CHAPTER 3

AFFECTED ENVIRONMENT

The "Affected Environment" describes existing conditions for those elements of the natural and cultural environments that would be affected by the implementation of the actions considered in this environmental impact statement. The natural environment components addressed include vegetation, soils and water quality, white-tailed deer herd health, and sensitive and rare species. The cultural environment components include archeological resources and cultural landscapes. Visitor use and experience, visitor and employee safety, socioeconomic conditions, and park management and operations are also addressed. Impacts for each of these topics are then analyzed in "Chapter 4: Environmental Consequences."

VEGETATION

OVERVIEW

The forest at Catoctin Mountain Park in most places is less than 100 years old, with plant communities reflecting the park's varying past uses, as well as the natural influences of soil and exposure on vegetation types (Hickey 1975). Large individual trees (24 to 36 inches diameter) of major canopy species are present, but are widely scattered and infrequent (Hickey 1975). Over 700 species of vascular plants have been recorded in the park, including 60 tree species (Warner 1972; Hickey 1975; Anderson et al. 1976; NPS 1996b), and approximately 100 nonnative plants (Swauger, pers. comm. 2005d) have been identified.

Most of the park contains a mixture of oaks (*Quercus* spp.), beeches, hickories, maples (*Acer* spp.), and tulip poplars, with an understory of spicebush, American witch hazel (*Hamamelis virginiana*), blueberry (*Vaccinium* spp.), mountain laurel (*Kalmia latifolia*), and serviceberry (*Amelanchier* spp.) (NPS 2005d). Until the chestnut blight reduced the chestnut to second growth around old stumps, the region's forest was classified as oak / chestnut (Braun 1950). A few large chestnut logs remain, but most have decayed beyond recognition or were used for fuel soon after they fell (Hickey 1975); some were salvaged for construction of the cabin camps in the 1930s.

In addition to the native forest, there are areas of open woodland and landscape plantings around the old mountain homesteads and developed areas within the park. Some clearings near homesteads are still evident, but most are grown over with sour gum (*Nyssa sylvatica*), tulip poplars, white ash (*Fraxinus americana*), oaks, and hickories. Remnant orchard trees and white pine plantations mark several previously cultivated areas (Hickey 1975). Catoctin Mountain Park also manages approximately 300 acres of developed zones. Vegetation within these zones has been altered from its natural state and consists of lawns, shrubbery, and trees, which have been planted and are maintained primarily for historic, aesthetic, or erosion control purposes (NPS 1994b).

Small streams and associated wetlands are located throughout Catoctin Mountain Park, but have not been surveyed. Park wetlands contain many special status species, and two of these areas (the Owens Creek and Hog Rock wetlands) are recognized as rare plant habitats. In 1983 the Nature Conservancy designated Owens Creek Swamp as an outstanding Maryland natural area because of its unique assemblage of plants (NPS 1994b). These two areas and their associated wetland vegetation are discussed in detail in the "Sensitive and Rare Species" section of this environmental impact statement.

WOODY SPECIES

Nearly 97% of Catoctin Mountain Park is covered by eastern deciduous forest. The park has over 60 species of trees and 50 species of shrubs. The primary cover types found in Catoctin are shown on the "Vegetation Map," which notes the dominant overstory species and their relative distribution within the park.

VEGETATION MAP

See attached file

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(The map was derived from a 1977 map; therefore, it is not a totally accurate depiction of current conditions. The park is currently updating the map; however, this task is not expected to be completed until 2006/2007.)

As can be seen on the "Vegetation Map," the primary cover types in the park include chestnut oak, white oak, tulip poplar, sugar maple (*Acer saccharum*), and black locust (*Robinia pseudoacacia*), with a hemlock/birch (*Tsuga* spp./*Betula* spp.) mix along stream drainages. A few scattered sparse stands of pine (*Pinus* spp.) also exist, some of which are remnant plantations.

The composition of trees in a given area may differ depending on soil type, slope, nutrients available, and moisture (NPS 2005d). As the map shows, the park has two distinct vegetation zones that follow the park's predominant geologic strata, which divide the park into eastern and western forest communities (Hickey 1975). Chestnut oak is far more abundant in the eastern half of the park, which has thinner soils that are highly permeable and therefore well drained. Tree species such as chestnut oak, table mountain pine, and pitch pine (*Pinus rigida*) occur on the drier ridge tops. On lower slopes and ravines, where soil is richer, white oak, tulip poplar, red maple (*Acer rubra*), black birch (*Betula occidentalis*), American beech, sour gum, and eastern hemlock (*Tsuga canadensis*) occur (NPS 2005d). The heaviest gypsy moth infestations (up to 6,120 egg masses per acre) have occurred in the eastern third of the park (approximately 55 acres east of Chimney Rock), which is dominated by chestnut oak (NPS 2003b).

The western portion of the park has deeper, richer, and moister soils, with larger and more abundant trees, including sugar maple, basswood (*Tilia americana*), hickories, hornbeam (*Carpinus caroliniana*), white ash, beech, and tulip poplar. In the higher ridge areas, chestnut oak trees dominate. Floodplain areas contain elm (*Ulmus* spp.), yellow birch (*Betula alleghaniensis*), and sycamore (*Platanus* spp.) (NPS 2005d).

There are approximately 200 acres of eastern hemlock forest within Catoctin, primarily along Big Hunting and Owens Creeks. The hemlock forests, particularly along Big Hunting Creek, consist of dense stands of small trees, 4 to 10 feet in height, with a mixture of a few larger trees. Hemlocks are limited to these shaded moist areas because of their very shallow roots. Hemlock trees in the park play a vital role in the ecology of Big Hunting Creek. The dense hemlock canopy provides shade, which helps cool the water temperature in the summer, enabling the survival of cold-water organisms, like the brook and brown trout (*Salmo trutta*). Natural hemlock stands typically grow in or close to riparian areas that are often classified as wetlands or floodplains (NPS 2003c).

Shrubs are generally found in the forest understory or along the forest edge. The most common shrubs include mountain laurel, spicebush, lowbush blueberry (*Vaccinium angustifolium*), witch hazel, and viburnum (*Viburnum* spp.) (NPS 2005d). The shrub layers of the east and west portions of the park are quite different. Acid-loving shrubs, like lowbush blueberry and mountain laurel, mark the eastern area and are less common in the western area. Mountain laurel, deerberry (*Vaccinium stamineum*), black huckleberry (*Gaylussacia baccata*), and lowbush blueberry are abundant in the east, but black huckleberry and deerberry are essentially absent in the west. Shrubs in the western portion of the park are

varied, consisting primarily of spicebush in moist areas, along with wild grape vines (*Vitis* spp.) and Virginia creeper (*Parthenocissus quinquefolia*). Flowering dogwood (*Cornus florida*) was abundant in the western area, but nearly absent from the east (Hickey 1975).

Multiflora rose and Japanese barberry occur throughout much of the park. They are invasive species that were introduced by man. Spiked with thorns, these shrubs crowd out native plants (NPS 2005d). Management of invasive species is described later in this section under "Vegetation Management."

HERBACEOUS SPECIES

The majority of the plants known to occur in the park are herbaceous, including ferns, grasses, and wildflowers. Over 700 plant species have been inventoried in the park (Hickey 1975), and over 33 different species of fern have been reported.

Some of Catoctin's wildflowers include spring beauties (*Claytonia virginica*), cutleaf toothwort (*Cardamine concatenate*), wild geranium (*Geranium maculatum*), bloodroot (*Sanguinaria* spp.), wild ginger (*Asarum canadense*), rue anemone (*Isopyrum biternatum*), wood anemone (*Anemone quinquefolia*), yellow violet (*Viola pubescens*), yellow adders tongue (*Erythronium americanum*), cardinal flower (*Lobelia cardinalis*), hepatica (*Hepatica* spp.), jack-in-the-pulpit (*Arisaema triphyllum*), mayapple (*Podophyllum peltatum*), and several species of orchid (NPS 2005d).

Since the early 1980s park staff have noted evidence of heavy deer browsing and the effects it was having on woody and herbaceous species.

The Maryland Department of Natural Resources' Wildlife and Heritage Service identifies six plant species as potentially occurring in or near the vicinity of the park. These species are rare and listed by Maryland as threatened, endangered, or of special concern. These species are described in the "Sensitive and Rare Species" section of this plan, as well as species associated with rare plant habitats, including wetlands.

CURRENT VEGETATION STATUS AND THE ROLE OF DEER

Numerous studies within eastern deciduous forests have shown that browsing by white-tailed deer at densities greater than 15–20 deer per square mile can influence forest regeneration success (Hough 1965; Behrend et al. 1970; Marquis 1981; Tilghman 1989; Redding 1995; Augustine and deCalesta 2003; Bowersox et al. 2002; Horsley et al. 2003; Sage et al. 2003). Since the early 1980s, park staff have noted evidence of heavy deer browsing within the park and its effects on woody and herbaceous species, and thus forest regeneration. Browsing impacts, including foliage damage and impacts on plant reproductive success, have been identified for 24 species of plants, including hemlock, elm, pine, and large purple-fringed orchid (NPS 2000e). A complete list of plant species lost to deer browsing has not been compiled at this time.

Langdon (1985) noted that deer impacts on plant communities consist of three primary effects: (1) failure to reproduce, especially in slowly maturing woody species where seedlings are killed, (2) alteration of species composition, which occurs where deer remove preferred browse species and indirectly create opportunities for less preferred or unpalatable species to proliferate, and (3) extirpation of highly palatable plants, especially those that were naturally uncommon or of local occurrence in the park (Langdon 1985). Among the direct impacts described by Langdon and later observed by park staff were the loss of mountain laurel from stands that occurred on the eastern ridge of the park and the browsing of white pines so that all saplings accessible to deer were severely injured or dead.

When vegetation inventories from the 1970s (Warner 1972; Hickey 1975; Anderson et al. 1976) are compared with a 1992 plant survey, the abundance of at least 12 species had been reduced or nearly eliminated from the park (see table 9). Additionally, Hickey (1975) listed nodding trillium (*Trillium cernum*), wild ginger, wild hydrangea (*Hydrangea arborenscens*), common blackberry (*Rubus allegheniensis*), and mapleleaf viburnum (*Viburnum acerifolium*) as abundant in the park. Occurrences of these plants are now scattered or infrequent (Swauger, pers. comm. 2005f). Hickey (1975) also found pink ladies slipper (*Cypripedium acaule*) and pasture rose (*Rosa carolina*) in the park. Park staff have not located these plants within the past 10 years (Swauger, pers. comm. 2005f). This list is not all-inclusive, but it represents what has been happening overall to the vegetative community at Catoctin (NPS 1996b).

TABLE 9: NATIVE PLANT SPECIES AT CATOCTIN MOUNTAIN PARK WITH REDUCED ABUNDANCE

Common Name	Scientific Name
Columbine	*Aquilegia canadensis*
Ragged fringed orchid	*Platanthera lacera*
Great rhododendron	*Rhododendron maximum*
Cardinal flower	*Lobelia cardinalis*
Slender ladies tresses	*Spiranthes lacera* var. *gracilis*
Red Canada lily	*Lilium canadensis*
Adder's-tongue fern	*Ophioglossum pusillum*
Yellow lady slipper	*Cypripedium calceolus*
Pink lady slipper	*Cypripedium acaule*
Northern bush honeysuckle	*Diervilla lonicera*
Dutchman's breeches	*Dicentra cucullaria*
Hairy beard tongue	*Penstemon hirsutus*

Source: NPS 1996b.

A comparison of deer forages listed by Bramble and Goddard (1953) to those observed in the park revealed that several, less-preferred forages had been heavily browsed in the park (Langdon 1983, 1985). White pine, eastern hemlock, mountain laurel, rhododendron (*Rhododendron* spp.), wild azalea (*Rhododendron* spp.), and gooseberry (*Ribes* spp.) in Catoctin all showed moderate to heavy browsing pressure by deer. These species are all listed by Bramble and Goddard (1953) as less preferred deer forages (i.e., normally less than 2% utilization). Thus, this habitat indicator also supports the conclusion that the deer herd is overpopulated and that deer are forced to use less preferred forage (Warren and Ford 1990).

Bark stripping is indicative of the extent of an overbrowsing problem, making trees more susceptible to disease and mortality.

Bark stripping on American elm (*Ulmus americana*) and slippery elm (*U. rubra*) was first observed in February 1983, where several American elms in the center of the park were found with the bark of their trunks and roots freshly gnawed and stripped (Langdon 1985). More damage was observed in 1984 and extended to an area of approximately 8 square kilometers (NPS 2000f). Bark stripping by deer in Catoctin represents an exacerbation of the overbrowsing problem and its influence on ecological succession in the forest (Warren and Ford 1990). The detrimental effects of deer overbrowsing on understory vegetation and seedlings (Tilghman 1989) are further compounded by the effect of bark stripping on the midstory and overstory trees because trees are more susceptible to disease and mortality (Warren and Ford 1990).

Data were collected between 1990 and 1994 by NPS biologist John Hadidian in 45 vegetation sampling plots in the park to evaluate the impacts of deer browsing on tree regeneration, ground cover, and plant diversity (NPS 2000f). The results indicated a very heavy browsing impact and little forest regeneration. However, the sampling did not include any exclosure areas; therefore, impacts could not be directly linked to deer. Thus, for future studies, exclosures were incorporated into monitoring.

In 1997 Dana M. Backer and Douglas Boucher surveyed Catoctin Mountain Park's vegetation within three deer exclosures and six open plots to document differences in areas without deer browsing. Results showed that species' richness and plant abundance were significantly higher in exclosures. Browsing by white-tailed deer reduced diversity of spring ephemerals, tree seedlings, and summer herbs. The researchers concluded, "if deer herds are left uncontrolled, associated plant and animal communities could be adversely affected, and further reduction in biodiversity is possible" (Backer and Boucher 1997).

Douglas Boucher and Kerrie Kyde continued the exclosure study in 1998 and 1999. This second annual report compared 12 plots measured in the spring and summer of 1999 with data from 1997 and 1998. The results of the 1999 study "confirmed and strengthened the findings of the previous two years, indicating that deer browsing has significantly decreased the abundance and diversity of plants in Catoctin Mountain Park." The exclosures had a higher abundance and diversity of species than the unprotected vegetation plots. In the western portion and wetland areas of the park, abundance and diversity recovered rapidly after

two years of excluding deer, while recovery was very slow in the eastern and central areas of the park. Even after 15–20 years without deer, abundance and diversity remained very low (Boucher and Kyde 1999).

In 2003, Dr. Estelle Russek-Cohen of the University of Maryland analyzed vegetation data collected during 1990–1994 (by Hadidian, NPS 2000e) and 2000–2002 (by park staff), specifically investigating the possible impacts of white-tailed deer on vegetation (Russek-Cohen 2003). The report noted a "significant decline in the number of plant species and density over the entire combined study period." However, the analysis showed that "browsing damage declined significantly between the first and second study," which could be attributed to "the result of vegetation that survived earlier grazing activity being less desirable." The deer preferentially browsed on younger seedlings, impacting their ability to grow into mature trees. A change in seedling composition suggests that the deer may have already eaten much of the vegetation they would have preferred and were left with vegetation that may be less desirable.

Generally, data collected by the park and other researchers indicate that forest regeneration is nearly absent within the majority of the park (Langdon 1985; Fuller 1991; Backer and Boucher 1997; Boucher and Kyde 1999; Russek-Cohen 2003; Pavek 2000; Warren and Ford 1990), due in large part to high deer numbers.

Invasive Exotic Plant Species

In the 1930s most of the park area had been disturbed by intensive cultivation and logging. The park is currently known to support over 670 species of plants, including about 100 exotic species. Several of these exotic species were identified in 1985 as being well established and invasive in the natural zone (NPS 1994b).

In the 1990s informal surveys indicated an apparent increased encroachment by exotic species throughout the park and identified garlic mustard (*Alliaria petiolata*) and beefsteak plant as additional invasive exotic species, as listed in table 10 (NPS 1994b). During the 2003–2004 season, park staff compiled records for previous exotic plant survey and control work; surveyed for exotic plant species throughout the park; implemented control measures for high priority areas; and provided leadership and information for future management. The exotic plant species project analyzed the frequency of each exotic species within each type of transect used (park boundary, roads, or park grid transect) and the frequency of each exotic species within each class of observed disturbance (NPS 2004g).

Total areas treated for exotic plants at Catoctin from 1992 to 1999 ranged from approximately 0.0035 acre to 11.6 acres. Areas treated were "significantly" higher from 2000 to 2002 due to additional control efforts by the Exotic Plant Management Team and in 2003 and 2004 due to increased park personnel efforts. In 2004 the park completed an *Integrated Pest Management Plan* (NPS 2004d), which addressed many of these identified invasive exotic species in the park. For a description of vegetation management actions taken at Catoctin, see "Chapter 1, Purpose of and Need for Action."

TABLE 10: INVASIVE EXOTIC PLANT SPECIES FOUND AT CATOCTIN MOUNTAIN PARK

Common Name	Scientific Name
Japanese honeysuckle	*Lonicera japonica*
Other honeysuckle	*Lonicera* spp.
Tree-of-heaven	*Ailanthus altissima*
Chinese wisteria	*Wisteria sinensis*
Japanese wisteria	*Wisteria floribunda*
Japanese stiltgrass	*Microstegium vimineum*
Multiflora rose	*Rosa multiflora*
Ohio buckeye	*Aesculus glabra*
Garlic mustard	*Alliaria petiolata*
Japanese barberry	*Berberis thunbergii*
Autumn olive	*Elaeagnus umbellata*
Beefsteak plant	*Perilla frutescens*
Wineberry	*Rubus phoenicolasius*
Asian bittersweet	*Celastrus orbiculata*
Thistle (especially Canada thistle)	*Cirsium* spp., especially *C. arvense*
Common mullein	*Verbascum thapsus*
Mile-a-minute	*Polygonum perfoliatum*
Purple crown-vetch	*Coronilla varia*
Chinese lespedeza	*Lespedeza cuneata*
Empress tree or princess tree	*Paulownia tomentosa*

Source: NPS 1994b.

SOILS AND WATER QUALITY

SOILS

The primary concern related to soils and deer management identified in this plan is the potential for greater erosion as a result of increased deer browsing, which can reduce vegetative ground cover and result in sedimentation in Owens and Big Hunting creeks. In 1997 the U.S. Department of Agriculture (USDA) conducted a comprehensive soil survey of Catoctin Mountain Park, classifying and mapping 33 soil types that could then be used in land planning programs (USDA 1997). Of the 33 soil types identified within Catoctin, 14 have a soil erosion hazard classification as either moderate (11) or severe (3), comprising 57.1% of the soils in the park. The other 19 soil types have a slight soil erosion hazard (see the "Soil Erodibility Map"). Soils with a moderate erosion hazard generally occur on slopes from 15% to 25%, while those classified as severe occur on slopes from 25% to 65%. Soils in the park with these two classifications are generally found on mountain summits, shoulders, headslopes, backslopes, and footslopes. Some of these that occur in or adjacent to intermittent streams have the greatest potential for sedimentation into permanent creeks in the park (e.g., Owens and Big Hunting creeks).

WATER QUALITY

Two main permanent streams flow through the park and drain its two principal watersheds — Big Hunting Creek and Owens Creek (see the "Park Location Map" on page 7). The water quality in these streams is very good, and both are classified by the state as Class III-P "natural trout waters." This indicates that the waters are suitable for the growth and propagation of trout, capable of supporting self-sustaining trout populations and their associated food organisms, and suitable for use as a public water supply. The primary concern related to water quality and the deer management plan centers on the potential for increased sedimentation and turbidity levels within the creeks, which can be affected by erosion due to loss of vegetative ground cover due to deer browsing.

Big Hunting Creek consists of four permanent named and numerous intermittent unnamed tributaries.

Big Hunting Creek consists of four permanent tributaries and numerous intermittent, unnamed tributaries. Although the park comprises only 7% of the Big Hunting Creek drainage basin, the creek drains 34.5% of the park (NPS 1998b). The rest of the watershed lies outside park boundaries. Developed areas in the park occurring within the creek's watershed include Camp Greentop, Camp Round Meadow, and Camp Misty Mount; the maintenance yard; the visitor center; and the administration office (see the "Park Location Map" on page 7). Runoff from these areas enters Big Hunting Creek, as does runoff from Park Central Road, Maryland Route 77, and Camp 3.

The gradient of Big Hunting Creek varies greatly. From its headwaters outside the park to Cunningham Falls, the gradient is low and the stream is little more than finger-like rivulets that run down from the farms and lots bordering the park to the west and southwest (NPS 1998b). From the falls to the east boundary of

the park, the gradient is very steep, and the stream is full of large rocks and boulders with many clean gravel bars. In a few places, the stream bottom is bedrock with little gravel or sediment (Voigt, pers. comm. 2005e). The gradient of the last section of stream before leaving the park is moderate.

Whiskey Still Creek, a small tributary of Big Hunting Creek, lies entirely in the park and contains a small population of brook trout. Very little understory or ground cover occurs in this stream valley, with an obvious deer browsing line and a fair amount of sediment in the stream (Voigt, pers. comm. 2005e).

Owens Creek consists of six permanent tributaries and numerous, intermittent, unnamed tributaries. Owens Creek drains 64% of the park, equivalent to 14.5% of its total watershed (NPS 1998b). Developed park areas that drain into Owens Creek include Camp Round Meadow, both government housing facilities, the Owens Creek and Chestnut picnic areas, and the Owens Creek campground (see the "Park Location Map" on page 7). A park wastewater treatment plant at the head of the creek discharges directly into the stream and wetlands area where Owens Creek originates (NPS 1998b).

A moderate gradient stream, Owens Creek contains a healthy population of brook trout. This creek begins primarily on the park's west side and flows north, where it leaves the park and flows through an agricultural area before briefly entering the park again for 0.25 mile. The creek skirts the park boundary for 2 miles. The general terrain of Owens Creek is not as rocky as Big Hunting Creek, and the bottom is a combination of silt, gravel, and small rocks. There is a fair amount of bank erosion, and the stream channel is changing. The most prominent tributary of Owens Creek within the park, Ike Smith Creek, has significant erosion problems (Voigt, pers. comm. 2005e).

In 1978 Catoctin Mountain Park began a long-term water quality monitoring program to closely monitor for signs of pollution and other problems within Big Hunting and Owens creeks. The program entails analyzing monthly water samples from eight locations within the park (four sites on each creek) for temperature, dissolved oxygen, pH, ammonia, salinity, specific conductivity, turbidity, and alkalinity (see "Water Quality Testing Map"). Turbidity is an indirect measure of sediment in the water and can be an indicator of problems with soil erosion. Table 11 provides the average annual turbidity levels for Owens Creek and Big Hunting Creek from 1984 to 2003; before 1984 turbidity data are sporadic.

Turbidity levels in Owens and Big Hunting creeks are very low. As a general guide, water begins to appear cloudy when the turbidity is greater than 5 NTU (nephelometric turbidity unit). Since monitoring began on a monthly basis in 1978, turbidity levels in the two creeks has exceeded 5 NTU in 7.8% (114) of the water samples, with only 11 samples exceeding 5 NTU since the beginning of 2000.

Few states set specific numeric turbidity values when classifying state waters as "trout waters." Most states, like Maryland, simply provide narrative guidelines indicating turbidity may not exceed levels detrimental to aquatic life. For the few states that do designate numeric turbidity levels, most indicate turbidity shall not

SOIL ERODIBILITY MAP

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WATER QUALITY TESTING MAP

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TABLE 11: AVERAGE ANNUAL TURBIDITY LEVELS (NTU) FOR OWENS CREEK AND BIG HUNTING CREEK, 1984–2003

Year	Owens Creek Sampling Stations				Big Hunting Creek Sampling Stations			
	FOXV	OCPC	IKES	OCCM	HEML	JOEB	PENL	WHST
1984	7.80	4.35	2.13	2.58	5.55	3.55	3.05	1.35
1985	—	5.40	2.06	2.85	4.63	3.22	2.29	3.10
1986	—	6.64	2.77	3.47	8.14	3.42	3.61	3.36
1987	—	7.62	1.92	4.39	5.47	3.84	3.34	2.72
1988	—	1.32	2.27	0.96	2.26	1.72	1.42	0.99
1989	—	0.92	0.37	0.69	1.18	1.71	1.38	0.86
1990	—	1.04	0.36	0.78	1.68	1.11	0.86	0.52
1991	—	1.11	0.56	0.77	1.36	1.27	0.67	0.57
1992	—	1.71	0.86	1.07	2.19	2.61	2.11	0.97
1993	—	3.92	1.79	3.63	3.96	5.53	4.25	2.06
1994	4.44	2.41	0.96	1.94	3.90	3.29	2.56	1.52
1995	5.29	2.48	1.53	1.59	2.38	2.86	2.54	1.88
1996	2.72	2.05	1.30	1.56	2.66	2.56	2.34	1.60
1997	4.35	2.51	1.60	1.71	2.53	2.43	1.65	1.45
1998	2.26	1.90	0.78	1.25	1.97	2.16	1.43	1.74
1999	2.35	1.70	0.70	1.32	1.76	1.57	1.10	1.14
2000	2.26	1.86	0.57	1.03	1.54	1.64	1.18	1.07
2001	2.96	1.99	1.37	1.97	1.64	1.77	0.90	1.28
2002	2.19	0.97	0.58	0.57	0.97	1.28	0.83	0.74
2003	1.93	0.86	0.57	0.71	1.25	1.75	1.48	0.83

Source: Swauger, pers. comm. July 21, 2005.

Note: NTU – nephelometric turbidity unit.

exceed 10 NTU in trout waters (Chesapeake Bay Program 2005). Since 1978 only 1.3% (20) of the water samples measuring turbidity for the two streams equaled or exceeded 10 NTU, with all instances occurring prior to 1996. The maximum turbidity level recorded in either of the two streams since 1978 was 19.68 NTU at the PENL sampling station in Big Hunting Creek during November 1993.

Biologists from the Maryland Department of Natural Resources have conducted macroinvertebrate sampling on Owens Creek and Big Hunting Creek since 1981. Aquatic macroinvertebrates are organisms highly sensitive to environmental factors, and the sampling of these animals can offer additional information about water quality and the impacts of pollution. These organisms can be seen with the naked eye and include insects, crustaceans, mollusks, and annelids. The sampling program high diversity of these organisms in both Owens Creek and Big Hunting Creek, including more than 90 taxa of insects (NPS 2000e), indicating very good water quality in the two streams.

WHITE-TAILED DEER HERD HEALTH

The management of white-tailed deer herds must take into account the species biology and its interactions with key components of the habitat (NPS 1998b).

GENERAL ECOLOGY

The white-tailed deer is one of the most adaptable mammals in the world and is most abundant in eastern woodlands.

White-tailed deer are medium-sized ungulates, native to North America and regarded as one of the most adaptable mammals in the world (Hesselton and Hesselton 1982). Among the reasons for this adaptability are the hardiness, reproductive capability, wide range of plant species accepted as food, and the tolerance deer express for close contact with humans.

Most abundant in the eastern woodlands, white-tailed deer are typically forest dwellers, but often frequent wetlands or woodland openings while feeding. Deer also forage along forest margins, in orchards, and on farmlands. When deer populations become excessive, damage to crops and forests may result, and in addition, their winter food may be reduced to the point where starvation results (Martin et al. 1951).

The diet of white-tailed deer consists of twigs from shrubs and trees, as well as herbaceous (non-woody) plants, which are eaten frequently in spring and summer when they are abundant. Acorns, blackgum fruits, persimmons, and other kinds of fruits are consumed in late summer and fall. Some of the plants that deer browse heavily in the winter season are selected by necessity rather than choice (Martin et al. 1951).

White-tailed deer are well known for their ability to rapidly increase reproductive productivity given abundant food resources, and to limit productivity in the presence of less nutritious forage (Verme 1965, 1969; Hesselton and Hesselton 1982). On good range containing abundant food, deer tend to produce more than one young, usually twins and sometimes triplets. Where food is limited, the number of births is typically restricted to a single fawn, and sometimes the doe does not ovulate (Morton and Cheatum 1946; Verme 1965; Hesselton and Hesselton 1982). Nutrition plays an important role in influencing the onset of puberty, with yearling (1.5 year) does on submarginal range possibly remaining sexually immature, while doe fawns on nutritious range possibly becoming reproductively active as early as six or seven months of age (Verme and Ullrey 1984). The potential for rapid expansion of deer populations, coupled with the wide variety of plant species deer consume, can result in substantial impacts to plant communities (Marquis 1981; Shafer 1965).

HOME RANGE

As part of the research conducted by the University of Georgia, an attempt was made to determine deer home ranges within the park by radio-telemetry (Warren and Ford 1990). Locations for five of eight radio-collared does were collected between February 1988 and March 1989. In addition, park staff conducted several complete (dusk to dawn) telemetry monitoring periods between December 1989 and October 1990, and again between June 1994 and June 1995. No significant seasonal differences in doe movements could be determined, although considerable individual variability was found. Four of five does in the 1989–90 study had home ranges that incorporated areas both within and outside park boundaries. The deer ranged an average of 0.5 mile outside the park boundary.

The ranges of the five does radio-collared in the 1994–95 study varied by individual deer and by season, with the largest ranges in the fall (77 to 242 acres) and the smallest in the spring (2 to 46 acres). The study also found that the collared deer, although originally captured very close to the boundary, spent very little time outside the park (NPS 1995a). Home ranges for deer in eastern states typically vary by sex, age, and habitat type. The average annual home range for females is around 300–600 acres, while the range for bucks is probably two to four times larger (600–2,400 acres) (Strickland and Demarais 2003).

POPULATION DENSITY

In 1983 the park initiated deer population density surveys to estimate the size of the herd within the park. Between 1983 and 2004, aerial surveys conducted over the park found that the total number of deer observed per survey ranged from 105 to 320 (NPS 1999b, updated in November 2004). Aerial surveys of deer were conducted in years when adequate snow cover was available (13 of 21 years). These surveys consisted of counts of the deer observed during prescribed flyovers of the park.

Starting in 1989, spotlight surveys were conducted annually, which provided observation data similar to the aerial surveys (NPS 1999a). In October 2000, the spotlight survey method was modified to use a distance sampling technique, which uses the spotlight count data to project an estimated deer density. This method provides a more accurate estimate of the density of deer within the park (Underwood, pers. comm. 2005; NPS 2004f). The results from the distance sampling surveys have not been published to date, but are listed in table 12.

The deer population density in the park has and will continue to vary over time depending on factors such as winter temperatures, snow depth and duration, disease, habitat conditions, deer movements, hunting pressure outside the park, and acorn production. However, based on observations between the early 1980s and the present, the deer population has continued to increase, and in the absence of any population management measures, this increase is expected to continue over time, with some fluctuations due to weather and other factors.

TABLE 12: ESTIMATED DEER DENSITY IN CATOCTIN MOUNTAIN PARK

Year	Deer (per square mile)
2000	175
2001	185
2002	155
2003	194
2004	104
2005	75
2006	88

Source: NPS unpublished data from distance sampling model.

DEER HERD HEALTH

Deer herds in poor physical condition have typically exceeded the nutritional carrying capacity (the point at which deer herd health is at equilibrium with nutritional value obtained from forage). Poor herd health indicates that the habitat has been stressed and is no longer supporting healthy deer (Eve 1981).

In 2002 a third deer herd health check was conducted and, after evaluation, it was determined that the overall health status of the population was degraded and that some disease-related mortality was likely occurring.

Before 1988 there was no empirical evidence as to the physical condition of the deer population in Catoctin Mountain Park. To establish an indication of the overall health of the herd, the University of Georgia examined a number of deer within the park in 1988, in 1988–89, and in 2002. The objective of two of the studies was to focus on two major disease problems in southeastern deer — a syndrome of parasitism/malnutrition and epizootic hemorrhagic disease. Both of these diseases are linked to deer density, with the former known to be more dependent on deer density than the latter (Davidson 2002). The third study objective was to determine baseline population and ecological characteristics of the park deer herd.

The first deer herd health check at the park was conducted on August 21, 1988. Five randomly chosen deer were examined, ranging in age from 2 to 7 years and weighing from 82 to 100 pounds. The study included blood tests, documentation of parasites present, and general physical condition of each deer (Davidson 1988). The overall physical condition of each deer was described as fair. Several different parasites were found in all five deer, with moderate tissue damage present. Body weight, kidney fat indices, and hematologic blood values were generally below levels considered consistent with vigorous deer herds. Antibodies to selected infectious diseases were not found within the herd, indicating limited herd immunity and thus vulnerability to outbreaks of diseases such as epizootic hemorrhagic disease and bluetongue virus. One of the five animals tested was markedly anemic and the other four exhibited only marginal health (Davidson 1988).

A similar study was also conducted in 1989 by the University of Georgia, which incorporated the 1988 data (Warren and Ford 1990). Both studies concluded that the herd health was deteriorated. The cause of the observed health condition was attributed to high deer density, suggesting that the continuation of the current population density increase would lead to further declines in both herd health and habitat quality (Davidson 1988; Warren and Ford 1990).

A third deer herd health check was conducted at the park on August 27, 2002, again examining five randomly selected deer (Davidson 2002). These deer ranged in age from 2.5 to 6.5 years, and from 75 to 102 pounds. No control of the deer population density or growth had been implemented during the 14 years between these studies. This evaluation disclosed further deterioration of herd health. Three of the five animals exhibited stress characteristic of a parasitism/malnutrition syndrome. Three were considered in poor condition and two in fair condition. Three deer were also anemic. The conclusion after this evaluation was that the overall health status of the population was degraded and that some disease-related mortality was likely occurring. Based on the poor condition of the herd and low immunity to diseases such as epizootic hemorrhagic disease and bluetongue virus, the population is susceptible to higher rates of disease-induced mortality as the population density increases and habitat quality decreases (Davidson 2002).

When these results were compared to similar herd health checks at nearby parks (Monocacy and Antietam national battlefields), the Catoctin deer population showed much poorer health status than the other two parks. The health differences were attributed to different habitat conditions at the other parks, which provided access to large amounts of agricultural grain or forage as compared to Catoctin.

The findings of all three studies 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 losses from disease 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 planned for 2007.

DISEASES OF CONCERN

There are a number of diseases of concern in eastern deer populations. These include parasites, malnutrition, bluetongue virus, and epizootic hemorrhagic disease. Chronic wasting disease has recently been documented within 60 miles of the park and is being watched, as it is thought to be spread easily in areas with high concentrations of deer. These diseases are briefly described below:

PARASITISM

Parasitism occurs when an organism grows, feeds, and is sheltered on or in a different organism, resulting in a type of symbiosis in which one species benefits at the expense of the other. There are many varieties of parasites, both internal and external. Parasites can have a variety of consequences from minimal to marked on an individual or population.

MALNUTRITION

Malnutrition is the condition that develops when the body does not get adequate amounts of the vitamins, minerals, and other nutrients necessary to maintain healthy tissues and organ function.

BLUETONGUE VIRUS

Bluetongue virus is an insect-transmitted, viral disease of ruminant mammals, including white-tailed deer.[3] A bluetongue virus infection causes inflammation, swelling, and hemorrhage of the mucous membranes of the mouth, nose, and tongue. Inflammation and soreness of the feet also are associated with bluetongue virus. Bluetongue virus is considered by the Office International des Epizooties (the international organization that sets animal health standards) to be a disease that has the potential to spread rapidly. White-tailed deer can be severely affected by bluetongue virus because virus infections cause hemorrhaging and sudden death, and the mortality rate can be extremely high (APHIS 2003).

Bluetongue virus is spread from animal to animal by biting gnats. Animals cannot directly contract the disease from other animals. The disease is most prevalent in the United States in the southern and southwestern states. It is currently almost non-existent in the upper north central and northeastern states, where biting flies do not appear able to transmit the viruses (APHIS 2003).

Bluetongue virus is a seasonal disease that is generally observed in the late summer and early fall. Virus transmission begins in the early spring with the onset of insect flight activity and continues until the first hard frosts (APHIS 2003).

EPIZOOTIC HEMORRHAGIC DISEASE

Epizootic hemorrhagic disease is an insect-borne viral disease of ruminants. The disease causes widespread hemorrhages in mucous membranes, skin, and viscera, the result of disseminated intravascular clotting. Strains of epizootic hemorrhagic disease can cause widespread vascular lesions similar to those described for bluetongue virus. Degenerative changes (focal hemorrhage or dry and gray-white appearance, or both) in striated musculature are prominent in the esophagus, larynx, tongue, and skeletal muscles. Epizootic hemorrhagic disease in white-tailed deer can lead to death. Often, deer are found dead around waterholes, suggesting that they had a high fever and were dehydrated (Stott 1998).

Not all deer infected with epizootic hemorrhagic disease or bluetongue virus will die; this is known because many normal deer have antibodies that indicate prior exposure to various viruses. Deer that recover develop immunity to the specific virus, which protects against reinfection by the same virus. However, it is not known how well this immunity cross-protects deer against other hemorrhagic viruses. When deer survive infection with a virus from one virus type (epizootic hemorrhagic disease or bluetongue virus), there is good evidence to indicate they

3. A ruminant animal is an even-toed, hoofed mammal (such as sheep, oxen, and deer) that chew the cud and have a complex three- or four-chambered stomach.

are not protected from disease caused by subsequent infection with a different virus strain (Southeastern Cooperative Wildlife Disease Study 2000).

CHRONIC WASTING DISEASE

Chronic wasting disease belongs to a group of diseases known as transmissible spongiform encephalopathies, which include scrapie, bovine spongiform encephalopathy, and Creutzfeldt-Jakob disease. The diseases are grouped because of similarity in clinical features, pathology, and presumed etiology: the infectious agents are hypothesized to be prions (infectious proteins without associated nucleic acids). Transmissible spongiform encephalopathies cause distinctive lesions in the brain and consistently result in death.

Transmissible spongiform encephalopathies (TSEs) are characterized by accumulations of abnormal prion proteins in neural and lymphoid tissues, causing lesions in the brain and resulting in death.

Deer and elk affected by chronic wasting disease show loss of body condition and changes in behavior. Affected animals may demonstrate a variety of behavioral signs, including decreased fear of humans and isolation from the remainder of the herd. Animals in the later stages of the disease become emaciated. Excessive drinking and urination are common in the terminal stages because of specific lesions in the brain. Many animals in terminal stages have excessive salivation and drooling. Death is inevitable once clinical signs are visible.

The clinical course of chronic wasting disease varies from a few days to several months. While a protracted clinical course is typical, occasionally death may occur suddenly; this may be more common in the wild than in the relative security of captivity.

The health risk for humans consuming elk or deer infected with chronic wasting disease is unknown; however, the risk is likely extremely low. This risk is based on an analysis of existing research studies that indicate no established link between the disease and similar human transmissible encephalopathy diseases. Current literature reviews and experts agree that more information is needed and that many questions remain unanswered about the transmissibility of chronic wasting disease to humans. Appendix D provides additional information on CWD diagnosis and management.

OTHER WILDLIFE AND WILDLIFE HABITAT

Catoctin's forested ecosystem is habitat for more than 280 species of animals (excluding invertebrates), most of which are resident and migratory birds (NPS 2005d). Of the native animal species known historically to range within the area of Catoctin, bison (*Bison bison*), elk (*Cervus elaphus*), gray wolf (*Canis lupus*), eastern cougar (*Felis concolor*), porcupine (*Erethizon dorsatum*), and fisher (*Martes pennanti*) have been extirpated. Bobcats (*Lynx rufus*), beavers (*Castor canadensis*), and black bears (*Ursus americanus*) still occur in Maryland and are believed to live in the park (NPS 1998b). Common animals include squirrels, chipmunks (*Tamias striatus*), mice (*Peromyscus* spp.), pileated woodpeckers (*Dryocopus pileatus*), wild turkeys (*Meleagris gallopavo*), brook trout, bats, wood frogs (*Rana sylvatica*), and eastern box turtles (*Terrapene carolina*) (NPS 2005d).

White-tailed deer are the focus of this deer management plan, and therefore are addressed in a separate section. The role deer have played in the state of the current wildlife habitat is included at the end of this section.

MAMMALS

Mammals found in the park, in addition to white-tailed deer, are fairly typical for this region and include striped skunks (*Mephitis mephitis*), woodchucks (*Marmota monax*), squirrels, chipmunks, several species of mice, eastern cottontail rabbits (*Sylvilagus floridanus*), opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*), and gray foxes (*Urocyon cinereoargenteus*). Recent sightings of coyotes (*Canis latrans*), bobcats, beavers, mink (*Mustela vison*), and black bears indicate that populations of these mammals are returning to the area (NPS 1996b).

A small mammal survey was conducted for the park by the Smithsonian Institution in 2001 (McShea and O'Brien 2003). It confirmed the presence of 12 small mammal species within the park and also revealed a new species to the park, the coyote (see table 13). A coyote was photographed by a motion sensitive camera set up by the researchers. While coyotes have been reported in western Maryland, they had never before been documented at Catoctin Mountain Park. This may indicate that coyotes are expanding their range eastward, as is popularly believed.

The most abundant species identified in the 2001 survey were white-footed mouse (*Peromyscus leucopus*), eastern gray squirrel (*Sciurus carolinensis*), and northern short-tailed shrew (*Blarina brevicauda*). It was noted that pygmy shrew (*Microsorex hoyi*) and woodrat (*Neotoma magister*) were not found within the park. Gray squirrels were observed, but were not captured during either the winter or summer survey. A single red squirrel (*Tamiasciurus hudsonicus*) was captured during the winter trapping. Field measurements and habitat (high elevation pine forest) were consistent with expectations for this species (McShea and O'Brien 2003).

TABLE 13: 2001 SMALL MAMMAL SURVEY, CATOCTIN MOUNTAIN PARK

Common Name	Scientific Name	Abundance
Northern short-tailed shrew	*Blarina brevicauda*	Common
Smoky shrew	*Sorex fumeus*	Locally Abundant
Pygmy shrew	*Microsorex hoyi*	Rare
Southern flying squirrel	*Glaucomys volans*	Locally Abundant
Red-backed vole	*Clethrionomys gapperi*	Rare
White-footed mouse	*Peromyscus leucopus*	Common
Eastern gray squirrel	*Sciurus carolinensis*	Common
Eastern fox squirrel	*Sciurus niger*	Locally Abundant
Eastern chipmunk	*Tamias striatus*	Locally Abundant
Red squirrel	*Tamiasciurus hudsonicus*	Rare
Raccoon	*Procyon lotor*	Common
Red fox	*Vulpes vulpes*	Common
Coyote	*Canis latrans*	Rare
White-tailed deer	*Odocoileus virginianus*	Common

Source: McShea and O'Brien 2003.

Animals, especially squirrels and chipmunks, play an important role in tree regeneration by hiding or "caching" nuts in the soil to eat at a later date. These nuts are often forgotten and are able to germinate under the protective layer of soil (NPS 2005d).

BIRDS

Approximately 170 species of birds occur in the park during some part of the year, including great horned owls (*Bubo virginianus*), wild turkeys, hawks, woodpeckers, and a variety of songbirds such as crows, warblers, sparrows, and finches (Sinclair 2002). Bird surveys were conducted from February 2001 through 2003. A total of 162 species have been documented in the park by volunteers and park staff (Sinclair 2002). One species was newly documented in the park, white-crowned sparrow (*Zonotrichia leucophrys*), and two other species were identified that were not expected — barn swallow (*Hirundo rustica*) and ring-billed gull (*Larus delawarensis*).

Many of the birds confirmed to occur within the park nest on or near the ground, including black-and-white warblers (*Mniotilta varia*), worm-eating warblers (*Helmitheros vermivorus*), hooded warblers (*Wilsonia citrina*), and ovenbirds (*Seiurus aurocapillus*). These species depend on shrubs and ground vegetation for constructing nests and for concealment when feeding (Robbins et al. 1983).

Wild turkey is also a ground-nesting bird that is native to Catoctin Mountain Park. It was extirpated in the early part of the 20th century due to hunting pressure and habitat destruction. Turkeys recolonized southeast Frederick County and northwest Montgomery County in the 1970s and have been present in the park since that time. Observation records indicate the population increased in the 1980s, followed by a decrease in the early 1990s (NPS 1994b). Turkeys nest in forest ground litter, with nests generally next to a log, tree trunk, or similar large

protective object, usually under the cover of low-hanging branches or in tangles of shrubs or vines.

Birds that nest in the upper understory or canopy include red-eyed vireos (*Vireo olivaceus*), wood thrushes (*Hylocichla mustelina*), acadian flycatchers (*Empidonax virescens*), American redstarts (*Setophaga ruticulla*), northern cardinals (*Cardinalis cardinalis*), cerulean warblers (*Dendroica cerulea*), and yellow-throated vireos (*Vireo flavifrons*) (Robbins et al. 1983).

The upper canopy also supports cavity-nesting birds such as barred owls (*Strix varia*), woodpeckers, Carolina chickadees (*Parus carolinensis*), and tufted titmice (*Parus bicolor*). Many of these birds depend on older trees that have natural cavities or weakened sections that can be hollowed out for nesting.

Birds of prey, such as owls and hawks, that are known to live in the park, depend on other birds and mammals for food. Scavengers, like crows, ravens, and vultures (*Cathartes aura* and *Coragyps atratus*), also depend on the remains of other animals for food.

REPTILES AND AMPHIBIANS

The park provides habitat for about 30 species of reptiles and amphibians. To date, 22 species of amphibians — salamanders, frogs, and toads — have been identified at Catoctin Mountain Park. These species are generally found close to a water source as part of their life cycle is in an aquatic form. Eggs that are usually laid in or near the water, change from a completely aquatic form into a more terrestrial form (e.g., tadpoles change to toads and frogs) (NPS 2005d). Therefore, habitat important to amphibians within Catoctin is generally close to small pools and stream drainages.

There are 12 different species of salamanders and 1 species of newt at Catoctin. Spotted salamanders (*Ambystoma maculatum*) spend most of their time underground in animal burrows and natural underground openings. Some salamanders do not have an aquatic life form (e.g., redback salamander, *Plethodon cinereus*), and while these species are less dependent on water pools, they still require moist ground cover. Salamanders most commonly feed on worms and small insects.

Frogs and toads are primarily predatory, feeding on any animal, insect, worm, or spider of the appropriate size. Similar to many of the salamanders, frogs are dependent on water for reproduction and survival, and at Catoctin they are found near streams and wetlands. However, species such as wood frog, spring peeper (*Pseudacris crucifer*), green frog (*Rana clamitans*), gray tree frog (*Hyla chrysoscelis*), and American toad (*Bufo americanus*) also use lower woodland canopy vegetation to hunt for food and to provide cover (Oldfield and Moriarty 1994).

Reptiles within the park include snakes, turtles, and lizards (NPS 2005d). Of the 12 species of snakes found in the park, only two — copperhead (*Agkistrodon contortrix*) and timber rattlesnake (*Crotalus horridus*) — are venomous. The

habitat for these two species includes rocky slopes, loose rock walls, stream areas, and abandoned buildings or woodpiles. Other snakes such as northern black racers (*Coluber constrictor*) and eastern milk snakes (*Lampropeltis triangulum*) often are found overwintering in rock outcroppings. Many species that occur in the park use the herbaceous layer and the forest floor for hunting and cover, including the following: northern ring neck (*Diadophis punctatus*), black rat (*Elaphe obsoleta*), eastern hognose (*Heterodon platirhinos*), green (*Opheodrys aestivus*), and eastern garter (*Thamnophis sirtalis*). The primary food of snakes is small rodents, birds, insects, and amphibians (NPS 2005d).

Turtles are also commonly seen in the forest. Box turtles feed on invertebrates and carrion, as well as an assortment of wild fruits and berries. Omnivorous like the box turtle, wood turtles (*Glyptemys insculpta*) are partial to vegetation, feeding mainly on wild fruits and berries. The more aquatic turtles, such as snapping turtles (*Chelydra serpentina*), spotted turtles (*Clemmys guttata*), and painted turtles (*Chrysemys picta*), are found closer to streams and ponds (NPS 2005d).

FISH

As described in the "Soils and Water Quality" section, the various streams of Catoctin support populations of brook, brown, and rainbow trout (*Salmo gairdneri*). The headwaters and tributaries of Big Hunting Creek contain a population of brook trout. Big Hunting Creek also contains two exotic species, brown and rainbow trout, which have been introduced below the dam in Cunningham Falls State Park to enhance the stream's recreational fishing. Owens Creek, on the northern side of the park, contains small but viable populations of brown and brook trout, with brook trout being the more abundant of the two (NPS 2005d). No trout have been stocked in Owens Creek since 1990 (Swauger, pers. comm. 2005f).

Prior to the 1930s brook trout was probably the dominant predatory fish in both Owens and Big Hunting creeks. Over the past 50 years, habitat changes, fishing pressure, and competition with stocked brown and rainbow trout have all adversely impacted brook trout. However, where stocking of brown and rainbow trout has been stopped, brook trout populations are recovering. Small but viable populations continue to survive in Distillery Run, Ike Smith Creek, and Owens Creek. These streams are very small and vulnerable to drought, severe flooding, and sedimentation, all of which threaten the survival of the brook trout (NPS 1994b).

Other fish species in Catoctin's streams include American eel (*Anguilla rostrata*), white sucker (*Catostomus commersoni*), largemouth and smallmouth bass (*Micropterus dolomieui and M. salmoides*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), mottled sculpin (*Cottus bairdii*), longnose dace (*Rhinichthys cataractae*), rosyside dace (*Clinostomus funduloides*), cutlips minnow (*Exoglossum maxillingua*), blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), common shiner (*Luxilus cornutus*), and fantail darter (*Etheostoma flabellare*) (NPS 2005d).

CURRENT STATUS OF WILDLIFE AND THE ROLE OF DEER

There is more research on the effects of deer density on vegetation than on wildlife populations. However, a number of studies have shown distinct changes in bird abundance as a result of reducing deer density by exclosures (deCalesta 1994; McShea and Rappole 2000). One researcher found that seedling richness began to decline with just 10 deer per square mile, and that songbird habitat was negatively impacted with 20–39 deer per square mile within a cherry / maple forest (deCalesta 1992, 1994). Similarly, a nine-year study found that a reduction in deer density changed the composition of forest bird populations (McShea and Rappole 2000). Three patterns of change were observed in bird populations within exclosures (where there were no deer): (1) species that preferred open understory (e.g., chipping sparrow, *Spizella passerina*) declined, (2) species that preferred a dense herbaceous ground cover (e.g., indigo bunting, *Passerina cyanea*) immediately increased but then decreased as herbaceous species were replaced by woody species, and (3) species that preferred a dense, woody understory (e.g., ovenbird, *Seiurus aurocapillus*) gradually increased.

A bird density study conducted within Catoctin Mountain Park and the Frederick City Watershed compared differences in habitat and deer density to the density of bird species found in both parks (NPS 2005h). The Frederick City Watershed had lower deer density and more forest regeneration than Catoctin, which was reflected in many of the bird species observed. With a denser understory and ground cover, the Frederick City Watershed had a higher occurrence of ovenbirds, black-and-white warblers, worm-eating warblers, and hooded warblers, which are all species that nest on or close to the ground. In Catoctin, with its more open ground and lower canopy habitat because of a high deer density and browsing, upper canopy birds were more common (wood thrushes, American redstarts, tufted titmice, Carolina chickadees, and northern cardinals).

The habitat most affected by heavy deer browsing is the herbaceous and woody vegetation in the forest understory. Deer can browse vegetation from ground level to an average of 60 inches (150 cm) above the ground, and this is the habitat that is primarily affected. Other wildlife also use this understory habitat.

Heavy deer browsing adversely affects ground-nesting or feeding birds, because of a lack of cover for protection from hawks, owls, coyotes, foxes, skunks, and raccoons.

Wild turkeys feed on acorns and insects. In the Allegheny Mountains of Maryland and Virginia their diet is dominated by grapes and acorns in the fall and winter, and it is supplemented by leaves and buds in the winter (Martin et al. 1951). This puts them in direct competition with deer for food (acorns). Deer also affect the density of herbaceous vegetation, which may reduce the number of insects and herbaceous leaves available at ground level. Turkeys nest on the ground and may be more prone to predation if herbaceous and woody cover are insufficient.

Other species also compete with deer for available food, including squirrels and mice (which feed on acorns and other food from trees), and rabbits and woodchucks (which feed on young woody stems and green vegetation) (Martin et al. 1951; McShea and Rappole 2000). Heavy deer browsing also results in lack of cover for small mammals, such as squirrels, as well as snakes, frogs, and small ground-nesting or feeding birds. Less cover may make predators

more visible to prey, giving the prey a greater chance to escape. However, without adequate cover to hide, these animals would be increasingly vulnerable to predation from hawks, owls, coyotes, foxes, skunks, and raccoons.

Species that primarily depend on other habitats would be less affected by high deer numbers. Some frogs, snakes, salamanders, and turtles (e.g., bullfrogs [*Rana catesbeiana*], northern water snakes [*Nerodia sipedon*], and 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 turtle, wood turtle, hognose snake, American toad, and gray tree frog) are dependent on vegetation, fruits, and insects found within the understory of the forest, and their habitat is affected by high deer numbers.

Species that would benefit from high deer numbers and resulting habitat changes are those that prey on deer (e.g., bears, coyotes, or bobcats) or that feed on carrion (e.g., vultures and box turtles). Predators would also benefit from hunting other prey (such as mice, squirrels, rabbits) in areas with less dense cover at ground level, thus allowing better views through the forest and less cover for prey to hide. However, as prey declines due to reduced cover, predators will also decline.

The upper canopy of the forest has not changed noticeably to date as a result of high deer numbers. Therefore, those species that depend on the upper canopy of the forest (such as woodpeckers and other birds that nest high in the trees) have not experienced any noticeable change in their habitat. As the forest ages, improved habitat may become available for cavity-nesting birds and birds that feed on insects as older trees die or become stressed from disease or infestations. However, in the long term with little to no regeneration, the dead trees will not be replaced by new trees, resulting in fewer trees that upper canopy species can use as habitat.

SENSITIVE AND RARE SPECIES (INCLUDING RARE PLANT HABITATS)

No federally listed species have been documented in the park, based on correspondence with the U.S. Fish and Wildlife Service (see appendix B). The Maryland Department of Natural Resources' Wildlife and Heritage Service identifies one state-listed animal species, common raven (*Corvus corax*), and six plant species as potentially occurring in or in the vicinity of the park including small purple-fringed orchid, leatherwood (*Dirca palustris*), Torrey's mountain-mint (*Pycnanthemum torrei*), long-bracted orchid (*Coeloglossum viride*), large-leaved white violet (*Viola incognita*), and Herb-robert (*Geranium robertianum*) (see appendix B). Based on correspondence with the park, an additional 13 plant species are of park concern, including the large purple-fringed orchid (Loncosky and Swauger, pers. comm. 2005).

American ginseng has all but disappeared from Catoctin Mountain Park.

As discussed in "Chapter 1: Purpose of and Need for Action," the common raven would be affected only minimally by deer management activities and is therefore not discussed in detail in this section or in "Chapter 4: Environmental Consequences."

SENSITIVE AND RARE PLANTS

As detailed in the "Vegetation" section, numerous plant species have been extirpated or are at risk of being extirpated from the park's plant community due to excessive deer browsing in the park. A complete list of the number of plants lost to deer browsing has not been compiled at this time. Since the early 1980s park staff have noted the effects of deer browsing on vegetative species, and a 2000 report lists browsing impacts to 24 species of plants, including American ginseng, large purple-fringed orchid, long-bracted orchid, and leatherwood (NPS 2000f).

In 1989, 12 remaining large purple-fringed orchids were discovered in the park. Wire cages were installed around them to protect them from deer browsing.

In 1989, 12 remaining large purple-fringed orchids were discovered in the park, and the following year the park located and installed wire cages around all known occurrences of large purple-fringed orchids and leatherwood (NPS 2000f). These species are still protected by the park.

Table 14 lists the species of special concern identified by the Maryland Department of Natural Resources and Catoctin Mountain Park staff. Where information was available, the table also provides the state status or rank for the species, preferred habitat, and palatability to deer. Six species documented in the park are identified as palatable to white-tailed deer — long-bracted orchid, leatherwood, large-leaved white violet, American ginseng, large purple-fringed orchid, and nodding trillium.

TABLE 14: SPECIES OF SPECIAL CONCERN IN CATOCTIN MOUNTAIN PARK

Common Name	Scientific Name	State Listing	Confirmed Occurrence in Park	General Habitat	Deer Preference
Wildlife (Maryland Department of Natural Resources)					
Common raven	*Corvus corax*	Rare	Yes	Habitat varies; prefers wooded areas	Not applicable
Plants (Maryland Department of Natural Resources)					
Robert geranium	*Geranium robertianum*	Endangered	No	Woods and gravelly shores (Brown and Brown 1984)	Genus *Geranium* considered resistant (Deer-Resistant Landscape Nursery 2004)
Large-leaved white violet	*Viola blanda* var. *palustriformis*	Highly rare	Yes	Rich, deciduous woods (Brown and Brown 1984)	Palatable – "Frequently Damaged" (referring to *Viola* spp.) (Gibbs 1995)
Eastern leatherwood	Dirca palustris	Threatened	Yes	Rich woods and stream banks in midland and mountain zones	Palatable (NPS 2000f)
Long-bracted orchis	*Coeloglossum viride*	Endangered	Yes	Moist, rich deciduous woods, frequently on steep slopes	Possibly palatable (some species within this genus are palatable)
Small purple-fringed orchid	*Platanthera psycodes*	Endangered; extirpated	No	Moist fields and moist open woods	No information found
Torrey's mountain-mint	*Pycnanthemum torrei*	Endangered	Yes	Dry woods and thickets (Brown and Brown 1984)	Genus *Pycnanthemum* considered resistant (Deer-Resistant Landscape Nursery 2004)
Additional Plant Species (Catoctin Mountain Park)					
American chestnut	*Castanea dentata*	State rare/Watch list	Yes	Forest tree, most abundant on poor, or dry, acid soils (Brown and Brown 1972)	No information found
American ginseng	*Panax quinquefolius*	Watch list	Yes	Rich deciduous woods (Brown and Brown 1984)	Palatable – leaves and stalks (NPS 2000f)
White bergamot	*Monarda clinopodia*	Watch list	Yes	Low woods and thickets (Brown and Brown 1984)	Genus *Monarda* considered resistant (Deer-Resistant Landscape Nursery 2004)
Butternut	*Juglans cinerea*	State rare /Watch list	Yes	Rich soils usually in the woods or along fence rows; most commonly in the mountains (Brown and Brown 1972)	No information found
False pennyroyal	*Isanthus brachiatus*	Watch list	Yes	Prefers open areas in dry soils	No information found
Large purple-fringed orchid	*Platanthera grandiflora*	Threatened	Yes	Rich moist woods and meadows (Brown and Brown 1984)	Palatable – upper leaves and stalks (NPS 2000f)
Nodding trillium	*Trillium cernuum*	Watch list	Yes	Moist woods in midlands and mountain zones (Brown and Brown 1984)	Palatable – "Frequently Damaged" (referring to *Trillium* spp.) (Gibbs 1995)
Pale corydalis	*Corydalis sempervirens*	Watch list	Yes	Rock crevices, talus, forest clearings, open woods, and on burned or otherwise disturbed areas in shallow, often dry soil	Resistant (Deer-Resistant Landscape Nursery 2004)
Red turtlehead	*Chelone obliqua*	Threatened	Yes	Wet woods (Brown and Brown 1984)	Resistant (Lowe's Greenhouse 2003)
Whorled milkweed	*Asclepias verticillata*	Watch list	Yes	Dry woodlands, fields, and roadsides	Resistant (Deer-Resistant Landscape Nursery 2004)

Sources: Maryland Department of Natural Resources (appendix B in this document); NPS 2000f; Loncosky and Swauger, pers. comm. 2005.

RARE PLANT HABITATS

The Owens Creek and Hog Rock wetlands are considered sensitive habitats due to the occurrence of sensitive plant species and high plant diversity.

OWENS CREEK WETLAND

The Owens Creek wetland is an approximately 12-acre area that occurs in association with a riparian habitat along Owens Creek. The wetland occurs at an elevation of 1,300 feet and is between the Owens Creek picnic area and campground. The Nature Conservancy designated the wetland an outstanding Maryland natural area in 1983 due to its unique assemblage of plants (NPS 1994b). At least three state-listed plant species occur in the wetland, including long-bracted orchid, which is state endangered, and large purple-fringed orchid and leatherwood, which are state-listed threatened species. Other common plant species occurring within the Owens Creek wetland are listed in table 15.

HOG ROCK WETLAND

The approximately 0.3-acre Hog Rock wetland is adjacent to Hog Rock at an elevation of 1,660 feet, making it the highest wetland habitat in the park. There are no known state-listed species in the wetland, but the high diversity of plant species in this small habitat makes the area unique. The park constructed an exclosure around the wetland to prevent deer browsing. Table 16 lists the plant species occurring within the Hog Rock wetland area.

TABLE 15: OWENS CREEK WETLAND PLANT SPECIES

Common Name	Scientific Name
Trout lily	*Erythronium americanum*
Witch hazel	*Hamamelis virginiana*
Jewelweed	*Impatiens* spp.
Sensitive fern	*Onoclea sensibilis*
Cinnamon Fern	*Osmunda cinnamomea*
Interrupted fern	*Osmunda claytoniana*
Canada clearweed	*Pilea pumila*
Eastern swamp saxifrage	*Saxifraga pensylvanica*
Greenbrier	*Smilax* spp.
Skunk cabbage	*Symplocarpus foetidus*
Fox grape	*Vitis labrusca*
Spicebush	*Lindera benzoin*

Source: Gould, pers. comm. 1998.

TABLE 16: HOG ROCK WETLAND PLANT SPECIES

Common Name	Scientific Name
Red maple	*Acer rubrum*
Jack-in-the-pulpit	*Arisaema triphyllum*
Smallspike falsenettle	*Boehmeria cylindrica*
Buttonbush	*Cephalanthus occidentalis*
Water hemlock	*Cicuta maculata*
American beech	*Fagus grandifolia*
Ash	*Fraxinus* spp.
Tulip poplar	*Liriodendron tulipifera*
Japanese stiltgrass	*Microstegium vimineum*
Black gum	*Nyssa sylvatica*
Sensitive fern	*Onoclea sensibilis*
Cinnamon fern	*Osmunda cinnamomea*
Royal fern	*Osmunda regalis*
Virginia creeper	*Parthenocissus quinquefolia*
Canada clearweed	*Pilea pumila*
Lady's thumb	*Polygonum persicaria*
Arrowleaf tearthumb	*Polygonum sagittatum*
Pickerelweed	*Pontederia cordata*
Sassafras	*Sassafras albidum*
Mad Dog skullcap	*Scutellaria lateriflora*
Greenbrier	*Smilax* spp.
Skunk cabbage	*Symplocarpus foetidus*
Poison ivy	*Toxicodendron radicans*
Bellwort	*Uvularia perfoliata*
Blueberry	*Vaccinium* spp.
Sedges	*Carex* spp.
Oak species	*Quercus* spp.
Grasses	No identification of species were made.

Source: Loncosky, pers. comm. 2005.

CULTURAL RESOURCES

ARCHEOLOGICAL RESOURCES

Only about 5% of Catoctin Mountain Park has been surveyed for archeological resources. Park staff and contracted archeologists have completed archeological resource assessments in areas of disturbance (e.g., water and electric lines, wireless telecommunication facilities). These assessments have been site-specific and project-driven, not parkwide in scope. Known prehistoric archeological sites include rhyolite quarries, rockshelters, lithic (stone) processing sites, and lithic scatters. The park also contains archeological sites related to agriculture and rural industry, such as house foundations, road traces, charcoal hearths, and colliers' huts. Other sites include a whiskey still from the early 20th century and several dumpsites from the World War II era (NPS 2000a). Twelve archeological sites, charcoal hearths, and flint-knapping sites have been identified within the park boundaries.

For centuries before the arrival of Europeans, the Catoctin Mountain area was largely uninhabited except for occasional groups of roaming Native Americans, lured by the rich natural resources of the area. Archeologists have uncovered enough evidence to establish that early Native Americans did inhabit the region that became Maryland. Gradually, as the climate warmed and forests developed, the early Native American population increased, particularly around the waterways of the Chesapeake. By the Woodland period (1000 B.C. to A.D. 1600), agricultural villages and organized tribes had emerged in the coastal areas (Werhle 2000).

The Blue Ridge and Monocacy Valley areas contained significantly fewer occupants than eastern areas. Some scholars have theorized that during and after the Woodland period, western Maryland served as a buffer zone between coastal settlements and the western tribes occupying the Ohio Valley. Yet archeologists have uncovered significant evidence that western Maryland was not completely uninhabited.

Catoctin Mountain became an important source of rhyolite during the Archaic Period (8,000 to 1,200 B.C.), with the most active period during the Woodland Period. Rhyolite was a valued material that could be fashioned into arrowheads, hoes, and other important tools. Those in search of rhyolite would dig small pits into the flat tops of ridges. Catoctin experienced a very active period in stone quarrying and the production of these tools from 200 to 900 A.D.

Between 1978 and 1980, the Maryland Geological Survey conducted an intensive archeological reconnaissance of upper Frederick County. "Aboriginal quarries" were excavated along the west slope of Catoctin Mountain near Foxville as part of the survey. Most likely from the Woodland period, the quarry site was characterized by large amounts of primary chipping debris, few diagnostics, and occasionally small pits against the face of the outcrop. This evidence of rhyolite quarrying seemed to indicate that the site might have been part of a large rhyolite procurement and processing system. Although, little is known about the system, archeologists theorize that a regional exchange network may have operated between bands or by movement of groups from the Coastal Plains, where there

were more inhabitants, to temporary base camps near the rhyolite quarry sites and a potable source of water (Wehrle 2000). There were no year-round residences in the area. Usually large, rough "blanks" were taken from the quarry site, and finishing work was performed by the flint knappers at the base camps.

Rhyolite tools have been found as far away as coastal Virginia and New York. The closest source of rhyolite is a belt that runs from Gettysburg, Pennsylvania, through Catoctin, to Harpers Ferry, West Virginia, indicating that people practiced trade and traveled great distances to quarry stone. After 900 A.D. the quarrying of rhyolite in Catoctin abruptly ended. At the same time, there is evidence that permanent, year-round residences began to appear in the area, although no evidence has been found to indicate any year-round residences in the park area.

Archeologists have also found evidence of base camps related to hunting in Catoctin Mountain Park. The Catoctin and Monocacy areas served as fertile hunting grounds for eastern tribes. Exploring parties pursued deer and other game, setting large brush fires in uninhabited territories to clear out game (Wehrle 2000).

CULTURAL LANDSCAPES

Cultural landscapes, as defined by *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes,* consist of " 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" (NPS 1996c).

All of Catoctin Mountain Park is a cultural landscape that is potentially eligible for the National Register of Historic Places.

All of Catoctin Mountain Park is a cultural landscape that is potentially eligible for the National Register of Historic Places. The park as a whole has not been evaluated for listing in the National Register, except in the 2000 *Cultural Landscapes Inventory*, which identifies the significance of the park landscape. The park cultural landscape also contains two component landscapes, the cabin camps at Camp Misty Mount and Camp Greentop, which were both listed on the National Register of Historic Places in 1988. Features identified as contributing to the park's cultural landscape during the inventory are identified in table 17. The following information, unless noted otherwise, was derived from that report (NPS 2000a).

TABLE 17: CATOCTIN MOUNTAIN PARK CULTURAL LANDSCAPE CONTRIBUTING FEATURES

Characteristic Feature	Landscape Characteristic
Collier's huts (25 identified, 1992 Colby survey)	Archeological Site
Distinguishable farmsteads (4 identified, 1992 Colby survey)	Archeological Site
Native American quarrying and processing sites	Archeological Site
Old road traces	Archeological Site
Whiskey still (not Blue Blazes) (1 identified, 1992 Colby survey)	Archeological Site
Farm building foundations — 19th century	Buildings and Structures
Ike Smith pumphouse	Buildings and Structures
Retaining wall (breastwall) at Camp Misty Mount — New Deal	Buildings and Structures
Stone headwalls on Blue Blazes tributary — New Deal	Buildings and Structures
37 buildings at Camp Misty Mount (on the List of Classified Structures)	Buildings and Structures
Twenty three buildings at Camp Greentop (on the List of Classified Structures)	Buildings and Structures
Two buildings (resources office and blacksmith) at Camp Round Meadow (on the List of Classified Structures)	Buildings and Structures
Two tall sections of drylaid retaining wall along Hunting Creek	Buildings and Structures
Wells from farm period (3 identified, 1992 Colby survey)	Buildings and Structures
Foxville-Deerfield Road	Circulation
Main graveled trail through each cabin camp	Circulation
Manahan Road	Circulation
Maryland Route 77	Circulation
Old turnpike section of Catoctin Trail	Circulation
Park Central Road	Circulation
Path through center of Owens Creek picnic area	Circulation
Road traces (mapped in 1992 Colby survey)	Circulation
Section of trail east of Park Central Road	Circulation
Sections of Blue Blazes and Deerfield Nature Trail	Circulation
Section of trail through Brown Farm and horse trail in northwest section of park	Circulation
Sections of trail to Hog Rock from parking lot	Circulation
Trace of old Maryland 77 roadway in visitor center parking lots	Circulation
Trail along Hunting Creek east of Camp Peniel	Circulation
Trail from Brown Farm to Camp Round Meadow	Circulation
Trail from Wolf Rock to Crows Nest	Circulation
Trail to Chimney and Wolf Rocks	Circulation
Camp Greentop	Cluster Arrangements
Camp Misty Mount	Cluster Arrangements
Two lines of buildings and grassed slope at Camp Round Meadow	Cluster Arrangements
Raceways associated with 19th-century mills (if any)	Constructed Water Features
Any remaining ca. 1937 stone boundary markers	Small Scale Features
Charcoal hearths from 19th century (141 identified, 1992 Colby survey)	Small Scale Features
Chestnut rail fencing related to farms (2 sections identified, 1992 Colby survey)	Small Scale Features
Curved stone wall across Park Central Road from visitor center and section of free-standing wall adjacent to building	Small Scale Features
Farm-area stone walls (47,000 linear feet identified, 1992 Colby survey)	Small Scale Features
Mileage marker stone for Emmitsburg	Small Scale Features
Old campfire circles at cabin camps	Small Scale Features
Remains of CCC-reconstructed stone wall outside park resources office at Camp Round Meadow	Small Scale Features

TABLE 17: CATOCTIN MOUNTAIN PARK CULTURAL LANDSCAPE CONTRIBUTING FEATURES (CONTINUED)

Characteristic Feature	Landscape Characteristic
Spring boxes	Small Scale Features
Stone and galvanized metal culvert at Camp Misty Mount	Small Scale Features
Stone bases of removed drinking fountains at cabin camps	Small Scale Features
Stone edges of some trail sections	Small Scale Features
Survey stone marked "77"	Small Scale Features
Trail culverts of galvanized metal from New Deal era	Small Scale Features
Unmortared flagstone walk outside resources office at Camp Round Meadow	Small Scale Features
All streams	Topography
Chimney Rock	Topography
Drainage divide near Camp Round Meadow (location of repeated land use related to topography)	Topography
Hog Rock	Topography
Wolf Rock	Topography
Degree of openness of forest at cabin camps	Vegetation
Grass playing field and horse pasture at Camp Greentop	Vegetation
Grass slope outside resources office and remaining open areas at Camp Round Meadow	Vegetation
Native plant communities of forest	Vegetation
Landscape plants at farm sites	Vegetation
Remaining orchard trees	Vegetation
Views from Blue Ridge Summit	Views and Vistas
Views from Chimney Rock	Views and Vistas
Views from Hog Rock	Views and Vistas
Views from Thurmont Vista	Views and Vistas
Views from Wolf Rock	Views and Vistas
Views of Harbaugh Valley and Foxville from edges of park	Views and Vistas

Source: "Catoctin Mountain Cultural Landscapes Inventory" (NPS 2000a).

Two significant historical events shaped the park's landscape. The first was the discovery of iron in the foothills and the development of an iron furnace by 1776. Catoctin Furnace was one of the country's early sites of iron manufacturing. Among earliest furnaces, it was particularly long-lived, although it suffered slow periods and periods of non-production. It was finally eclipsed by advances in iron manufacture elsewhere. Much of the land that was to become Catoctin Recreational Demonstration Area was influenced by furnace activity. Forests were cut to manufacture the charcoal that fueled the furnace, and charcoal was produced at hearths that eventually dotted the mountain. A community of farmers and timber processors spread across the west side of the mountain (an area that accounts for about a third of the park), where the land was more conducive to cultivation and habitation. The park's first period of significance extends from the first accumulation of land for the furnace to its closure (1770–1903).

In 1934 the present park was part of a larger area selected for a Recreational Demonstration Area during the New Deal. Rustic design principles and practices espoused by the National Park Service during these years shaped parts of the

landscape for recreational use. The rustic period of park development is a significant legacy nationwide, which is shared by Catoctin Mountain Park.

The park's second period of significance concludes with the end of New Deal programs as the country entered World War II. The concluding date also marks the end of the rustic mode of park development that characterized national park design in its first decades. The second period covers the years from 1934 to 1942.

The park has additional importance because it contains NSF, the presidential retreat, formed out of one of the cabin camps constructed during the New Deal and selected by Franklin Roosevelt as his place of retreat from Washington during World War II.

Two cabin camps, Camp Misty Mount and Camp Greentop, constructed in 1937 and 1938 as Organized Group Camps #1 and #2 of the Catoctin Recreational Demonstration Area, are listed on the National Register of Historic Places as historic districts. The majority of Catoctin Mountain Park's New Deal era buildings are located in these two camps. A third area, the Camp Round Meadow section of the park, was the administrative and work building core during the New Deal years. Only two buildings there retain historic integrity.

Camp Misty Mount Historic District covers 72 acres and contains 35 buildings and structures that have historical significance. Camp Greentop Historic District encompasses approximately 41 acres and contains 22 contributing buildings. Each camp is subdivided into units (Camp Misty Mount has three units and Camp Greentop has two). The units each have cabins for campers, a lodge with an outdoor kitchen, at least one leaders' cabin, and a latrine/washhouse. Camp Misty Mount's cabins each house four campers and Camp Greentop's, six. There is also a core of buildings that serve the entire camp, including a dining room/recreation hall, an infirmary, a camp office, a building for crafts, a storage building, and a cabin for help staff. A pool and a central washhouse/laundry are also part of each camp. Neither camp has the original pool or central washhouse, and Camp Greentop is lacking its original dining hall. Most of the original latrines have also been replaced.

Camp Misty Mount and Camp Greentop embody two historic themes: the human and natural conservation efforts of the New Deal programs, and the development of NPS-sponsored rustic architecture in concert with the rise of outdoor recreation. One or both of these themes is also expressed in other features of the park — its roads, trails, and small-scale features. The entire park was selected to fulfill a conservation mission as well as a recreational one; thus, the park as a whole reflects the conservation ethic of much New Deal work.

Few features remain from the first period of significance — the iron furnace era — and its industrial and agricultural landscape. Even though integrity is low, traces of that era are found across the park. For example, roads from the earlier period intersect and sometimes run together with trails in current use; the alignment of the park road was derived from two distinct older roads; the earthen impressions of former charcoal hearths, shaped as concave discs, occur throughout the park; and numerous stone walls mark the edges of old fields, now incorporated into the forest.

The vegetation of the park has cultural and historic aspects. It is comprised primarily of various communities of native plants, with a small number of plantings and patches of invasive nonnative plants. The native and self-generating vegetation is a changing mosaic distributed according to soil, moisture and light requirements, and it is influenced by pests and diseases, deer browsing, and changing human use. Vegetation management by park personnel supports cultural as well as natural landscape objectives.

For a property to be listed on the National Register of Historic Places, the quality of significance in American history, architecture, archeology, engineering, and culture must be present (in districts, sites, buildings, structures, or objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association), and the site must meet one of four criteria. Catoctin Mountain Park is significant under two of those criteria, as described below:

- Association with events that have made a significant contribution to the broad pattern of our history. Two periods of significance meet this criterion: (1) the iron-production / charcoaling / agricultural period and (2) the New Deal period.

- Embodying distinctive characteristics of a type, period, or method of construction. This criterion applies mostly to the rustic architecture of the cabin camps of the latter period of significance, as well as to the stone walls of the earlier period, which exhibit the distinctive characteristics of type, period, and method of construction.

The park also contains archeological resources that may yield information important in history and prehistory (the fourth criterion). However, the archeological significance of the park landscape awaits further study.

VISITOR USE AND EXPERIENCE

VISITATION

Catoctin's visitors come primarily from Maryland (64%), with the remainder from Pennsylvania (10%), Washington, D.C. (8%), and other states. The majority of visitors are family groups (52%), and 41% of visitors come in groups of two. About two-thirds (70%) of visitors spend two to four hours in the park. Over three-quarters of visitors (77%) come primarily to visit Catoctin Mountain Park, but do not stay overnight in the area (i.e., within 50 miles). Of the remaining 23% who do stay overnight either in the park or the surrounding area, roughly half of those visitors stay in the park's campgrounds (NPS 2002a; also see appendix G).

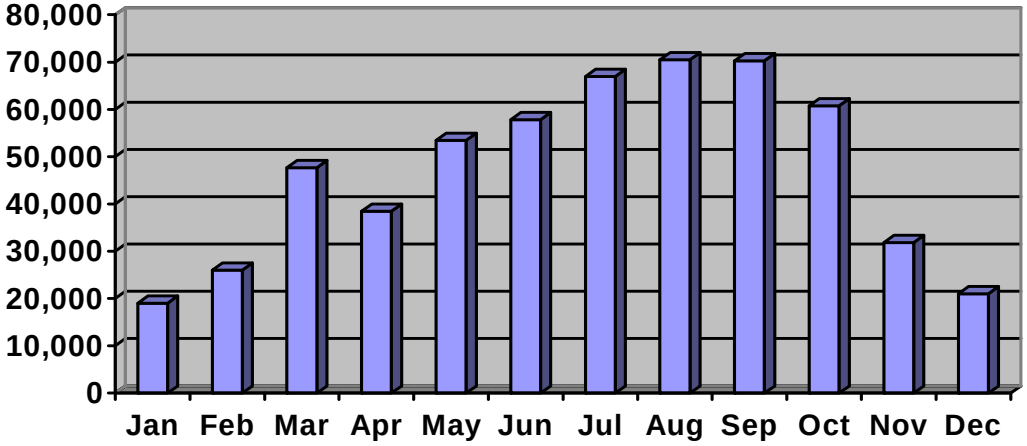
Annual visitation at Catoctin has fluctuated over the past 10 years, probably due to weather and periodic security closures. Visitation increased dramatically in 2003 (35.7%) compared to previous years and continues to increase (see table 18).

As shown in figure 2, visitation is highest during August and September, which reflects the popularity of hiking and viewing fall foliage. High visitation during May and June may also indicate an attraction to the park's spring flowers. Seasonal events hosted by park staff, particularly in the spring and fall, may also be responsible for higher visitation during these months. Overnight visitation generally corresponds with the summer season, with July and August being peak months (NPS 1996b).

TABLE 18: CATOCTIN VISITATION

Year	Visitation	Percent Change from Previous Year
1994	704,289	—
1995	552,906	-21.5%
1996	484,892	-12.3%
1997	503,812	3.9%
1998	483,762	-4.0%
1999	459,002	-5.1%
2000	508,539	10.8%
2001	532,615	4.7%
2002	457,641	-14.1%
2003	621,114	35.7%
2004	699,274	12.6%
Average	546,168	10.7%

Source: NPS 2004k.



Source: NPS 2004k.

FIGURE 2: AVERAGE CATOCTIN MONTHLY VISITATION, 2000–2004

Staff at Catoctin expect a 3% yearly increase in visitation in future years, as well as increased pressure for various recreational uses. Visitor use of Catoctin Mountain Park has grown because of the increased popularity of Cunningham Falls State Park (Catoctin's neighbor to the south). High-density day use of the state park's lake and beach during the summer months often results in Cunningham Falls being closed to additional visitors by 11 a.m. Visitors who are turned away frequently overflow into Catoctin Mountain Park, placing a strain on federal facilities and staff, as well as causing traffic congestion along Maryland Route 77 and filling parking lots at the visitor center to capacity. The state park's hunting program can also cause traffic congestion in parking areas and along Maryland 77 (NPS 1996b).

VISITOR ACTIVITIES

Visitors come to Catoctin to participate in various activities associated with its natural mountain setting. According to park staff, hiking and foliage viewing in the fall are very popular activities, as is hiking to scenic overlooks in the eastern area of the park. Spring flowers attract visitors, but deer browsing has decreased the bloom in some areas. Bird watching also attracts many visitors. Mushroom hunting remains a popular recreational activity (visitors are permitted by 36 CFR 2.1(c)(1) to gather small amounts of mushrooms and berries for personal consumption [NPS 2004h]), and fly-fishing for trout occurs throughout the year in Big Hunting Creek. Cross-country skiing is popular, but primarily if there is no snow at lower elevations. Very little snowshoeing occurs in the park (NPS 2004e).

Catoctin hosts a number of events throughout the year that also attract visitors, such as fall color walks during October, winter outdoor sports programs for cross-country skiers, and spring wildflower walks in early May and the "International Migratory Bird Day Program" in spring. Summer events include campfire programs. Basic orienteering classes and volunteer trail workdays are held throughout most of the year (NPS 2005d).

Visitors at Catoctin identified and rated specific activities in a survey conducted August 3–11, 2002. A total of 604 questionnaires were distributed to visitors, and 470 questionnaires were returned, for a 77.8% response rate. In addition to responding to survey questions, 48% of visitor groups wrote additional comments. According to the survey, the most common activities included viewing wildlife and scenery (82%), driving through the park (61%), and hiking for one hour or more (46%). Repeat visitors also identified these activities as the most common they engaged in during past visits. Other popular activities include taking shorter hikes, photographing scenery, camping, and rock climbing. About 12% of visitors go to cultural or historic sites, 1% come to ride horses, 1% come to gather berries and mushrooms, and 12% come for "other" activities, such as attending the maple syrup festival, seeing slide shows and exhibits, checking cabins to rent, and enjoying natural quiet. These activities are described in more detail below (NPS 2002a).

Visitor groups were asked to rate the appropriateness of selected management activities within Catoctin Mountain Park. Controlling the white-tailed deer population was one of three management activities that received the highest "always appropriate" rating (NPS 2002a).

VIEWING WILDLIFE AND SCENERY

Visitor groups were asked to rate the importance of selected Catoctin Mountain Park elements for preservation. Results of the survey are shown in table 19.

Viewing native plants and Catoctin's forest was important for 97% of visitors — 67% rated this element as extremely important, 18% as very important, and 12% as moderately important (NPS 2002a). Catoctin's wildflower season begins in early April, with different plants continuing to bloom throughout the summer. Location, altitude, and weather can affect bloom times (NPS 2005d).

Viewing native animals other than deer ranged from moderately to extremely important for 94% of Catoctin's visitors (56% rated this as extremely important, 27% as very important, and 11% as moderately important). Viewing birds ranged from moderately to extremely important for 93% of all visitors (NPS 2002a).

Viewing deer ranked next in popularity. It was rated extremely important by 46% of respondents, very important by 24%, and moderately important by 19%, for a total of 89% (NPS 2002a).

TABLE 19: ACTIVITY RANKING BY VISITORS

Activity	Ranking			
	Extremely Important	Very Important	Moderately Important	Total
Natural Quiet/Sounds of Nature	73%	19%	6%	98%
Views without Development	74%	15%	7%	96%
Viewing Native Plants/Forest	67%	18%	12%	97%
Viewing Birds	60%	23%	10%	93%
Viewing Other Native Animals	56%	27%	11%	94%
Viewing Deer	46%	24%	19%	89%

Source: NPS 2002a.

DRIVING THROUGH THE PARK

The roads of Catoctin Mountain Park offer scenic driving all year, but portions of Park Central Road and Manahan Road are closed to vehicles in winter. A scenic overlook on the east side of Hunting Creek Lake (in Cunningham Falls State Park) offers a panoramic view of the water and surrounding forest (NPS 2004j).

HIKING

Catoctin's trails offer a variety of scenic vistas, cultural exhibits, and spectacular rock outcroppings. The level of difficulty ranges from easy strolls to rugged hikes, with over 25 miles of trails to choose from, including a spur of the Appalachian Trail. Most hiking trails are accessed from the visitor center. Interpretive trails have either signs or exhibits along the trail, or an accompanying descriptive brochure. Bicycles are not permitted on park trails (NPS 2005d). The "Visitor Use Areas Map" on page 143 shows Catoctin's hiking trails, as well as the park's most visited areas.

One of the most common activities Catoctin's visitors engage in is hiking.

The park maintains two orienteering courses that are available for public use from November 1 through April 15; the courses are closed the rest of the year to lessen impacts on forest vegetation and wildlife. Basic orienteering (map and compass reading) courses are offered at the park visitor center in March and November. The west side course is within the area bounded by Park Central Road, Manahan Road, and Foxville-Deerfield Road (NPS 2005d). The courses are used on a first-come, first-served basis if no advance reservations are made (NPS 2005d).

OVERNIGHT STAYS

Camping

Although the majority of Catoctin's visitors do not stay overnight in the park, those who do are primarily campers (NPS 2002a). Camping is permitted only in campgrounds, cabins, and shelters. Owens Creek campground is open mid-April through the third week of October (NPS 2005d).

The Poplar Grove youth group tent camping area is open by reservation to adult-supervised, organized youth groups. The site is open year-round except March 1 through April 15.

The park offers two hike-in Adirondack shelters, three-sided wood shelters that are offered as an alternative to camping in the open. The shelters require a 1.5 to 3 mile hike and are open all year (NPS 2005d).

Cabins

Camp Misty Mount includes 29 cabins available for rent to both individuals and groups (NPS 2005d), and is closed November through March. Camp Greentop can accommodate 140 people and is set up in units of cabins and is also closed

November through March. Camp Round Meadow accommodates a maximum of 120 people in four dormitories; it is open year-round (NPS 2005d).

ROCK CLIMBING

Rock climbing is allowed only at Wolf Rock (see the "Visitor Use Areas Map" on page 143), and a permit is required; all other park areas are closed to rock climbing and rappelling (NPS 2005d). In 2004, 95 individuals obtained permits to climb at Wolf Rock (NPS 2005g). Climbing is limited to a total of 25 people at one time, and permits are not issued on weekends in October due to high visitation, or during any weather conditions that appear to be unsafe for climbing (NPS 2005d).

VISITING HISTORIC / CULTURAL SITES

Two of Catoctin's trails lead to cultural sites, including the Blue Blazes Whiskey Still Trail and the Charcoal Trail (NPS 2004j). In addition, Camp Misty Mount and Camp Greentop are cultural landscapes listed on the National Register of Historic Places as historic districts. The influence of the New Deal era can also be felt in other areas of the park, including roads, trails, and small-scale features (NPS 2000a). The park also offers events about Catoctin's history, such as a blacksmith shop demonstration, whiskey still talks, and other pertinent programs (NPS 2005d).

HORSEBACK RIDING

A very small percentage (1%) of Catoctin's visitors come to ride horses, and approximately 6 miles of trail are maintained for public horseback riding. The trail is open for day use only, from April 15 through January 31, and is closed in the winter to help preserve the trail (NPS 2004h).

CROSS-COUNTRY SKIING

Skiing, snowboarding, snowshoeing, tubing, and sledding are allowed on Manahan Road north of Park Central Road to the park's north boundary, and on Park Central Road east of Camp 3 to the visitor center whenever the road closures are in effect (NPS 2004h). A number of places in the park afford good cross-country skiing for beginners and intermediates when snow conditions are favorable. Generally, the best skiing is along certain sections of park roads that are closed to vehicular traffic in winter (NPS 2005d).

PICNICKING

The Chestnut Grove picnic area is open year-round, although the amenities are closed in winter. It has tables with grills, a 0.25-mile loop nature trail, restroom facilities, and a small play area for children, and it is wheelchair accessible. The Owens Creek picnic area is open seasonally and includes a 0.5-mile loop nature trail, flush toilets, tables, and grills.

Some trailhead parking areas also provide picnic tables (NPS 2005d).

VISITOR USE AREAS MAP

See attached file

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FISHING

Anglers can fish at Big Hunting Creek and Owens Creek. Big Hunting Creek has played a prominent role in the development of recreational trout fishing in Maryland and has long been popular among fly fishermen. Fish include brook, brown, and rainbow trout (NPS 2005d).

Anglers can fish at Big Hunting Creek and Owens Creek. Big Hunting Creek has played an important role in the development of recreational trout fishing in Maryland.

NOISE

The results of the 2002 visitor survey at Catoctin Mountain Park showed that 92% of visitors ranked "natural quiet" (the absence of human-caused sound) as either very or extremely important, and 20% felt that unnatural noise detracted from their experience at the park (NPS 2005g). Various activities contribute to unnatural noise at Catoctin Mountain Park. Hunting occurs outside all boundaries of the park, and visitors may hear gunshots in many areas during hunting season. Most hunting occurs very early in the morning or at dusk when most visitors have left the park (Voigt, pers. comm. 2005b). Hunting for white-tailed deer begins in mid-September and continues through the end of January. The hunting season for most other animals occurs within the same period. The hunting season for some animals, such as squirrels, is slightly extended, and the spring wild turkey hunting season occurs from mid-April through May (MD DNR 2005a).

Catoctin has a shooting range that is near the north central boundary. It is used by government employees throughout the year but only for a few days each month. Only four to five people can shoot at a time (Voigt, pers. comm. 2005b). No visitor trails or overlooks are close to the range, and the activity occurs on weekdays, when visitation is lowest. Noise from the firing range is most audible from the Poplar Grove group campsites (see the "Visitor Use Areas Map" on page 143).

Shooting ranges also exist on private land on the west side of the park. Most of Catoctin's trails and scenic overlooks are located in the east and central portions of the park. In addition, it is likely that a number of people in the local community shoot at targets on their own land (Voigt, pers. comm. 2005b).

Catoctin's airspace is closed below 12,500 feet and eastward for five miles. This limits the level of noise from airplanes, although distant commercial flights are audible. Intermittent government helicopter activity associated with the restricted area affects the park's soundscape.

Catoctin Mountain Park receives a steady flow of visitors due to its proximity to major urban centers. Group campsites and cabin facilities are well used, and many visitors are drawn to the park for the activities described above. Noise from visitor use is concentrated in the park's developed areas, particularly along the east and west ends of Park Central Road, where visitors can access Camp Misty Mount, Camp Greentop, and Camp Round Meadow. Foxville-Deerfield Road, which is near the park's western boundary, also provides access to the Owens Creek campground (NPS 2005g).

INTERPRETATION GOALS AND THEMES

In 2001 Catoctin Mountain Park staff developed a list of "Desired Visitor Outcomes" for the park (NPS 2001a). The second item on the list states "visitors have the opportunity to see wildlife in a natural setting." Other outcomes that apply to this deer management plan include:

One of the park's goals is that visitors leave the park with the idea that it is valuable to preserve and interpret our cultural and natural heritage.

- Visitors have opportunities to make self-discoveries.
- Visitors leave with the idea that it is valuable to preserve and interpret our cultural and natural heritage, even if it is emotional or controversial.
- Each visitor has the opportunity to leave the park understanding natural processes and cultural heritage.
- Visitors have opportunities for solitude and personal reflection.

There are also two primary interpretive themes for the park, which are supported by sub-themes. These themes or sub-themes could be related to deer management activities at the park (NPS 2001c):

1. Catoctin Mountain Park is an evolving example of resource stewardship and environmental ethics where the interaction between natural resources and local cultures on Catoctin Mountain has shifted from subsistence toward sustainability.

    - Catoctin is an example of the natural regeneration of disturbed lands; this is supported by monitoring and research activities to understand natural processes and relationships, providing an outdoor classroom for many levels of learning.
    - The natural resources of Catoctin Mountain Park provide a dynamic demonstration of nature's ability to regenerate, and they 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.

2. The mountains have provided many people in the past with the resources for physical, social, and economic survival.

    - The forest's natural resources have provided people with a means of survival and economic growth for generations; Native American rock quarries, family farms, whiskey stills, sawmills, and the charcoal/iron industry remains remind people today of their direct connections to the land.

- A series of federally sponsored job programs provided gainful employment for many people, including displaced workers or students who learned technical skills while developing recreational facilities for families or groups. These included the New Deal era programs providing jobs and opportunities for growth and hope, while providing for recreational and educational opportunities in the future.

VISITOR AND EMPLOYEE SAFETY

Various safety concerns could result from implementation of the alternatives described in this *Draft White-tailed Deer Management Plan / Environmental Impact Statement.* Safety applies to both park visitors and park employees.

VISITOR SAFETY

A visitor accident or incident is defined as an accidental event affecting any non-NPS employee that results in serious injury or illness requiring medical treatment, or in death. Park staff help ensure the safety and security of visitors by preserving, maintaining, and monitoring facilities; providing protection, search and rescue, criminal investigations; and identifying, investigating, and correcting or mitigating sources of injury and property damage experienced by visitors. The park incorporates safety messages into a variety of media, including bulletin boards, press releases, scheduled programs, and during roving contacts, and has conducted health and safety fairs.

Catoctin experiences a visitor accident rate of 2 per 100,000 visitor days (roughly three years) (NPS 2005a). Outdoor activities can involve accidents such as tripping, falling, and bee stings. Injuries sustained are typically not serious or life-threatening.

EMPLOYEE SAFETY

Park staff are also proactive about protecting the safety of employees. The park plans to reduce its employee injury rate to meet the employee safety goal established in its 2004 "Annual Performance Plan" through analysis of workplace incidents and a variety of training and awareness activities, including health and safety fairs for employees and monthly safety team inspections of park facilities.

In 2004 the park had a five-year average of 10.06 accidents/100 employees based on data provided by the NPS Risk Management Office, or an average annual rate of four incidents (NPS 2004a). Currently, the park is meeting its employee safety goal. From July 2004 to July 2005, one employee experienced an injury from an insect bite, one sustained a back injury, and one slipped or fell while performing job-related tasks, totaling three accidents or incidents in a one-year time frame. Most injuries or accidents are usually sustained by maintenance staff and park rangers, who often perform manual work outdoors (Swauger, pers. comm., 2005a). Injuries sustained are typically not serious or life-threatening, and no injuries related to deer management activities performed have occurred to date.

SOCIOECONOMIC RESOURCES

The following discussion of socioeconomic resources focuses on the potential for deer-related crop damage or landscape plant damage to neighboring properties. No other actions under the alternatives considered would have more than a negligible effect on local or regional socioeconomic conditions. Therefore, the analysis for socioeconomic resources was limited to deer damage on crops and neighbors' landscape plants.

REGIONAL AND SOCIOECONOMIC OVERVIEW

Catoctin Mountain Park is in north-central Maryland near the town of Thurmont and approximately 15 miles north of the town of Frederick. The majority of the park is in Frederick County, and only the western edge is in Washington County; therefore, the following description focuses on Frederick County. Frederick County's population has grown considerably in recent years, increasing 30% from 1990 to 2000, compared to 10.8% statewide (U.S. Bureau of the Census 2005). The county's population in 2003 was 213,662, a 9.4% increase from 195,277 in 2000. Maryland's population increased less than half that amount (4.0%) during the same period.

The lands surrounding Catoctin Mountain Park include state parklands, residential and developed zones, and agricultural areas. With approximately 26 linear miles of boundary, the park is bordered primarily by agricultural lands (36.3%) and residential areas (27.2%), with approximately equal boundaries shared with forested or undeveloped private land (18.1%) and state forested lands (18.1%) (NPS 2000a).

There are approximately 130 landowners on the boundaries of Catoctin Mountain Park (NPS 2004b). According to county zoning maps for the area (see "Land Use Areas Map" on page 151), agricultural lands border the park's north-central and northwest boundaries, particularly near Deerfield and Manahan roads. Small parcels of agricultural land also border the park's western and southwestern boundary near Foxville Church Road. The purpose of agricultural zoning is to "preserve productive agricultural land and the character and quality of the rural environment and to prevent urbanization where roads and other public facilities are scaled to meet only rural needs" (Frederick County n.d.a)

A small area zoned as a village center exists near the intersection of Maryland Route 77 and Foxville-Deerfield Road. The purpose of village centers, or commercial centers, "is to provide sufficient and convenient locations throughout the county for commercial uses, serving the needs of local areas, the larger community, and regional users. . . . These small communities have historically been the commercial centers for the surrounding rural areas, and it is the purpose of this district to promote their continuance" (Frederick County, n.d.a).

Two small residential parcels, zoned as "R1 (low-density residential)," exist on the east and west sides of the village center. Under the R-1 classification, the maximum dwelling units per acre is one (Frederick County n.d.a). Other residential areas near the park are within the town of Thurmont, on the park's

eastern border. Thurmont has a population of approximately 5,600, with three exits on U.S. 15, and is shown as "municipality" on the "Land Use Areas Map" on page 151.

Catoctin Mountain Park and Cunningham Falls State Park to the south, as well as many small areas surrounding the park, are zoned as resource conservation areas. These areas allow low intensity uses and activities that are compatible with the goal of resource conservation. Areas within this district include mountain areas, rural woodlands, and cultural, scenic, and recreation resource areas. Environmentally sensitive areas within the resource conservation zone, including steep slopes, wetlands, and the habitats of threatened and endangered species, are protected from development (Frederick County n.d.a).

AGRICULTURE IN FREDERICK COUNTY

Agriculture is a leading and vital sector of Frederick County's economy. The total market value of agricultural products sold in the county was $109,197,000 in 1992. This compares favorably with Frederick County's manufacturing sector, which exhibited total earnings in 1990 of $169,560,000. Between 1987 and 1992 the overall value of agricultural products grew by $14,550,000, indicating continued growth in the agricultural sector. This occurred despite a reduction in the total number of farms and in the amount of agricultural acreage during this period. Agricultural census data indicate that agriculture is in transition in Frederick County (Frederick County 1995).

During the 1960s, 1970s, and early 1980s, Frederick County's substantial population growth and low-density dispersal patterns came into conflict with the county's agricultural sector. This was characterized by an increasing frequency of conflicts between new residents and farm owners and operators. Escalating land prices have also worked to change the agricultural landscape throughout the county (Frederick County 1995).

The county has established an extensive agricultural preservation program, the goals of which are to preserve prime farmland, agricultural businesses, and active farming in Frederick County. The agricultural vision is communicated in the *Frederick County Comprehensive Plan, Volume I: Countywide Plan*, last approved in 1990 and updated in 1995. Part of the plan's vision statement emphasizes the importance of agriculture within the county (Frederick County 1995):

> The rural/agricultural heritage of the County is and always has been an essential element of the fabric of Frederick County and therefore its preservation is a high priority to the citizens and elected representatives. Outside of the designated growth areas, residential development is extremely limited to retain the economic, ecological, and scenic value of the countryside. Some large wood lots and forests are retained and selectively used for managed forestry, if not in preserves and parks.

Land Use Areas Map

See attached file

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Pertinent objectives within the *Frederick County Comprehensive Plan* include

- Promote planning efforts to preserve large, usable agricultural areas.
- Protect environmentally sensitive areas including, but not limited to, steep slopes, stream valley buffers, woodlands and forests, floodplains and wetlands, and habitats for endangered and threatened species.
- Preserve the county's best agricultural lands for continued and future production.

The 1995 *Comprehensive Plan* also specifies that

> a Countywide target of 100,000 acres of agricultural land should be established as the minimum acreage to be preserved through permanent easement agreements by the year 2020, with an overall goal of retaining 200,000 acres for agricultural use. Agricultural easement targets should be adopted in each Region Plan leading to the 100,000-acre agricultural preservation target.

The *Comprehensive Plan* establishes land use policies to preserve agriculture and to support the farming economy and communities. Catoctin Mountain Park is in the Thurmont Region. The current "Thurmont Region Plan," adopted in October 1995, designates Thurmont as the regional community and the town of Emmitsburg as a district community. The county has initiated updates for the Walkersville and Thurmont region plans (Frederick County n.d.b and n.d.c), the latter of which is currently underway. These two communities would be the focus for residential, commercial, and employment development. In addition, the portion of the region east of U.S. 15 is designated as agricultural/rural, with the mountain areas to the west of U.S. 15 mostly designated for resource conservation (Frederick County n.d.b).

Economic Impacts to Agriculture from Deer Damage

Deer Damage to Crops

A variety of agricultural operations occur on approximately 36% of the lands adjacent to the park, including forage and row crops and orchards (see the "Park Location" and "Land Use Areas" maps for locations of adjacent agricultural lands). Agricultural lands to the north and east of the park are predominantly hay and alfalfa (50%); vegetable crops, orchards, and fruits such as strawberries and blueberries (25%); and corn and soybeans (25%). To the east near Thurmont, agricultural lands support orchards, mixed hay and alfalfa, and some corn and soybeans. Hay and corn predominate on agricultural lands to the southwest and west of the park because of the steepness of the terrain (Welsh, pers. comm. 2005). Farms range from approximately 15 acres to 200 acres, averaging approximately 100 acres (Nicholson, pers. comm. 2005). These agricultural landowners have experienced damage to crops and orchards from deer browsing. Common damage to row and forage crops includes foliage, flowers, and crops that are eaten and plants that are trampled (West Virginia University 1985). Neighboring farmers report that the deer population in the area continues to increase and farmers are sustaining more and more crop and fruit tree damage and, ultimately, loss of profits (NPS 2005b).

Agricultural landowners to the north and east of the park have experienced damage to crops and orchards from deer browse. Deer trample plants and eat foliage, flowers, and crops.

To determine the extent of crop damage from deer occurring statewide, 1,000 Maryland grain farmers were randomly selected to receive mail survey in March 1997 (McNew and Curtis 1997). All counties of the state were represented, including central Maryland, which encompasses Frederick, Washington, Carroll, Howard, Montgomery, Baltimore, and Hartford counties. Nearly 92% of farmers statewide indicated that they suffered deer damage in 1996, with the greatest damage reported by farmers in western Maryland and on the lower eastern shore. Table 20 indicates the average harvested yield for 1996 for those farmers surveyed in central Maryland, along with the average yield loss caused by deer (both in bushels per acre and as a percentage of harvested yield).

In central Maryland, including Frederick County, corn yield losses from deer damage averaged 9.2 bushels per acre or approximately 7.4% of the expected 124.5 bushels per-acre yield. Soybean losses were 4.8 bushels per acre, or 11.8% of the expected per acre yield, and wheat losses were the lowest at 1.1 bushels per acre or 2.0% (McNew and Curtis 1997).

Losses per acre increased for some crops between 1996 and 2001. According to data from the Maryland Agriculture Statistics Service (MASS) presented in table 21, yield loss increased from 7.4% to 9.8% for corn and from 2.0% to 5.2% for wheat in central Maryland. Per bushel crop prices in 2001 were $2.18 for corn, $4.20 for soybeans, and $2.45 for wheat (MASS 2004). Thus, per acre losses to deer averaged $20.93 in 2001.

A study conducted in 1982 by Decker and Brown indicated that fruit and berry growers experienced more severe damage than did grain and crop farmers, experiencing losses that were three times greater. However, despite the greater absolute monetary losses, slightly fewer fruit growers than other framers reported losses greater than 10% of the crop value. Fruit growers were twice as likely as other farmers to describe their damage as "substantial" or "severe" and to consider it unreasonable (Lynch 1997).

TABLE 20: 1996 CROP LOSS DUE TO DEER DAMAGE — CENTRAL MARYLAND

Crop	Harvested Yield (bushels/acre)	Yield Loss (bushels/acre)	Yield Loss (percentage of harvested yield)	Losses (× $1,000)[A]
Corn	124.5	9.2	7.4%	3,521
Soybeans	40.6	4.8	11.8%	2,758
Wheat	56	1.1	2.0%	248

Source: McNew and Curtis 1997

Notes: Central Maryland includes Frederick, Washington, Carroll, Howard, Montgomery, Baltimore, and Hartford counties.

a. Dollar losses resulting from deer were determined using figures from the Maryland Department of Agriculture for total grain acreage for each county and region in 1995. Based on the acreages and damage levels suffered by sample farmers, total crop loss was estimated for each region. Regional grain prices at harvest time in 1996 were used to value the losses for each crop.

TABLE 21: 2001 CROP LOSS FROM DEER — CENTRAL MARYLAND

Crop	Harvested Yield (bushels/acre)	Average Yield Loss (bushels/acre)	Yield Loss (percentage of harvested yield)	Economic Loss (× $1,000)
Corn	98.2	9.6	9.8%	2,464
Soybeans	34.0	3.9	9.8%	1,479
Wheat	63.3	3.3	5.2%	310

Source: MASS 2002.

Note: Central Maryland includes Frederick, Washington, Carroll, Howard, Montgomery, Baltimore, and Hartford counties.

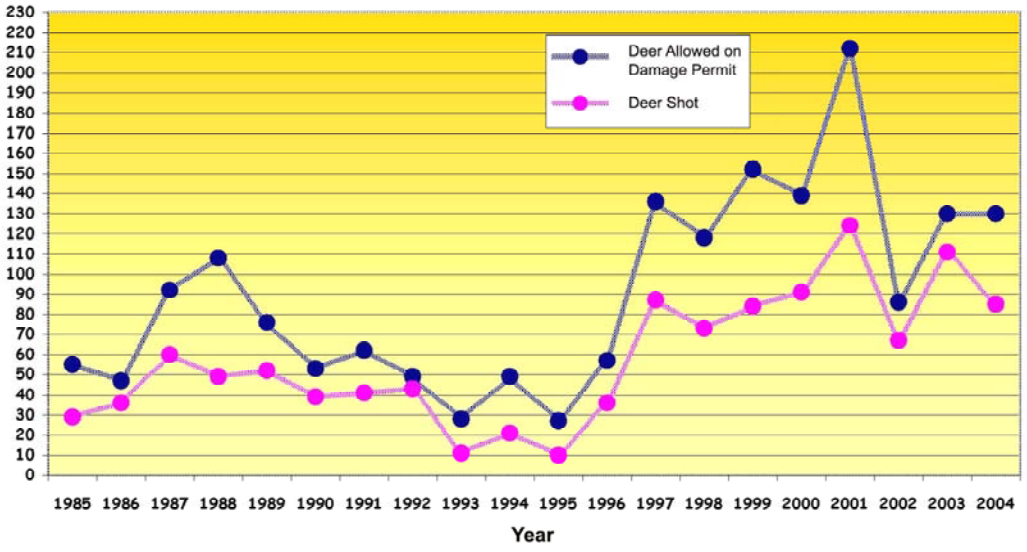
DEER DAMAGE PERMITS

To assist landowners in controlling deer numbers, the Maryland Department of Natural Resources oversees a program to issue deer damage permits. This program allows landowners to reduce the number of deer on their property outside the deer hunting season. An investigator from the MD DNR Wildlife and Heritage Service Wildlife Response staff reviews a landowner's request for eligibility; considers the type, extent, and severity of damage; the time of year; and deer population estimates in the locale before issuing a permit (MD DNR 2004a).

Information dating from 1985 from the Maryland Department of Natural Resources regarding crop damage permits is illustrated in figure 3. The number of deer allowed to be harvested rose fairly steadily, from 12 permits in 1980, to 55 permits in 1985, to 108 permits in 1988 when 49 deer were shot (down from a high of 60 deer in 1987). Beginning in 1989 the number of permits declined, reaching a low of 27 in 1995, and then rose sharply between 1995 and 2001, when 212 permits were issued and approximately 124 deer were harvested. The number of permits stabilized at approximately 130 in 2003 and 2004, but the number of deer harvested varied. After 1987 the number of male deer harvested relative to females changed dramatically, as many more females were allowed to be harvested than males. This change reflected the emphasis by the state on greater issuance of nuisance permits for female deer than for male deer (NPS 1995a; MD DNR 2005c).

In the 1996 crop damage survey only 18% of the farmers responded that they had received MD DNR permits to harvest deer. For those farmers statewide who used the program, 18.8 deer were allowed to be harvested, and an average of 13.4 deer were actually harvested. In central Maryland 15% of the farmers in the six-county region (including Frederick County) received an average of 23 permits per farm. However, on average, only 14.3 permits per farm were used (McNew and Curtis 1997).

The MD DNR deer damage control permits are issued to the farms most severely affected by deer damage. The farms that had lower crop losses did not use hunting as a means for controlling deer numbers (see table 22).



Source: NPS 1995a; MD DNR 2005c.

FIGURE 3: MD DNR CROP DAMAGE PERMIT DATA FOR THE CATOCTIN MOUNTAIN PARK AREA, 1985–2004

TABLE 22: MARYLAND YIELD LOSSES PER ACRE UNDER DIFFERENT CONTROL INSTRUMENTS

Crop	Crop Losses (bushel/acre)			
	No Hunting on Farm	Hunting Allowed on Farm	Received DNR Permits for Deer Harvest	State Average Yield Loss
Corn	2.9	9.2	11.0	8.5
Soybeans	4.5	5.4	6.8	5.1
Wheat	0.3	2.2	2.3	1.5

Source: McNew and Curtis 1997.

ECONOMIC IMPACTS TO LANDSCAPING FROM DEER DAMAGE

Residential areas, including resource conservation areas, also experience pressures from deer browsing. Deer damage shrubs and landscape vegetation by eating the buds, leaves, flowers, and twigs and rubbing on the bark. In home gardens, deer often eat leaves, flowers, stems or other edible parts and trample plants. Other less frequent damage includes trampling of plants and damage to trees and shrubs caused by antler rubbing (West Virginia University 1985). Some park neighbors noted that they were not able to maintain even modest amounts of landscaping in their yards (NPS 2005b).

Deer damage to landscape plants is widespread in the Northeast, but it is not evenly distributed across the landscape. Sayre and Decker (1990) indicated that homeowners with deer impacts reported a median loss of $200 per household in southeastern New York, and about three-fourths of these respondents classified the damage as light to moderate. The average replacement costs for trees and shrubs was nearly $500 for households with deer damage.

PARK MANAGEMENT AND OPERATIONS

The staff of Catoctin Mountain Park are currently organized into four operating divisions: Administration, Resource Management, Resource Education and Visitor Protection, and Maintenance. There are 32 full-time employees (see table 23). The permanent park staff is augmented by a seasonal or temporary workforce, which changes from year to year due to substantial funding variations. Typically, this seasonal workforce has included four to six park rangers, four to five visitor use assistants, one biological technician, two to four laborers, and up to six maintenance workers (Voigt, pers. comm. 2005f; NPS 2004e).

The 2005 and 2006 operating budgets for Catoctin Mountain Park are detailed in table 23. The 2005 information reflects the divisional organization in effect. Operating budgets may vary annually (Voigt, pers. comm. 2005c).

RESOURCE MANAGEMENT

Catoctin Mountain Park currently has one full-time employee with duties solely in resource management and one employee with duties in resource management and visitor protection. The resource management staff currently devote about 10% to 20% of their time to deer management activities, which includes erecting and maintaining small exclosures, applying repellents, conducting annual fall spotlight surveys to determine deer population densities, conducting annual vegetation plot monitoring, conducting winter kill surveys, and euthanizing (when necessary) sick or injured deer. The resource management staff also coordinates volunteers to help conduct annual fall distance sampling / spotlight surveys and vegetation monitoring (Voigt, pers. comm. 2005f; NPS 2004e).

TABLE 23: CATOCTIN MOUNTAIN PARK 2005 AND 2006 OPERATING BUDGETS

Division	Full-time Employees	2005 Operating Budget
Management (Superintendent's Office)	2	$168,258
Administration	4	$308,166
Maintenance	14	$1,031,870
Resource Management	2	$164,414
Interpretation	3	$219,192
Law Enforcement	6	$432,100
Total	**31**	**$2,324,000**
Division	**Full-time Employees**	**2006 Operating Budget**
Management (Superintendent's Office)	2	$170,499
Administration	4	$282,789
Resource Management	2	$167,037
Resource Education and Visitor Protection	10	$726,283
Maintenance	14+	$915,518
Total	**32**	**$2,262,126**

One full-time term (not to exceed one year) employee assigned to the Resource Management division coordinates this project. Funding for this position is not part of the park's operating budget.

Table 24 provides a breakdown of the annual costs allocated for deer management activities.

Seasonal employees relieve some of the resource management and deer management responsibilities of the full-time resource management staff. The nonprofit Student Conservation Association often assigns a volunteer to work at Catoctin Mountain Park for up to 12 weeks during the fall, with duties including deer monitoring, population and distance sampling, and exclosure maintenance (Voigt, pers. comm. 2005d).

Deer management activities are currently conducted by Catoctin's resource management staff.

The NPS Center for Urban Ecology also assists the park resource management staff by providing services related to distance sampling and deer management statistics, such as conducting pellet surveys and providing statistical assistance for vegetation monitoring (Voigt, pers. comm. 2005d). The center, located in Washington, D.C., identifies and responds to the natural resource needs for the National Capital Region and provides monitoring services to parks free of charge. In addition to deer management activities, the center also provides services for such activities as water and air quality monitoring (Voigt, pers. comm. 2005d).

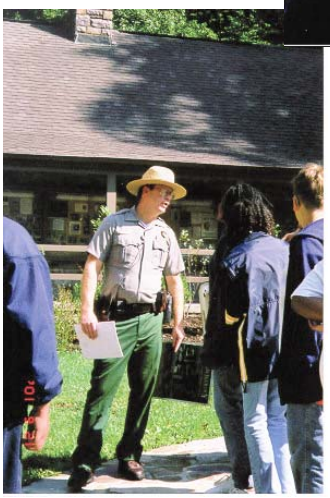
TABLE 24: CATOCTIN MOUNTAIN PARK DEER MANAGEMENT OPERATING BUDGET

Action	Assumptions	Cost / Year
Distance sampling / spotlight surveys	3 nights of survey plus data analysis	$1,000 / year
Vegetation monitoring of existing exclosures	Data collection and analysis	$7,000 / year
Maintenance of existing exclosures	Four visits/year/ exclosure; minimal materials cost (varies by year)	$1,500 / year (labor)
Deer health check	Every 5 years, plus yearly supplemental health monitoring activities	$6,000 / 5 years plus $600 / year
Fencing for species protection	Small exclosures	$120 / year
Repellent use	Limited use around developed/landscaped areas	$80 / year

RESOURCE EDUCATION AND VISITOR PROTECTION

RESOURCE EDUCATION

Catoctin Mountain Park offers a variety of educational and interpretive programs focused on cultural heritage and history, ecology, conservation and land use, and natural history. The park gears these programs toward school groups (first through seventh grades), families, and adults. Several programs are focused specifically on white-tailed deer ecology and management. The park has an interactive computer program, created by park staff, which provides an overview of white-tailed deer ecology. The main themes explored in this program include necessary habitat, digestion, life cycle, antler growth, predator/prey relationships, and carrying capacity. Within the program, students get to "Design a Forest" by selecting habitat components, deer population, and both predator and competitor species. After the model is run, a report is produced defining student results of their "forest," and options for deer population management are explored for the computer model that the students created. These results are then compared to the real-life scenario of deer overabundance within the park, their impact, and potential management options that could be used (Voigt, pers. comm. 2005f).



Catoctin Mountain Park offers a variety of educational and interpretive programs focused on cultural heritage and history, ecology, conservation and land use, and natural history.

In addition to the computer program, the park visitor center runs an interpretive program titled "OH DEER . . ." that is focused toward family audiences and explores the problems associated with the deer population in the park and their impacts on the forest.

Education and interpretation is also provided along the Brown's Farm trail, a short, self-guided interpretative trail at the Owens Creek picnic area. Interpretation along this trail explores several environmental concepts, including the impacts that an overabundance of deer can have on the ecosystem.

VISITOR PROTECTION

Currently there are 10 park rangers with law enforcement commissions at Catoctin Mountain Park. Their responsibilities include tasks associated with forest or structural fire control; protecting property; gathering and disseminating natural, historical, or scientific information; developing interpretive materials for the natural, historical, or cultural features; investigating violations, complaints, trespass/encroachment, and accidents; conducting search and rescue; and managing historical, cultural, and natural resources, such as wildlife, forests, and recreation areas. In addition to these duties, during the deer hunting season, park rangers conduct dawn and dusk patrols within and around the park to help discourage poachers.

Of the ten commissioned park rangers, two have duties in Resource Education and one has duties in Resource Management working directly on deer management activities (Voigt, pers. comm. 2005f).

MAINTENANCE

Of Catoctin's 14 full-time maintenance employees, few perform general maintenance tasks specifically aimed towards deer management, and no maintenance staff employees are currently assigned to perform deer management tasks, such as applying repellents or erecting small exclosures. These activities are carried out by the resource management staff, as described above. Any maintenance services provided to construct or maintain large exclosures or other deer management related tasks considered in this environmental impact statement would require project funding (Voigt, pers. comm. 2005d).

The primary responsibility of the Maintenance Division is to provide for the general upkeep and maintenance of all park buildings and infrastructure, including one visitor center, one campground equipped with an amphitheater, two youth group tent camping areas equipped with pavilions and fire rings, six self-guided trails, 24 miles of hiking trails, five scenic overlooks, 15 miles of roadways with eight parking areas, two maintenance facilities, one park headquarters, four employee housing units for onsite protection and management of park resources and facilities, one fire cache with one general purpose fire truck and one brush truck, and 162 buildings (58 of which are listed on the National Register of Historic Places). Maintenance staff are also responsible for the maintenance and upkeep of three cabin camps having a total capacity of 370 campers, two Adirondack shelters, two picnic areas and three smaller picnic sites, seven water systems (consisting of nine wells), 10 wastewater systems, and connections to two large treatment facilities managed by other jurisdictions, and two electric distribution systems that serve the majority of the park buildings.