maintain the population.

CROP AND LANDSCAPING DAMAGE. The reduction of the existing park deer population by approximately 80% over the short and long terms may result in fewer deer leaving the park and browsing on crops and landscaping on adjacent lands, depending on where the sharpshooting was focused and the home range locations of the deer. Acreage within the park would most likely provide sufficient browse for a reduced deer population. Thus, the bushels per acre lost to park-related deer damage for crops such as corn, soybeans, tree fruits, hay, and alfalfa would most likely be reduced, resulting in an increased total harvested yield.

The degree of reduction in crop damage is unknown. Available studies such as McNew and Curtis (1997) and Brown et al. (2004) indicate, based on survey results, that per acre damage is greater in regions of Maryland and New York where deer populations are potentially highest or most protected from measures such as hunting and much less in regions where deer populations are lower. However, the authors who summarized the New York survey data (Brown et al. 2004) state,

> It is impossible to tell from this study the extent to which the high variation in estimated deer damage from farm to farm is due to differences in deer populations, feeding habits, and other factors such as types of crops raised and proximity of farm to deer refugia (e.g., park, posted lands), versus measures farmer have taken . . . to reduce deer damage (Brown et al. 2004, 23).

With an 80% reduction in the deer population, the related reduction in crop and landscaping damage would result in beneficial, long-term impacts to farmers and other private landowners, assuming that park deer populations are currently foraging on private lands adjacent to the park and within their home range. A

reduction of approximately 80 deer per square mile (compared to 2004 deer density) would be readily apparent and would affect the majority of adjacent landowners. Adverse, short- and long-term impacts would be reduced from moderate under alternative A to minor under alternative C. However, if deer populations outside the park remained high, benefits would be limited.

Annual controls to maintain a reduced park deer herd would help prevent the large annual population fluctuations that have been evident in recent years, resulting in reduced short-term crop damage and short-term benefits to farmers and other landowners.

PROTECTION MECHANISMS AND COSTS. A corresponding decline in costs for fencing, repellents, and other forms of deer control to protect crops and landscaping could also occur as the park deer population was reduced. Assuming that park deer are using adjacent lands as part of their home range, fewer deer and decreased deer browsing on private land could also result in fewer landowners adjacent to the park acquiring MD DNR deer damage permits and fewer monetary and time costs associated with harvesting deer on their lands. As a result, reduced time and monetary costs associated with protection measures would reduce adverse, long-term impacts to farmers and other private landowners to minor because they would still incur protection costs, but the cost would likely decrease noticeably. Issuance of fewer permits in vicinity of the park would probably not affect MD DNR.

Cumulative Impacts

As described under alternative A, continued development in the Thurmont region and damage from other wildlife would cause minor adverse socioeconomic impacts to landowners adjacent to the park, whereas hunting would provide economic benefits by contributing to the economy and reducing costs related to crop damage. These impacts, in combination with the benefits of alternative C, would be beneficial compared to alternative A because adverse impacts would be reduced to minor over the short and long terms.

Conclusion

The reduction of the existing deer populations by approximately 80% in both the short and long terms could result in fewer deer leaving the park and browsing on crops and landscaping on adjacent lands, assuming that these private lands are currently within the home range of the park deer population. The degree of reduction in crop damage is unknown; however, the reduction would most likely be measurable, reducing adverse impacts to farmers and other landowners to minor over the short and long terms by increasing harvested yield and preserving landscaping. A corresponding decline in costs for fencing, repellents, and other forms of deer control to protect crops and landscaping could also occur. Cumulative impacts would be beneficial compared to alternative A; adverse impacts would be reduced to minor over the short and long terms.

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

Under alternative D direct reduction would be used to reduce the size of the deer herd, and reproductive control (with direct reduction, if needed) would be used to maintain reduced deer herd numbers. Small fenced areas and repellents would be implemented as under alternative A.

As demonstrated in the analyses for alternative C, direct reduction methods would be the most effective in minimizing crop damage from deer browsing, assuming that adjacent private lands are currently within the home range of park deer populations. Non-lethal methods such as small-scale fencing and repellents that are analyzed in alternative A would protect park resources from further damage, but would not reduce crop and landscaping damage on lands adjacent to the park. Of the combined lethal and non-lethal methods under this alternative, the direct reduction method would most affect the degree of crop and landscaping damage. Therefore, the impacts associated with alternative D would be the same as alternative C. The damage resulting from park deer to crops such as corn, soybeans, tree fruits, hay, and alfalfa would most likely be measurably reduced, resulting in a beneficial effect compared to alternative A. Over the long-term, adverse impacts to adjacent landowners related to increased per acre and total harvested yields and lower costs for protection measures would be reduced to negligible or minor.

Cumulative Impacts

The same cumulative impacts described under alternative A would continue under alternative D. Impacts associated with past, present, and future actions described in alternative A, when combined with the overall beneficial impacts of alternative D, would result in beneficial impacts compared to alternative A. Cumulative impacts would be adverse and minor over the short and long terms because some level of deer-browsing impacts would continue.

Conclusion

Of the combined lethal and non-lethal methods under this alternative, direct reduction methods would affect crop and landscaping damage to the same degree as alternative C. Therefore, crop and landscaping damage would be reduced, resulting in beneficial impacts compared to alternative A. Deer browsing impacts would continue at some level, but adverse impacts to farmers and other landowners due to improved harvest yields and preserved landscaping would be reduced to negligible or minor levels over the short and long terms. Costs for fencing, repellents, and other forms of deer control to protect crops and landscaping would also decline. Cumulative impacts would be beneficial compared to alternative A, and adverse impacts would be reduced to minor.

PARK MANAGEMENT AND OPERATIONS

Park management and operations refers to the current staff available to adequately protect and preserve vital park resources and provide for an effective visitor experience. This topic also includes the operating budget necessary to conduct park operations.

METHODOLOGY AND INTENSITY THRESHOLDS

The discussion of impacts to park operations focuses on (1) the amount of staff available to ensure visitor and resident safety, and (2) the ability of park staff to protect and preserve resources given current funding and staffing levels. It was assumed that under all alternatives the park's annual budget would be increased to implement a particular alternative. However, this funding is not guaranteed; each alternative discusses the impacts of receiving or not receiving additional funding. Park staff knowledge was used to evaluate the impacts of each alternative, and the evaluation is based on the description of park operations presented in "Chapter 3: Affected Environment." Definitions of impact levels are as follows:

Negligible: Park operations would not be affected.

Minor: Park operations would be affected, and the effect would be detectable, but current levels of funding and staff would be adequate and other park operations would not be reduced.

Moderate: Park operations would be affected, the effect would be readily apparent, and increased staff and funding would be needed or other park operations would have to be reduced and/or priorities changed.

Major: Park operations would be affected, the effect would be readily apparent, increased staff and funding would be needed or other park programs would have to be eliminated.

AREA OF ANALYSIS

The area of analysis is Catoctin Mountain Park, including the cumulative impacts analysis.

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE A: NO-ACTION ALTERNATIVE (CONTINUE EXISTING MANAGEMENT)

Analysis

Under alternative A the existing deer management plan, which calls for limited fencing, use of repellents in landscaped areas, monitoring, and data management and research, would continue, with assistance from volunteers, the Student

Conservation Association, and the NPS Center for Urban Ecology. No new deer management actions would be taken. These controls would serve to protect important resources, but they would not affect the size of the deer population in the park.

The park's deer population would continue to grow over time, although numbers would fluctuate annually due to winter temperatures, snow depths and snow duration, food availability, reproduction and mortality rates due to herd health, and other factors. Existing park staff would be sufficient to continue performing current deer management functions at the present population level. However, as the deer population continued to grow, more time would have to be devoted to these activities, which would leave less time for other duties. Only two resource management employees are assigned to work directly with deer management activities (one full-time and one part-time). Additional management responsibilities, as well as any additional funding that might be needed to build and maintain additional exclosures and purchase repellents, would result in adverse, long-term, moderate impacts. Current deer management would become a permanent component of Catoctin's resource management activities, as adverse impacts to forest health would continue indefinitely into the future. The NPS Center for Urban Ecology would continue to provide inventorying and monitoring services. The park would also continue using the services of the Student Conservation Association volunteers to help with deer monitoring, population and distance sampling, and exclosure maintenance.

Training staff to perform deer monitoring activities.

Under this alternative Catoctin Mountain Park staff would also monitor the costs of the deer management program, including costs related to staff time, training, administrative, legal, public relations, and monitoring. If deer management costs increased substantially, funds and personnel from other park divisions might have to be reallocated (e.g., from administration and maintenance), resulting in adverse, long-term, moderate impacts to other divisions.

There would not likely be any adverse or beneficial impacts to education and interpretation programs currently conducted at the park, as currently there are sufficient funds and personnel to run these programs, and present funding and staffing are expected to continue.

Cumulative Impacts

Needs related to park operations and maintenance have been, and would continue to be, affected by outside influences, such as inflation and natural disasters, as well as demands related to the implementation of other park plans and resource programs. As the cost of goods and services rises faster than the park's operating budget, staff continue to accomplish the park's mission and maintain the visitor experience with fewer financial resources. Adverse, long-term, moderate impacts to park operations are expected as a result of these influences.

Under alternative A it is expected that funding would continue for current deer management activities, but the demand for those activities could increase if the deer population continued to grow. Responding to other needs would result in reduced funding to carry out park activities, with adverse, long-term, moderate cumulative impacts to park operations and maintenance.

Conclusion

Impacts to park operations and maintenance under alternative A would be adverse, long term, and moderate. Because present deer management actions would continue, the park's deer population is expected to continue to fluctuate and increase over the long term, resulting in long-term demands on park staff and funding for managing the deer herd at current levels and protecting other park resources. Past, present, and future activities, when combined with actions under this alternative, would result in adverse, long-term, moderate cumulative impacts.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Analysis

Under this alternative several non-lethal actions would be implemented to protect forest resources and reduce deer numbers in the park. Actions include the use of large-scale exclosures, increased use of repellents in limited areas, and doe reproductive control. Repellents and the small fenced areas described under alternative A would continue to be used. The participation of the Center for Urban Ecology and the Student Conservation Association in park programs would be expected to continue at no cost to the park.

Similar to alternative A, deer populations would continue to grow over time, pending the allocation of reproductive controls, and numbers would likely continue to fluctuate annually. The non-lethal management measures outlined under alternative B would require additional staff time and seasonal staff, for which additional funding would be needed. Additional temporary staff would likely be needed for the initial construction of the large enclosures, and additional staff time would be needed for long-term maintenance. It is anticipated that the construction of 15 exclosures would take up to 150 working days to complete (Voigt, pers. comm. 2005a). If staff from other park divisions were used, park operations in those divisions would be adversely affected during the construction period.

In addition to an increase in temporary staffing, additional funding would be required, as the initial cost of installing the 15 exclosures (each 23 acres in size) would be approximately $240,000 for supplies and labor. After the initial construction, the exclosures would be relocated every 10 years, at an estimated cost of $120,000 for supplies and labor. These costs would be in addition to the park's present budget.

Maintaining the large exclosures would require additional staff, especially if large storm events or natural disasters required the exclosures to be repaired or removed. Furthermore, to reduce impacts to visitors as much as possible, some exclosures would be located in remote areas of the park, adding to maintenance costs. Additional staff time would be needed to inspect and maintain the

exclosures, estimated at approximately one person-day per exclosure per year and up to four visits per year. Using an average rate of $160 per day, for 15 days to cover all of the exclosures, the yearly labor cost would be approximately $2,400. An additional $8,000 per year would be estimated for materials and additional visits for weather-related maintenance needs. The additional staff time and funds required for regular maintenance of the large exclosures would result in increased funding needs, with adverse, long-term, moderate impacts.

Leuprolide — A reproductive control agent that prevents secondary hormone secretion, which stops the formation of eggs and ovulation. Leuprolide is a GnRH agonist.

Alternative B includes additional applications of repellents in areas where fencing would cause unacceptable visual impacts. In 2004 the park applied two quarts of repellent at $40 per quart, for a total cost of $80. Under this alternative, the amount of repellent used is expected to double and cost approximately $160, resulting in an adverse, short- and long-term, minor impact. With twice the amount of repellents being applied, labor costs would double, with an adverse, long-term, minor impact to park operations and maintenance.

Alternative B would also include reproductive control of does. Costs for this would depend on the number of deer tested and the current available technology. Assuming the use of leuprolide (or similar agent) as described in "Chapter 2: Alternatives," costs would be approximately $1,000 per deer. If 590 does are treated, the annual cost would total $590,000, with $1,000 yearly monitoring costs.

Labor for the reproductive control efforts would be provided by qualified federal employees or contractors. This option would likely result in adverse, long-term, moderate impacts to the park budget because of the large amount of time and labor involved, most likely reducing the time available for other efforts. Impacts are expected to be adverse, long term, and moderate for reproductive control.

This alternative would also involve increased educational and interpretive activities, and would therefore require additional funding and/or additional staff time to implement these activities. There would be minor to moderate adverse impacts to resource education and visitor protection staff as a result, depending on the level of activities required.

Overall, the activities associated with alternative B would result in adverse, long-term, moderate impacts for installing large exclosures, applying repellents, increased educational/interpretive activities, and conducting reproductive control.

Cumulative Impacts

The same past, present, and future actions described under alternative A would continue under this alternative, including additional demands on the park's budget for other resource programs and to respond to natural disasters. In conjunction with actions under this alternative, impacts to park management and operations would be adverse, long term, and moderate.

Conclusion

Alternative B would result in adverse, long-term, moderate impacts on park management and operations from installing and maintaining large exclosures,

applying repellents, and implementing and monitoring reproductive controls. Past, present, and future activities, when combined with actions under this alternative, would result in adverse, long-term, moderate cumulative impacts.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE)

Analysis

Sharpshooting would be used to quickly reduce the herd size, with capture and euthanasia applied in certain circumstances. The existing deer population would be reduced over a period of three years to 15–20 deer per square mile, or a park population of 135–180 (based on 2004 baseline data). Additional deer would be removed in subsequent years to maintain the population. Alternative C would include the actions described under alternative A, including limited fencing, use of repellents in landscaped areas, monitoring, and data management and research. It is assumed that the participation of the NPS Center for Urban Ecology and the Student Conservation Society in park programs would continue at no cost to the park.

The addition of these lethal management measures would require additional staff time to accompany the qualified federal employees or contractors conducting direct reduction activities. Removal activities would require obtaining permits, setting up bait stations, locating deer, sharpshooting, and handling the disposition of meat. In addition to the actual reduction activity, time would be required to coordinate the details of the reduction activity, with limited NPS staff involvement to support these operations.

Costs to the park for direct reduction through sharpshooting would vary, depending on a number of factors, including the number of deer to be removed each year, access to deer, number and location of bait stations, training requirements, equipment availability, amount of data to be collected from the deer, and processing or disposal requirements. Based on similar removal efforts (Jacobson, pers. comm. 2004), the estimated cost for the park to implement direct reduction through sharpshooting would be $200 per deer initially, increasing to $400 per deer as the population decreased and more effort was required to locate deer, including actions to maintain the herd at the reduced level once the initial goal was achieved. Over the 15-year planning period for the deer management plan, sharpshooting efforts are estimated to cost approximately $543,600. The majority of project funding, including all deer reduction activities and management of these, would be the responsibility of the park. Any assistance offered by the park's staff would be considered part of regular duties, rather than project specific, and would not require additional project funding (Voigt, pers. comm. 2005d). Due to the amount of time required by park staff to participate in these activities and the funding increase that would need to be applied for, impacts would be adverse and moderate during the period of the reduction efforts.

Where direct reduction by sharpshooting was not possible due to safety or security concerns, capture and euthanasia would be implemented by qualified federal employees or contractors. Because this method would only be used in certain situations, the cost would vary depending on the conditions at each removal site, including the location of the removal, accessibility, type of trap or

immobilization drug used, how deer were disposed of, and the type of euthanasia used. Based on experience of park personnel and the range of costs identified for capturing deer under the reproductive control action, the costs would range from $100 to $1,000 per deer. This action would require increased funding and result in adverse, long-term, moderate impacts.

As part of this alternative, both deer population studies and vegetation monitoring would be conducted to document any changes in deer browsing and forest regeneration that may result from reduced deer numbers. This monitoring program would continue for six years after the density goals were reached to determine if vegetation was showing signs of recovery. This monitoring would be similar to current park efforts that are already scheduled to continue and would result in long-term minor impacts to park operations and maintenance.

This alternative would also involve increased educational and interpretive activities, and would therefore require additional funding and/or additional staff time to implement these activities. There would be minor to moderate adverse impacts to resource education and visitor protection staff as a result, depending on the level of activities required.

The combination of these lethal reduction alternatives would result in a greater reduction of deer over a shorter period of time, when compared to alternative A. As the number of deer declined in the park, the need for deer management and associated educational/interpretative activities would decline, allowing park staff to apply their efforts to other management areas. This would result in a reduction of adverse, long-term impacts from moderate to minor under this alternative.

Cumulative Impacts

Cumulative impacts would be similar to those described under alternative A. Under alternative C it is expected that funding would continue for current deer management activities and that funding for additional lethal management measures would be received, resulting in minor impacts as discussed above. With the expected funding needed for other resource programs and to respond to natural disasters, the cumulative impact to park management and operations would be adverse, long term, and minor to moderate, depending on the severity of these future actions.

Conclusion

Alternative C would result in adverse, moderate impacts during the period of direct reduction efforts because of the need for additional staff time for monitoring and coordinating activities. However, the use of qualified federal employees or contractors would reduce the amount of park staff time needed for implementation. With the greater reduction of deer over a shorter period of time, park staff would have more time to apply their efforts to other areas of the park when compared to alternative A, which would reduce adverse, long-term impacts from moderate to minor. Past, present, and future activities, when combined with actions under this alternative, would result in adverse, long-term, minor to moderate cumulative impacts.

ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Analysis

Alternative D would include the actions described under alternative A plus direct reduction to initially reduce the deer herd. Then reproductive control and direct reduction (if needed) would be used to maintain the herd at acceptable levels. The participation of the NPS Center for Urban Ecology and the Student Conservation Association in park programs would be expected to continue at no cost to the park.

The lethal management measures under alternative D would be the same as those described under alternative C. Costs to the park would vary from $200 to $400 per deer, as described under alternative C. Over the 15-year life of the deer management plan, sharpshooting efforts would cost approximately $243,600. The majority of project funding, including all deer reduction activities, and management of these, would be the responsibility of the park. Any assistance offered by the park's staff would be considered part of regular duties (Voigt, pers. comm. 2005d). Impacts are expected to adverse, long term, and moderate.

Where direct reduction by sharpshooting was not possible due to safety or security concerns, capture and euthanasia would be implemented by qualified federal employees or contractors. As described under alternative C the costs would range from $100 to $1,000 per deer based on situation conditions. Although limited staff time would be required since actions would be carried out by qualified federal employees or contractors, park staff would be involved in coordinating activities and an increase in funding would be required, resulting in adverse, long-term, moderate impacts.

After the initial reduction in density, alternative D would use reproductive control of the park's deer population by the methods described under alternative B. Costs are estimated $972,000, assuming treatment of 81 deer annually starting after year three, plus a $1,000 annual cost for additional surveys. Park staff would need to spend additional time and labor to coordinate and monitor activities, resulting in adverse, long-term, moderate impacts.

This alternative would also involve increased educational and interpretive activities, and would therefore require additional funding and/or additional staff time to implement these activities. There would be minor to moderate adverse impacts to resource education and visitor protection staff as a result, depending on the level of activities required.

Overall, the combination of non-lethal and lethal management alternatives and the associated educational/interpretive activities would have adverse, long-term, moderate impacts to park management and operations during the period of direct reduction and reproductive control. Once the deer herd was reduced, more staff time would be available for other activities, resulting in adverse, long-term, minor impacts.

Cumulative Impacts

Cumulative impacts would be similar to those described under alternative A. Under alternative D funding would continue for current deer management

activities, resulting in minor to moderate impacts as discussed above. With the expected funding needed for other resource programs and response to natural disasters, the cumulative impact to park operations and maintenance would be adverse, long term, and minor to moderate, depending on the severity of these future actions.

Conclusion

Alternative D would result in adverse, long-term, moderate impacts, as park staff involvement would be required for coordination and monitoring. Funding for these activities would be applied for and expected to be received. Once the deer herd was reduced, more staff time would be available for other activities, resulting in adverse, long-term, minor impacts. Past, present, and future activities, when combined with actions under this alternative, would result in adverse, long-term, minor to moderate cumulative impacts.

UNAVOIDABLE ADVERSE IMPACTS

The National Park Service is required to consider if the alternative actions would result in impacts that could not be fully mitigated or avoided (NEPA section 101(c)(ii)).

ALTERNATIVE A: NO-ACTION ALTERNATIVE (CONTINUE EXISTING MANAGEMENT)

Under alternative A, the demand on park staff related to deer monitoring and resource management would result in adverse impacts on park operations.

Under alternative A, there would be long-term, unavoidable adverse impacts to vegetation, deer herd heath, wildlife habitat, and sensitive/rare plant species due to the continued increase in the deer population over time and the associated damage to park vegetation. In addition, there would be continued unavoidable minor adverse impacts to soils and water quality due to the removal of vegetation from deer browsing and subsequent erosion and sedimentation, and some unavoidable adverse impacts to those wildlife species that depend on ground cover and seedlings for their food and/or cover. There would also be long-term unavoidable adverse impacts on visitor use and experience, because of the lack of vegetation and the associated wildlife and scenery which park visitors enjoy. Unavoidable adverse impacts would continue on park management and operations, due to the demand on park staff related to continued deer monitoring and resource management.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Alternative B would include most of the unavoidable adverse impacts described for alternative A over the life of the plan, since the benefits of reproductive control would not be realized until much later, given the length of time needed to realize a reduction in deer herd numbers based solely on reproductive control. Unavoidable adverse effects to some sensitive plant species would be mitigated by the use of the exclosures, however. Reproductive control may have some unavoidable adverse impacts if the actions were visible or disturbingly audible to park visitors. Providing interpretive materials may help mitigate some of this effect; however, reproductive control as proposed under this alternative would likely occur during relatively high visitor use periods and would require a substantial effort to treat the required number of deer. Unavoidable adverse impacts to park operations and management would increase compared to alternative A, due to the demands on staff for implementation of the program.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE) AND ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Unavoidable adverse impacts for these alternatives would be greatly reduced compared to alternatives A and B, because the reduction in deer numbers would occur relatively rapidly and the park's vegetation would begin to recover over the life of the plan. This would mitigate adverse effects to vegetation, deer herd health, wildlife habitat, and sensitive/rare plants. Some wildlife that prefer more

open habitat would be unavoidably impacted as the vegetation recovered. There may be some unavoidable adverse effects to visitors relating to the implementation of the sharpshooting and reproductive control, if the visitors were disturbed by these actions; however, reproductive control would require the treatment of a smaller number of deer compared to alternative B. Conducting sharpshooting at night and providing interpretive materials would help mitigate some adverse effects. Unavoidable adverse impacts to park operations and management would increase compared to alternative A, due to the demands on staff for implementation of the program, and would be greater under alternative D because of the combination of techniques being proposed.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

In accordance with the *National Environmental Policy Act* (NEPA), and as further explained in NPS *Director's Order 12*: Conservation Planning, Environmental Impact Analysis, and Decision-making, consideration of long-term impacts and the effects of foreclosing future options should pervade any NEPA document. According to *Director's Order 12*, and as defined by the World Commission on Environment and Development, "sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their needs." For each alternative considered in a NEPA document, considerations of sustainability must demonstrate the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. This is described below for each alternative.

The NPS must consider if the effects of the alternatives involve tradeoffs of the long-term productivity and sustainability of park resources for the immediate short-term use of those resources. It must also consider if the effects of the alternatives are sustainable over the long term without causing adverse environmental effects for future generations (NEPA section 102(c)(iv)).

Under alternative A, impairment of the park's vegetation, deer herd health, wildlife habitat, and sensitive/rare species would likely occur over the long term.

ALTERNATIVE A: NO-ACTION ALTERNATIVE (CONTINUE EXISTING MANAGEMENT)

Alternative A would trade any long-term productivity for short-term use of park resources. The deer population would continue to grow over time and use the park's vegetation at the expense of the long-term productivity and sustainability of the vegetation and other affected wildlife in the park, as well as the park's cultural landscapes. Impairment of the park's vegetation, deer herd health, wildlife habitat, and sensitive/rare species would likely occur over the long term.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Alternative B would involve a similar trade for short-term use of park resources at the expense of long-term productivity for the duration of the plan, since the reproductive controls would not reduce the numbers of deer in the park over the life of the plan. The construction of the exclosures would involve short-term impacts related to their construction and visual impacts to visitors, but they would help preserve some of the park's long-term productivity. They would only protect a small portion of the park's woody vegetation over time, and only 6% of the park's herbaceous vegetation at any one time. This 6% would meet the suggested need to protect a minimum of 5–10% of the park's forested area at any one time (Bowersox, pers. comm. 2005), and therefore, impairment of vegetation is not expected over the long term. However, for this alternative to be truly sustainable, the reproductive control aspect must be continually managed and

successful, and exclosures would need to be relocated to many areas of the park over time.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE) AND ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

These two alternatives are very similar in that there would be a short-term commitment of human resources and short-term impacts to the park's visitors and environment during deer removal actions, but with the result of long-term productivity of the park's vegetation and habitat and a sustainable use of the resources in the park. Alternative D would require more resources focused on the reproductive control aspect, since it is experimental in a free-ranging population. No impairment of park resources would occur for either alternative, but for either alternative to be sustainable, it will require long-term management, including monitoring and adaptive management to protect park productivity.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

The National Park Service must consider if the effects of the alternatives cannot be changed or are permanent (that is, the impacts are irreversible). The NPS must also consider if the impacts on park resources would mean that once gone, the resource could not be replaced; in other words, the resource could not be restored, replaced, or otherwise retrieved, (NEPA section 102(c)(v)).

Irretrievable — Loss of production, harvest, and consumptive or nonconsumptive use of natural resources.

ALTERNATIVE A: NO-ACTION ALTERNATIVE (CONTINUE EXISTING MANAGEMENT)

Under alternative A, impacts to vegetation (particularly the forest understory) from continued overbrowsing by deer could result in irreversible impacts to Catoctin's forests if no actions are ever taken to reduce deer numbers. Exotic plants that are not palatable to deer would continue to exploit openings in the understory, and animal species that rely on native ground vegetation might not remain in or return to Catoctin if the forest understory does not regenerate. Deer browsing has already resulted in the elimination or reduction of certain rare plant species at Catoctin. Even if fencing were used to protect some of the sensitive species, it would be impossible to identify all individual plants, and overbrowsing of new plants located outside the fenced areas could occur. In addition, the health of deer herd at Catoctin could suffer irretrievable adverse effects if no action is taken.

Irreversible — Loss of future options. Applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

ALTERNATIVE B: COMBINED NON-LETHAL ACTIONS

Alternative B has the potential for some irreversible impacts, if some areas of the park's forests are adversely affected to the point of non-generation or if invasive exotic plants take over some denuded areas before reproductive controls have had time to stabilize the deer herd numbers. Exclosures will not cover the entire park, and so some of the irreversible impacts described for alternative A would likely occur under alternative B as well.

ALTERNATIVE C: COMBINED LETHAL ACTIONS (PREFERRED ALTERNATIVE) AND ALTERNATIVE D: COMBINED LETHAL AND NON-LETHAL ACTIONS

Both of these alternatives present the least potential for irreversible or irretrievable commitments of resources. Although deer would be removed under each of these, the deer population would continue at a sustainable level. Because the herd would be reduced relatively rapidly, there would be little chance that park vegetation (including sensitive/rare species) or other species that are dependent upon forest understory and native ground cover would be irretrievably lost, since forest regeneration would begin within the life of the plan.