

**Amended
Environmental Assessment**

White-tailed Deer Management

on

**Occoquan Bay National Wildlife Refuge
Woodbridge, Virginia**

February 2007

U.S. Department of Interior
Fish and Wildlife Service
Occoquan Bay National Wildlife Refuge
Potomac River National Wildlife Refuge Complex
14344 Jefferson Davis Highway
Woodbridge, VA 22191

Table of Contents

	Background.....	2
I.	The Purpose and Need for the Proposed Action	2
II.	Introduction.....	2
	Purpose of the Refuge	3
	Long-Range Natural Resource Management Objectives.....	3
III.	Need for Proposed Action.....	6
IV.	Alternatives.....	8
	Alternative 1: No Action	9
	Alternative 2: Proposed Action–Controlled Hunt.....	9
	Alternative 3: Professional Removal	9
V.	Affected Environment	9
	Topography and Soils.....	9
	Hydrology and Water Quality	10
	Biological Resources	10
	Human Resources.....	14
VI.	Environmental Consequences.....	15
	Alternative 1: No Action	15
	Alternative 2: Proposed Action–Controlled Hunting	15
	Alternative 3: Professional Removal	16
VII.	Cumulative Impacts Analysis.....	16
	A. Alternative 1 (No Action)	16
	B. Alternative 2 (Control Hunting – Preferred Action).....	18
	C. Alternative 3 (Professional Removal)	23
VIII.	Regulatory Compliance	24
IX.	Consultation and Coordination.....	25
X.	Preparers and Reviewers	25
XI.	References Cited.....	26
APPENDIX		
	Options Eliminated from Further Consideration.....	29

Background

As a result of a 2003 lawsuit filed by the Fund for Animals, the U.S. Fish and Wildlife Service (Service) is required to amend environmental assessments (EA) that describe hunting programs on National Wildlife Refuges (NWR) dating back to 1999. The amendments to the EAs will include a discussion of the cumulative impacts of the program on the species being hunted. This amendment addresses the white-tailed deer management program at Occoquan Bay National Wildlife Refuge, Virginia.

Management of the white-tailed deer population was identified as a wildlife management objective in the Comprehensive Conservation Plan and Environmental Assessment for Occoquan Bay National Wildlife Refuge, issued in December 1997. The Comprehensive Conservation Plan stated that the method of population management would be determined in a separate EA in compliance with the National Environmental Policy Act. The Final Environmental Assessment, White-tailed Deer Management on Occoquan Bay NWR was issued in October 2001.

This document consists of the deer management alternatives as developed and finalized in the 2001 EA followed by the newly required cumulative impacts analysis of the proposed program.

I. PURPOSE AND NEED FOR THE PROPOSED ACTION

The U.S. Fish and Wildlife Service proposes to regulate the growth of the white-tailed deer population on the Refuge through implementation of a deer management plan. Hunting and other management techniques may be involved. The proposed action strives to protect and maintain the unique biota, species diversity and communities dependent upon the Refuges' grassland and wetland habitats by managing the deer herd within the carry capacity of the refuge. This environmental assessment examines potential strategies and programs to manage the deer herd on the refuge as defined in the Comprehensive Conservation Plan (CCP) within a relative index of approximately 50-75 deer. A sound deer management program will help achieve resource management objectives of the CCP and Environmental Assessment for the Occoquan Bay National Wildlife Refuge (December 1997).

II. INTRODUCTION

The 644-acre parcel of land formerly known as the Woodbridge Research Facility and the Marumsco National Wildlife Refuge is located near the confluence of the Occoquan and Potomac Rivers, tributaries to Chesapeake Bay. The research facility, which served as an Army communication and research center for several decades, closed its operations in September 1994 under the Base Realignment and Closure Act (BRAC). Local initiative and support led to the signing of legislation by President Clinton in September 1994, authorizing transfer of the entire facility to the U.S. Fish and Wildlife Service, whereby the parcel became the Occoquan Bay National Wildlife Refuge.

The purposes of the refuge are:

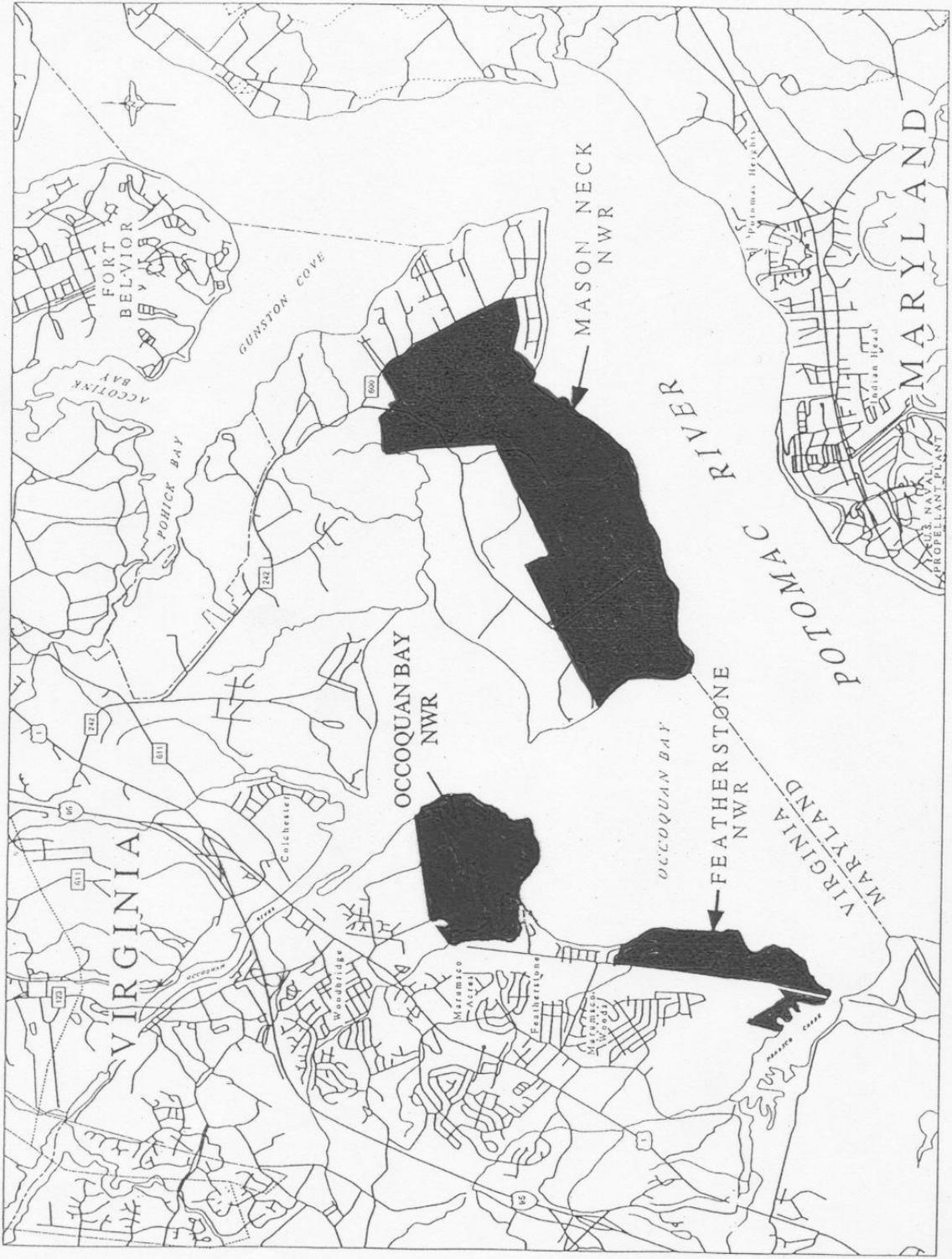
1. To establish a breeding area for migratory birds, inter-jurisdictional fishes, and endangered species.
2. To provide an outdoor classroom to the public with educational opportunities relating to fish and wildlife resources.
3. To provide for other compatible recreational uses including: fishing, wildlife observation, interpretation, and wildlife photography.

The Final Comprehensive Conservation Plan and Environmental Assessment for the refuge (issued in December 1997) included the following long-range natural resource management objectives:

1. Maintain approximately 290 acres in grassland habitat in a variety of successional stages to maximize the potential for the greatest diversity of breeding and migratory bird species.
2. Maintain approximately 180 acres in wetland habitat in the current mix of wetland types for migratory bird species.
3. Provide optimum conditions for migratory birds by maintaining the white-tailed deer population within the habitat carrying capacity.
4. Maintain the desired wetland diversity by evaluating the impact of beaver activity on wetland structure, composition, and water flow through the refuge.
5. Ensure that bald eagles are protected on the refuge.
6. Provide habitat that supports State-listed rare species and species of Service management concern.

The Occoquan Bay National Wildlife Refuge was established by Congress in 1998 in Section 128, Public Law 103-307 and Military Construction Appropriations Act of 1995 - H.R. 4453 (32) Sec. 127. (See maps 1 and 2).

The refuge consists of two bio-physiographic areas: wetlands dominated by a variety of hardwoods and emergent vegetation, and uplands dominated by a variety of grasses and herbaceous/shrub vegetation.



LOCATION MAP
POTOMAC NWR COMPLEX

Fig. 1



Occoquan Bay NWR

III. NEED FOR THE PROPOSED ACTION

Suburban expansion into regions of undeveloped and forested habitats has steadily reduced available habitat for wildlife, pushing normally secretive species such as black bear and white-tailed deer, onto increasingly smaller fragments and into residential communities. For example, the deer population on the 574-acre property of the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland increased by 200 almost overnight when adjacent woodland property was converted into a golf course (Allen Rutberg, Humane Society of the U.S., August 28, 2000, personal communication). Regionally, the deer population in northern Virginia is at a high level, and reports of deer foraging in neighborhoods, deer-related property and crop damage, and highway collisions with deer in northern Virginia have risen sharply over the last two decades.

While it may be argued that the deer problem is not one of overabundance but of undesirable interaction between deer and humans, the fact that optimum habitats in Northern Virginia are shrinking in the face of development cannot be denied, and this taxes the remaining habitats more heavily. One management concern is that ungulate populations generally overshoot the ultimate carrying capacity of the habitat before equilibrium is reached (McCullough 1982). White-tailed deer are more prone to habitat alteration during this process than many other species due to their high reproductive potential (McCullough 1982; McCullough 1997), with substantial impact on the vegetation. Deer foraging habits and preferences can change plant composition and structure over time (Russell and Fowler 1999, Augustine 1998a, Brown and Parker 1997, Van Deelen et al. 1996, Porter 1991a) and such alterations have subsequent impacts on other wildlife, such as songbird species richness and abundance (DeCalesta 1994). This impact is magnified when other factors, such as mild weather, alternative food sources, and reduced annual mortality allow populations to quickly increase in numbers. This results in severe degradation of habitat which can easily be observed on many of the protected lands in the area as evidenced by the distinct browse lines and virtual lack of forest understory.

The intensity of grazing on woody browse in forest fragments is inversely proportionate to the availability of field forbs (Augustine 1998a). Pastures and old fields are vulnerable to overgrazing when deer densities are high because they contain more abundant and higher quality forage, especially in spring and summer (Johnson et al. 1995). Cumulative effects of grazing over successive years may result in reduced plant reproduction and growth (Augustine 1998b) and height (Anderson 1994), which places sensitive plants at risk of extirpation (Augustine 1998b). A protected area with a high abundance of quality forage such as on the Occoquan Bay National Wildlife Refuge sets the stage for potential population irruption and degradation of its grassland vegetation.

In addition to a general decrease in habitat quality, impacts of high deer densities include a decline in overall deer population health as evidenced by decreased body weights, increased occurrence of deformities, increased levels of internal and external parasitism, decreased body fat

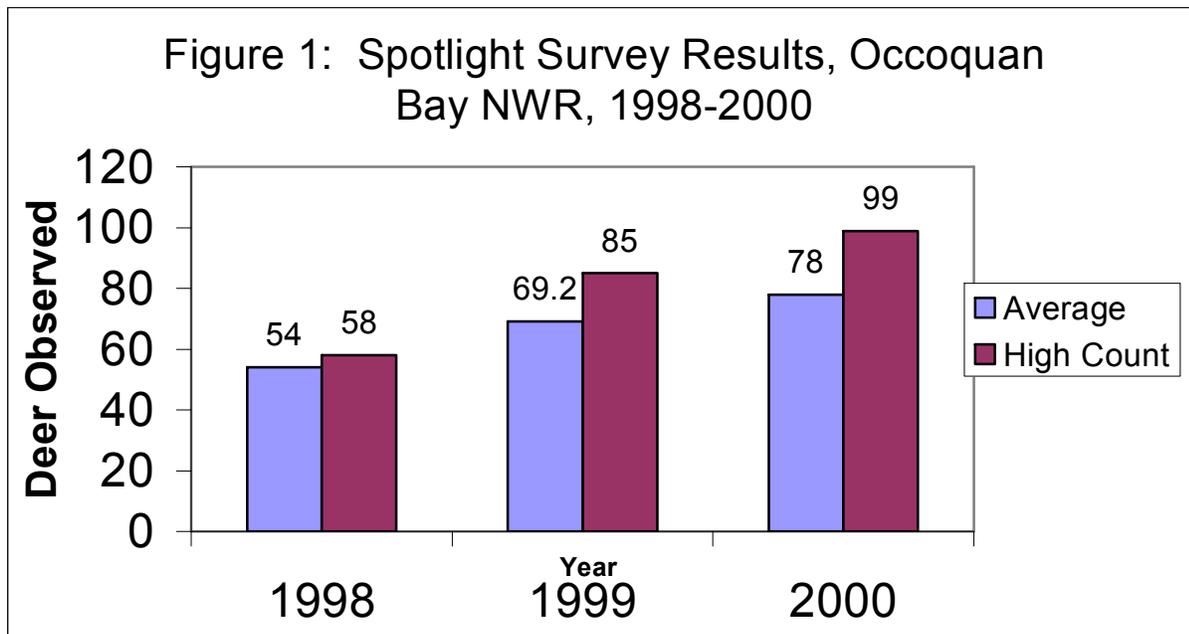
deposits, and disease transmission (Cypher and Cypher 1988, Demarais et al. 2000, Fischer et al. 1995).

If allowed to progress unchecked by natural predators or management, deer reproductive potential can be very high. For example, just one mating pair can grow to 1,000 in 10 years, including natural mortality (Yarrow and Yarrow 1999). Although a weak correlation exists between density and fertility rates (i.e., reproduction declines at high densities), substantial reproduction still occurs when densities exceed 50 deer/km² (or 50 deer/247 acres) (Swihart 1998). This is because of higher number of adult does in the population, and even though they have lower reproduction, collectively they produce a large number of offspring each year. The goal of the refuge, therefore, is to manage the deer herd not only to protect habitat but also to protect the overall health of the herd.

Deer Population Growth at Occoquan Bay National Wildlife Refuge

Deer counts made by the Army ranged between 61 to 157 from 1975 to 1984 and 211 in 1989-1990 (Woodbridge Research Facility Census Data). During the four-year no-hunt period from 1984 to 1989, the population indices greatly increased in size, from approximately 75 (based on Fall 1984 pre-hunt census) to 211 (91 deer harvested in 1989 and 120 counted immediately post harvest). During the subsequent five years of hunting, from 1991 to 1995 (the last year of any hunting on the property), harvest data ranged from 38 to 86 deer. More recently, spotlight surveys conducted by U.S. Fish and Wildlife Service personnel over the last 3 years indicate an increasing population of deer. The high counts on these surveys, conducted on only part of the grassland portion of the refuge, recorded numbers of 58, 84, and 99 deer for 1998, 1999, and 2000 respectively (see Figure 1). The index to the deer density on the Refuge in 2000 would thus be 1 deer per 6.5 acres for the entire 644 acres of the Refuge. This estimate is conservative because it only includes observed deer (there are likely more deer than were observed) and it includes the total acreage of the refuge, some of which is not habitable by deer.

Few estimates of habitat carrying capacity for deer exist and vary, naturally, with habitat type. Carrying capacity is enhanced by the additional forage provided by old fields, from 20 deer/km² (1 deer per 12.35 acres) for those sites that lack old fields, to perhaps 60 deer/km² (1 deer per 4.1 acres) for those that possess 50% old fields (DeCalesta and Stout 1997). These estimates, however, represent a single-species emphasis and do not integrate the needs of other ecosystem components. Recommended indices reported in literature that consider levels at which habitats rebound from deer grazing pressure when determining carrying capacity range from 1 deer per 10 acres (Halls et al. 1984), 1 deer per 12 acres (Harder 1980), to 1 deer per 25 acres (VDGIF 1999). As is apparent, the minimum index to deer density on the Refuge is still considerably higher than the recommended indices reported in the literature, even with the inclusion of inhabitable acreage. Deer counts, based on spotlight survey data and extrapolated to include all of the grassland acreage of the Refuge (not the wetland or forested acreage), grew from 117 in 1998 to 169 in 2000, an increase of 44% or about 15% per year.



IV. ALTERNATIVES

Options Considered but Eliminated from Further Consideration

There were several options that were analyzed and considered during the environmental assessment process but were eliminated as non-viable management options. These include immunocontraception, steroidal implants, oral delivery of contraceptives, GNRH vaccine, sterilization, live trapping and relocation, and habitat management. Please refer to the Appendix for their description and discussion.

Description of the Alternatives

The Service examined the feasibility and impacts of the proposed action and two alternatives, including the no-action alternative, and represents a reasonable range as required by the National Environmental Policy Act of 1969. They reflect management approaches based on existing wildlife populations, existing state and federal regulations, the refuge's purpose and objectives, endangered species considerations, Service policies and guidance, and safety considerations.

Alternative 1: No Action

The Service would manage the refuge without the use of deer hunting, professional removal, or other deer suppression program.

Alternative 2: Proposed Action - Provide a Controlled Hunt for the General Public

This alternative provides for an annual hunt based on the deer population estimates acquired through spotlight surveys, previous hunting success on the refuge (for example, the number of does and bucks harvested), and success or effectiveness of previous hunting techniques (for example, shotgun versus bow). Several approaches will be available to the manager, whereby the manager can choose the most appropriate management strategy to meet the population and habitat goals of the refuge. In addition, the refuge manager may seek assistance from organizations outside the agency to assist in the management of the hunts, so as to meet management goals and objectives based on budgets or time constraints.

As the refuge is situated in a residential area, safety will be given the highest priority in the conduct of the hunt. The hunt will be run similar to that of Mason Neck National Wildlife Refuge, which has operated for 10 years without incident. During the hunt, the Refuge may be closed to all but hunt participants. Hunting will be restricted to designated areas and access to closed areas will be strictly controlled. Such precautions as establishing buffer zones around restricted or sensitive areas, requiring tree stands in certain areas, or setting minimum distance requirements for discharging near buildings and recreation areas may be taken to ensure public safety. All Federal and State hunting regulations and laws will apply. All participants will be required to obtain a permit, issued based on attendance at an orientation on the hunt's rules and regulations and demonstration of shooting competence.

Alternative 3: Professional Removal or Sharpshooting

A refuge-specific professional removal program will be developed that complies with all State and Federal regulations, provides public safety, and poses no conflicts with other recreational uses. The refuge manager will consider various methods for conducting the sharpshooting alternative, particularly with respect to frequency and timing, since deer are capable of responding with avoidance behaviors that diminish marksmen's efforts.

V. AFFECTED ENVIRONMENT

In addition to the following descriptions, more details may be obtained from the Comprehensive Conservation Plan (USFWS, December 1997).

A. Topography and Soils

The topography exhibits a gentle west to east slope of about 10 feet per mile, superimposed on an even gentler north to south slope.

The refuge is located on unconsolidated sands, clays, and silts of the Atlantic Coastal Plain Physiographic Province. The Coastal Plain sediments begin at the Fall Line and thicken to the east and southeast. The sediment is composed primarily of terrace and alluvial deposits from this and the ancestral Potomac River. The cobbles and gravels derive originally from the ancestral Potomac River and include a variety of cherts, rhyolite, silicified sandstone, and quartz. Tributary streams such as the Occoquan River and Marumscoc Creek also carry this material as they cut through the adjacent cobble deposits and quartz float and veins of the Piedmont Plateau and Coastal Plain Physiographic Provinces. The sediments are underlain by undifferentiated Paleozoic meta-sedimentary and meta-igneous rocks. The Army installed two wells into the lower Potomac aquifer in the central part of the refuge and encountered bedrock at a depth of approximately 150 feet below ground surface. Locally, the unconsolidated sediments include the Potomac Group of the Cretaceous age, which are overlain by terrace and alluvial deposits of Pleistocene and Holocene age. The general soil types found on the refuge are the Dumfries-Lunt-Marr soil association (Prince William County USDA Soil Survey 1989).

B. Hydrology and Water Quality

The refuge is located at the mouth of the Occoquan River. Occoquan Bay borders the facility to the south. Belmont Bay, which is located on the facility's northeast side, is mainly fed by the Occoquan River. Marumscoc Creek borders the refuge to the southwest and drains into Occoquan Bay. The facility is also bisected by Catamount Creek originating from residential, partly industrialized, and golf course areas to the north. This creek flows through the refuge and is fed by several smaller tributaries before discharging to Belmont Bay. Several additional drainage ditches are found on the property. These waters are tidal tributaries of the Potomac River.

The lithology of the bottom sediment within Marumscoc Creek and the drainage ditches located on the refuge is controlled by current-velocity distributions. Coarse-grained materials are typically found in the areas where current velocities are insufficient to transport them and yet sufficient to transport the fine-grained materials. Organic-rich, fine grained material settles out of suspension in more dormant areas of the creek and drainage ditches. Tidal currents in Belmont and Occoquan Bays are such that their bottom sediments are composed of sand which is coarser along the shoreline due to wave action.

C. Biological Resources

1. Plant Communities

There are 20 vegetative communities at the refuge, with wetland habitats covering about 50 percent of the site (CCP, Comprehensive Conservation Plan 1997). Habitat categorization, map delineations, and acreage calculations were completed during the CCP process. Transitions between vegetative communities on the refuge are largely the result of differing hydrological

regimes. Tidal influences on the refuge are significant because 67 percent of the refuge lies below the 100-year flood plain elevation (US ARMY October 1992, page 3-221). Listed below are seven descriptions of the most dominant vegetative communities on the refuge, i.e. those which were equal to or greater than 30 acres.

Area 1 is 30 acres in size and is composed of two intermittent channels draining south from the east side of Dawson Beach Road. Except for the forested band along each channel, the area was traditionally mowed several times during the spring and summer. Common observed woody species include black gum (*Nyssa sylvatica*), northern arrowwood (*Viburnum recognitum*), sweetgum (*Liquidambar styraciflusa*), and red maple (*Acer rubrum*). Herbaceous species found in this habitat include soft rush (*Juncus effusus*), orchard grass (*Dactylis glomerata*), Virginia creeper (*Parthenocissus quinquefolia*), tickseed sunflower (*Bidens spp.*), and umbrella sedge (*Cyperus spp.*).

Area 3 is 103 acres in size and is an open field covering much of the area adjacent to the northern boundary of the refuge. Historically (prior to 1996), the area was mowed once annually. Dominant species include sweetgum saplings, eastern gamma grass (*Tripsacum dactyloides*), jointgrass (*Manisuris cylindrica*), dropseed grass (*Muhlenbergia expansa*), and bush clover (*Lespedeza capitata*).

Area 4 is 30 acres in size and is a forested tract in the northeast corner of the refuge. The dominant woody species include persimmon (*Diospyros virginiana*), sweetgum, and northern arrowwood. Herbaceous species along the stream channel include jointgrass, dropseed grass, barnyard grass, and Christmas fern (*Polystichum acrostichoides*).

Area 8 is 120 acres in size and is dominated by shrubby and emergent growth with occasional interspersions of tree species on islands that is tidally influenced covering most of the shoreline of Belmont and Occoquan Bays. Dominant species include marsh mallow (*Hibiscus moscheutos*), swamp rose (*Rosa palustris*), button bush (*Cephalanthus occidentalis*), spatterdock (*Nuphar luteum*), pickerelweed (*Pontederia cordata*), silky dogwood (*Cornus amomum*), and black willow (*Salix nigra*). The islands are dominated by green ash (*Fraxinus pennsylvanica*), sycamore (*Plantanus occidentalis*), black willow, and silver maple (*Acer saccharinum*).

Area 10 is 38 acres in size and is a transitional area between a tidal community (Area 8) and an open field community in the main compound (Area 12). The community contains a mixture of trees, shrubs, and herbaceous species. The most common species is the persimmon. Other common species include sweetgum, silky dogwood, black willow, jointgrass, and yellow foxtail (*Setaria glauca*).

Area 13 is 153 acres in size and is a drier grassland that is upslope of the floodplain and was historically mowed by the Army at least twice a year. Dominant vegetation consists of various herbaceous species, including broomsedge (*Andropogon virginicus*), yellow foxtail, and bush clover.

Area 20 is the 74-acre Marumsco Creek tidal marshland containing open marsh plants.

Invasive, non-native plants found on the refuge include Phragmites (*Phragmites australis*), Japanese knotweed (*Polygonum japonica*), Japanese clematis (*Clematis japonica*), Tree of Heaven (*Ailanthus altissima*), autumn olive (*Elaeagnus umbellatus*), crown vetch (*Coronilla varia*), wedge-shaped lespedeza (*Lespedeza cuneata*), bicolor bush clover (*Lespedeza bicolor*), and honeysuckle (*Lonicera japonica*).

2. Birds and Mammals

Over two hundred species of birds have been observed on the refuge by a variety of local organizations (Virginia Ornithological Society, Audubon Naturalist Society, and Prince William Natural Resource Council). The meadows along the northern boundary of the refuge provide particularly high quality foraging habitat for raptor species, such as the Red-tailed Hawk (*Buteo jamaicensis*) and American Kestrel (*Falco sparverius*), while the meadow southwest of the compound area appear to be favored as foraging habitat for the Northern Harrier (*Circus cyaneus*) during the winter. The grasslands also provide potential nesting habitat for several declining grassland species (grasshopper sparrow *Ammodramus savannarum*; vesper sparrow, *Pooecetes gramineus*; and eastern meadowlark, *Sturnella neglecta*). Other birds of particular interest include the wood duck (*Aix sponsa*), barred owl (*Strix varia*), pileated woodpecker (*Dryocopus pileatus*), and prothonotary warbler (*Protonotaria citrea*).

Forty-eight species of mammals are known or are expected to occur on the refuge (CCP 1997), with white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), red fox (*Vulpes vulpes*), beaver (*Castor canadensis*) and meadow voles (*Microtus pennsylvanicus*) commonly found.

Twelve species of salamanders, 13 toads and frogs, 8 turtles, 6 lizards, and 19 snakes are expected to occur on the refuge (CCP 1997).

In 1987, a fish survey of nearby Gunston Cove identified several species of fish including white perch (*Morone americana*), blueback herring (*Alosa aestivalis*), bay anchovy (*Anchoa mitchilli*), spottail shiner (*Notropis hudsonius*), and pumpkin seed (*Lepomis gibbosus*).

The refuge hosts many individual invertebrate species, but this taxon is the least studied and understood group of animals on the refuge. However, Kim Hosen and members of the Prince William Natural Resources Council, Inc. have compiled a butterfly list comprised of over 50 species observed within the refuge.

3. Threatened and Endangered Species

As of November 30, 1999, at least one federally-listed species had been documented within the Refuge boundaries, the Bald Eagle (*Haliaeetus leucocephalus*, status "Threatened"), an

occasional spring and summer resident and a common winter resident of the Refuge. There are no known historical nests on the Occoquan Bay National Wildlife Refuge, although they are known to nest across the bay on Mason Neck National Wildlife Refuge. Three other federally-listed species are likely to occur at Occoquan Bay (see list below). Terwilliger (1991) and Underwood (1997) provide the most current and comprehensive information on threatened, endangered, or species recommended for special concern for the state of Virginia. The following list is comprised of those species occurring in Prince William County on or near the refuge. Those indicated with (*) are also federally listed as endangered or threatened:

Birds:

Little Blue Heron (*Egretta caerulea*)
Great Egret (*Casmerodius albus*)
Glossy Ibis (*Plegadis falcinellus*)
Least Tern (*Sterna antillarum*)*
Forster's Tern (*Sterna forsteri*)
Caspian Tern (*Sterna caspia*)
Barn Owl (*Tyto alba*)
Northern Harrier (*Circus cyaneus*)
Bald Eagle (*Haliaeetus leucocephalus*)*
Loggerhead Shrike (*Lanius ludovicianus*) *
Bank Swallow (*Riparia riparia*)
Henslow' Sparrow (*Ammodramus henslowii*)
Yellow-Crowned Night Heron (*Nycticorax violaceus*)

Plants:

Eared Tomanthera (*Tomanthera auriculata*)
Ginseng (*Panax quinquefolium*)
Small-Whorled Pogonia (*Isotria medeoloides*)*
Virginia Nailwort (*Paronychia virginica*)
Epiphytic Sedge (*Carex decomposita*)

Mammals:

Star-Nosed Mole (*Condylura cristata*)
Fox Squirrel (*Sciurus niger*)*
River Otter (*Lutra canadensis*)

Arthropods:

Flints Common Stonefly (*Acroneuria flintii*)
Opuntia Squash Bug (*Chelinidea vittiger*)
Regal Fritillary (*Speyeria idalia*)

Reptiles:

Wood Turtle (*Clemmys insculpa*)

Mollusks:

Green Floater (*Lasmigona subviridis*)

Fish:

Bridle Shiner (*Notropis bifrenatus*)

4. Fish

No extensive surveys were conducted for fish species in the proposed project area. However, surveys of the fish fauna conducted at nearby Gunston Cove in 1987 identified species such as the White perch (*Moreone americana*), Blueback herring (*Alosa aestivalis*), Bay anchovy (*Anchoa mitchilli*), Spottail shiner (*Notropis hudsonius*), and Pumpkin seed (*Lepomis gibbosus*), which are likely to occur in the aquatic habitats of the refuge. In the summer of 1997, a survey of the fishery resources on the refuge by the Service's Fisheries Assistance Office confirmed the above list of species.

D. Human Resources

1. Land Use and Socioeconomic

Prince William County is one of the fastest growing counties in the Commonwealth of Virginia, with more than 262,000 residents. Since 1990 the population has been increasing at a rate of 3.2%, and in 1990 was the 168th most densely populated of the 3,141 like jurisdictions in the United States. The unemployment rate in 1997 was 2.6% and the labor force in July of the same year was 139,089. The county consists of 222,305 acres of land and 5,120 acres of water. Two incorporated cities are located near the Occoquan Bay NWR, Dumfries and Manassas, with the refuge being located in an unincorporated city of Woodbridge (Vicinity Map). Washington lies approximately 20 miles north of the refuge, and Richmond lies 90 miles south. The refuge is also within driving distance of several large urban concentrations. To the south is Richmond, VA, and to north are Washington, D.C., Baltimore, MD, and Philadelphia, PA.

The economic base within the vicinity of the refuge is dominated by military bases and defense-related activities with support related services and manufacturing. Small entrepreneur, trade, retail sales, and service industries are also important, and tourism is important as the refuge is relatively close to the Washington D.C. metropolitan area.

2. Cultural and Historic Resources

Historical records of the property which comprises the present-day refuge date back to the late 17th century when Martin Scarlet purchased approximately 700 acres (including the refuge) from Captain Edward Streater. The land (referred to as Deep Hole Point) was used primarily for tobacco farming for nearly a century. In 1765 the land was transferred to Colonel John Taylor in whose name the property remained until the Civil War. During the Civil War, Confederate artillery batteries were constructed in the vicinity of the refuge. When the war ended, the refuge land returned to farming, and farm residences and outbuildings were present on the site. Fishing ports were also located along the southern shoreline. In 1908, J. Lindsay Dawson purchased the farmland for raising cattle. Raising cattle and commercial fishing ended in 1950 when the Army acquired title to approximately 648 acres of land for use as a military radio station.

There was no consideration of wilderness designation for Occoquan Bay NWR. The conditions and setting of the refuge do not meet any minimum standards for the designation, according to the Wilderness Act of 1964 (determination made in CCP 1997).

3. Recreation Resources

Viewed from above (Map 1), the refuge is located on a neck of land west of the Potomac River between Occoquan Bay and Belmont Bay. Approximately 40 percent of the refuge's shoreline borders on Belmont Bay, and the remaining 60 percent lies along Occoquan Bay. Both

shorelines have visual and aesthetic value to recreational boaters along the Occoquan River and Potomac River.

Presently, outdoor recreational activities are limited to a hiking/walking loop around the savanna/wetlands near the southern center of refuge. In the future, additional areas of the refuge will be opened on a rotating basis as sensitivity of breeding species of wildlife permits.

VI. ENVIRONMENTAL CONSEQUENCES

Alternative 1: No Action

Disadvantages of the no action alternative include negative long-term effects such as potential for disease epidemic, increase in automobile accident rates, and browsing pressure on vegetation, which will affect abundance and distribution of species. The latter would have continued effects on composition of forest canopy even well after a population decline, should one occur. Grassland cover would quickly regenerate (Porter 1991); however, species composition may be permanently altered. A no-action approach carries the risk of allowing the population to exceed carrying capacity and may result in significant declines in deer health and in severe habitat degradation (Demarais et al. 2000, Cypher and Cypher 1988). The rapid rate at which deer populations are capable of expanding was already emphasized above. The no-action alternative would be favorable to that segment of the public which opposes hunting programs on National Wildlife Refuges. However, allowing overpopulation to occur is negligent management of the Refuge's other resources.

Alternative 2: Proposed Action - Controlled Hunting

Based on a nationwide survey of all states in the United States published in 1992, deer were effectively controlled with hunting and habitat manipulation in many areas where they were overpopulated. The remaining overpopulated herds were either not hunted, had an inadequate doe harvest, or inadequate harvest (Krausman 1992). In a 10-year study in northwestern Pennsylvania examining the impacts of varying densities of deer on deer health and habitat, starvation mortality resulted when densities reached higher than 25 deer/km². Also, species richness and abundance of shrubs and herbaceous vegetation was shown to decline when deer densities reach between 4-8 deer/km² (DeCalesta and Stout 1997). No prevention or control of epizootic hemorrhagic disease exists to date except by keeping populations below the carrying capacity. It is anticipated, therefore, that deer quality, deer health, and habitat would be enhanced by reduced numbers competing for resources. It is not likely that hunting will reduce the population to such low levels as to place it at risk because, despite fencing around the property, the population is relatively open. No adverse impacts to vegetation from trampling from hunters is likely, as most species will have senesced or become dormant. Neither are soils and water quality expected to experience any negative effects under this alternative. The deer hunt would occur outside of the breeding period of most species, thereby avoiding any potential disturbance. Although bald eagles forage along its shores, the species does not nest at Occoquan Bay NWR.

No adverse effects on migratory birds, inter-jurisdictional fishes, and endangered species are anticipated as a result of establishing a hunt program. Habitat use by birds, small mammals, and reptiles may experience some disturbance, but it is expected that this will be temporary and normal use will resume shortly after the hunt closes.

Reducing the deer population will benefit the surrounding human community by reducing grazing on residential landscape vegetation and by reducing potential for Lyme disease transmission. At high densities, deer may act as a host reservoir for Lyme-disease bearing ticks (Jones et al. 1998). The refuge may be closed to other public uses during the hunt. A controlled hunt would allow the refuge to manage the deer population while providing the public with a quality wildlife-dependent recreational opportunity, as is consistent with the requirements of the National Wildlife Refuge Improvement Act of 1997.

Alternative 3: Professional Removal/Sharpshooting

Professional removal with marksmen can be very efficient and cost-effective (Cypher and Cypher 1988) if performed by experts that are well-equipped, trained, familiar with deer behavior and the terrain, and familiar with use of bait stations (Earl Hodnett, Biologist, Fairfax County, VA, personal communication, August 29, 2000). Fairfax County, VA, uses sharpshooting in combination with managed hunts to increase efficiency of both methods. In general, this alternative will have the same impact as the controlled hunt but is expected to involve fewer personnel. No adverse impacts to habitat and wildlife, or existing public recreation are anticipated except that sharpshooting does deprive the public of hunting as one source of wildlife-dependent recreation. This alternative may be more costly than a public hunting program, particularly if outsourcing is required for equipment and personnel.

VII. Cumulative Impacts Analysis

A. No Action (Alternative 1)

1. Anticipated Direct and Indirect Impacts of Proposed Hunt on Wildlife Species

Under this alternative the refuge would not control the deer population which would be allowed to expand until regulated by some outside factor such as disease, weather, or malnutrition. While there are no impacts related to a control program there would be impacts relative to deer density on habitat and related wildlife. Due to limited home ranges, high refuge deer populations will have no affect on regional populations.

Overpopulation will result in decreased herd health and greater susceptibility to disease, disease spread, and starvation. Data collected from deer on the refuge and analyzed by Virginia Department of Game and Inland Fisheries (DGIF) staff show that the overall health and condition of the refuge deer population is fair at best and in poorer condition than in other areas in Northern Virginia. Continued decline in deer condition can be expected as deer densities increase.

High deer densities will have a negative effect on plant composition and structure. Current density estimates on the refuge are from 2 to 4 times the recommended indices reported that consider levels at which habitats rebound from deer grazing pressure. Continued high or increasing densities will result in habitat degradation from over browsing and can result in elimination of plant species preferred by deer.

Migratory and Non-migratory Birds

Due to the different types of preferred habitat, high deer densities would not significantly impact waterfowl. Long term over-utilization by deer will negatively impact habitat conditions for other bird species on the refuge. These impacts may alter bird use of the refuge during migration, wintering or nesting. The effect on bird species may range from complete avoidance of the area, to reduced numbers, to improvement of habitat for some species. A decrease in overall species richness and diversity can be expected.

Resident Wildlife

Wildlife on the refuge includes reptiles, amphibians, invertebrates such as dragonflies and butterflies, and small mammals from mice to foxes. While the refuge does not expect significant impacts to other wildlife related to high deer densities, these impacts are difficult to predict. Some species may find more favorable conditions related to food or prey abundance, or favorable habitat and foraging conditions, while the opposite may be true for other species.

Endangered Species

The bald eagle (currently threatened) uses the refuge for roosting and feeding. No direct or indirect impacts are expected.

2. Anticipated Direct and Indirect Impacts on Refuge Programs, Facilities, and Cultural Resources.

The public would not have the opportunity to harvest a renewable resource or participate in wildlife-oriented recreation that is compatible with the purposes for which the refuge was established. There would be no potential conflicts with other refuge programs or user groups. Refuge visitors would see more deer in larger groups which would be viewed by some as a benefit. There would be no additional impacts or costs associated with refuge roads and facilities over those already incurred or expected from current refuge programs.

Since there would be no additional programs or management activity under this alternative, there would be no impacts to cultural resources on the refuge.

3. Anticipated Impacts on Refuge Environment and Community

The refuge environment consists of soils, vegetation, air quality, water quality and solitude. As previously discussed, vegetation would be negatively impacted by over grazing/browsing by deer.

Since there would be no change to the current refuge program, the refuge staff expects no additional significant, adverse impacts under this alternative on the refuge environment.

Community

Nearby residential areas will incur increased landscape impacts due to deer browsing on shrubs, flowers, and vegetables in garden plots. The neighboring golf course will suffer the same impacts as well as increased incidents of deer injured while attempting to gain access to fenced areas. While area streets are mostly residential with lower speed limits, a larger deer population can be expected to have a corresponding increased in deer/vehicle collisions.

4. Other past, present, proposed, and reasonably foreseeable hunts and anticipated impacts.

No cumulative impacts under this alternative.

5. Anticipated impacts if individual hunts are allowed to Accumulate. No cumulative impacts under this alternative.

Cumulative Impact Summary: The refuge would not achieve the goal of management of the deer population as stated in the Occoquan Bay NWR Comprehensive Conservation Plan. Deer densities would increase while deer health/condition would decrease. Refuge habitat would be degraded affecting both plant and bird species richness and diversity. There would be an increase in deer depredation of plants and shrubs in the local residential area. No additional cumulative impacts on other refuge programs, facilities, or wildlife is expected.

B. Provide a Controlled Hunt for the General Public (Alternative 2)

1. Anticipated Direct and Indirect Impacts of Proposed Hunt on Wildlife Species

The two primary goals of the deer management program are to reduce the ecological impact of deer on the habitat and other species of wildlife and to improve overall health of the deer population. The negative impact of high deer densities on plant composition and structure, and subsequent impacts on wildlife species richness and abundance are well documented in the scientific literature. Density estimates on the refuge are from 2 to 4 times the recommended indices reported that consider levels at which habitats rebound from deer grazing pressure. Overpopulation will also result in decreased overall herd health and greater susceptibility to disease, disease spread, and starvation. Data collected from deer on the refuge and analyzed by Virginia Department of Game and Inland Fisheries (DGIF) staff indicate that the overall health and condition of the refuge deer population is fair at best and in poorer condition than in other areas in Northern Virginia. DGIF biologists recommended a reduction in population levels to improve overall condition.

A. Regional Impacts

Statewide populations have averaged between 800,000 and 1,000,000 deer for over a decade with an average harvest of over 200,000 during this period. In Northern Virginia (Prince William, Fairfax, and Loudoun Counties), high population levels have prompted DGIF staff to implement liberal harvest regulations and extend the hunting season in an effort to reduce deer populations. Fairfax County has also implemented managed hunts and/or sharp shooting operations in many of their county and regional parks in response to impacts on habitat. Due to limited home range size, hunting of local deer populations does not impact regional populations. This fact has been demonstrated on the nearby Mason Neck peninsula. Over 15 years of hunting on Mason Neck NWR and Mason Neck State Park has shown no impacts to deer populations on the rest of the peninsula (Earl Hodnett, Fairfax County Biologist, pers. comm.).

B. Refuge Harvest

The refuge will attempt to harvest approximately 50 deer annually to reach the target population of approximately 75 animals as identified in the CCP. This population level was determined by using standard density indices' and positively adjusting them to account for the diversity of habitat on the refuge which includes significant acreage of grasslands. The refuge then took the upper limit of the resulting range of densities to establish the maximum deer population. Thereafter, harvest levels will be adjusted to maintain the population, age, and sex characteristics of a healthy deer herd through consultation with DGIF. Impacts of this program will improve overall health of the deer herd, reduce impacts on habitat and wildlife species diversity and composition, and reduce browsing impacts to shrubs and gardens in neighboring residential areas. The impact of hunting on the refuge is insignificant when compared to the State management goals for the surrounding Northern Virginia area.

C. Other Wildlife

Hunting of white-tailed deer is the only hunting program permitted on the refuge. All other species are protected by law and take is prohibited. Non-hunted wildlife includes migratory and non-migratory birds, small mammals, reptiles, amphibians, and invertebrates. There are no direct impacts to any non-hunted species as the proposed action occurs during the winter months, outside of nesting, breeding, or rearing seasons and after any seasonal migration period. Only indirect impacts will be addressed.

Migratory Birds

There are varying numbers of waterfowl, wading birds, raptors, etc. that utilize the refuge during the winter depending on the weather. Indirect impacts could include disturbance to the daily wintering activities of any birds on the refuge, such as feeding and resting. Hunters are assigned to specific deer stands and are not allowed to walk through the refuge and there are areas where hunters are not placed. Any disturbance would be short-term and minimal as birds would have easy access to nearby disturbance-free areas.

Non-Migratory Birds

Due to the timing of the hunt and limited home ranges there would be no effect on regional populations. Indirect impacts could include disturbance to daily activities such as feeding and

resting. The structure of the hunt program allows less than 25 hunters per hunt day. The potential impact at this level will be minor and would likely be less than impacts from general refuge visitation. There will be no cumulative indirect impacts from this program.

Amphibians, Reptiles, Invertebrates

Hibernation or torpor by cold-blood reptiles and amphibians limits their activity during the hunting season when temperatures are low. Hunters will rarely encounter reptiles and amphibians, even during unseasonable warm weather conditions. Invertebrates are also not active during cold weather and will have few interactions with hunters during the hunting season. There will be no indirect impacts on these species.

Small Mammals

Regional effects are not applicable to small mammals due to home range size. Small mammals such as mice, voles, bats, etc. are not as active during the winter months when hunting season occurs. Hunter interactions with small mammals are rare and when occurring will result in minor short-term disturbances. Encounters with other wildlife such as foxes, raccoons, skunks, etc. will be infrequent. Impacts will be restricted to interruptions of daily activities such as hunting, foraging, or resting. These will be minor short-term disturbances that will have little impact on the animal. There will be no indirect impacts.

Endangered species

The Bald eagle is the only threatened or endangered species that occurs on the refuge. A Section 7 Evaluation was conducted in association with this assessment and the accompanying Decision Document Package for White-tailed deer Management on Occoquan Bay NWR. It was determined that the proposed alternative will not likely adversely affect this species. Bald eagles currently utilize the refuge for roosting or feeding, usually along the shoreline, and there are no active nests. If nesting activity is observed, that area would be closed to all public activities including hunting. Hunting has occurred on Mason Neck NWR for over 15 years, following the same restrictions, without any adverse impact on eagles.

2. Anticipated Direct and Indirect Impacts on Refuge Programs, Facilities, and Cultural Resources.

Refuge Programs

As public visitation and participation in activities expand, conflicts between user groups and refuge management actions may occur. Refuge programs are adjusted to eliminate or minimize the conflict whenever possible. Examples include area or refuge closures during prescribed burning, restrictions on roads or trails during maintenance activities, to protect sensitive species during nesting, closure during storms, etc.

The refuge would be closed to the public during the days the hunt is conducted. This closure would encompass approximately 5 days spread over a several month period during the winter when refuge visitation is low due to weather. In addition, part of the hunt is conducted on

weekdays when visitation is further reduced. At this time of year, visitation averages 60 visitors per day on weekends and is significantly lower on weekdays. Within eight miles of the refuge there are two State Parks, two county parks, two regional parks, a National Park, and a Bureau of Land Management special recreation area where the public could go when the refuge is closed. The closure of the refuge for a few days will not result in a significant impact to other refuge programs or visitation opportunities.

Refuge Facilities

Existing facilities such as roads and parking areas are used during the hunt. No new facilities are planned to support this program. Use of refuge roads during the hunt increases slightly over normal use and is comparable to the use received during events such as the fall festival. This will require minimal maintenance and no cumulative direct or indirect impacts will occur.

Cultural Resources

There are no known cultural resource sites on the refuge. Potential archaeological or historical sites are protected by the National Historic Preservation Act. The Service's policy is to preserve these cultural, historic, and archaeological resources in the public trust, and avoid any adverse effects wherever possible. No direct or indirect cumulative impacts to refuge cultural and historical resources will occur.

3. Anticipated Impacts on Refuge Environment and Community

The refuge staff expects no significant, adverse impacts of the proposed alternative on the refuge environment which consists of soils, vegetation, air quality, water quality and solitude. Hunting would benefit vegetation as it is used as a tool to keep deer populations in balance with the habitat's carrying capacity.

Air and Water Quality

Impacts to air and water quality will be minimal and only due to refuge visitors' automobile emissions and run-off. The effect of this, as well as other management activities, will be insignificant compared to the contributions of industrial centers, power plants, and non-refuge vehicle traffic of the Northern Virginia/Washington D.C. metropolitan region.

Community

Impacts on solitude associated with noise from gun shots are expected to be minimal. The property was hunted by the Army prior to transfer to the Service and nearby residents are accustomed to any possible noise disturbance. It is also likely that most residents do not distinguish between the potential disturbance from the hunt and that generated from the nearby waterfowl hunting occurring along the river.

Nearby residential areas could expect a reduction of landscape impacts due to deer browsing on shrubs, flowers, and vegetables in garden plots. The neighboring golf course would likewise expect a reduction of the same impacts as well as decreased incidents of deer injured while

attempting to gain access to fenced areas. While area streets are mostly residential with lower speed limits, a smaller deer population can be expected to have a corresponding decrease in deer/vehicle collisions.

Economic

The hunts would result in a net gain of public hunting opportunities. While some increase in local revenue is possible, the refuge does not expect it to be significant as most hunters are local and will travel to and from the refuge without requiring lodging or other amenities other than occasional meals.

4. Other past, present, proposed, and reasonably foreseeable hunts and anticipated impacts

Previous Hunts

Prior to transfer to the Service, the property was a research facility operated by the Army. The Army conducted hunts to control the deer population. The last hunt occurred in 1995 when the facility was identified for closure under the Base Realignment and Closure Act. The rapid increase in the deer population after the end of the hunt would indicate no cumulative impacts from the previous hunts.

Current and Future Hunts

The proposed deer management hunt would be expected to continue indefinitely. While the number, age, and sex of deer harvested would be adjusted once population goals are reached, the high reproductive potential of the deer population would necessitate an ongoing control activity of some type. Cumulative impacts of long term deer management would be lower deer densities, improved deer condition indexes, and reduced impacts to vegetation.

Foreseeable Hunts

There are no other planned or foreseeable hunts or actions that would impact this species.

Other Actions

Under the Army's management, large areas of the property were mowed on a regular basis for security and fire control purposes. This provided higher nutrient, young grass fields for deer to utilize on a year round basis. Under Refuge management, the fields were allowed to mature and were mowed or burned on a rotational basis to control woody vegetation while maintaining the grassland areas. While this increased the habitat value by providing cover, nesting, foraging, resting, and wintering habitats for a variety of wildlife, it decreased the quantity of nutrient-rich grass, browse, and forbs available for deer. The cumulative impact of this will be a long term decrease in the density of deer that can be supported while maintaining good overall herd health.

5. Anticipated impacts if individual hunts are allowed to Accumulate.

There should be no negative cumulative impacts related to this program. Condition of both individuals and the deer population as a whole are expected to improve. Plant structure and composition along with associated wildlife species is expected to improve. Refuge visitors will see fewer deer and smaller numbers of deer at any one time. However, since the target goal of 75 animals is a significant population on a refuge this size, the impact to the overall wildlife observation experience will be minimal.

Cumulative Impact Summary: The refuge would achieve the white-tailed deer management objective as directed in the Occoquan Bay NWR Comprehensive Conservation Plan. Deer densities would decrease while deer health/condition would be increased. There would be positive impacts on refuge plant composition and structure with corresponding positive impacts on refuge wildlife diversity. There are no direct impacts to other wildlife. Indirect impacts will be restricted to short term, minor disturbances of daily activities. The controlled hunt would provide an additional wildlife dependent recreational opportunity for the general public. Other public use programs will experience a minor reduction of opportunities for several days during the winter. Impacts to refuge facilities will result in minor maintenance related upkeep of roads. Nearby residential areas will observe a decrease in deer deprivation of plants and shrubs. There will be no cumulative impacts on Regional or State deer populations.

C. Professional Removal or Sharp Shooting (Alternative 3)

Generally the impacts of this alternative will be the same as with the proposed hunt program. There are some differences due to how the program is conducted and timing of the activities. Only these differences are discussed.

1. Anticipated Direct and Indirect Impacts of Proposed Hunt on Wildlife Species

The impacts of this alternative are the same as described for alternative 2 (hunting). Removal programs are often conducted at night with the aid of spotlights. Activities related to this action are more intense but of a shorter duration than with general hunt program (i.e. 2 nights versus 5 days). Potential disturbance of non-hunted wildlife would be less than with a hunting program. Typically nocturnal species (such as owls and opossums) would have an increased disruption of their daily activities as compared to the hunting program. This disturbance would be minor short term disturbances and would not have a negative cumulative effect on the animal.

2. Anticipated Direct and Indirect Impacts on Refuge Programs, Facilities, and Cultural Resources.

The impacts of this alternative are the same as described for alternative 2 (hunting). Since the management actions are conducted by professionals, the public would not have the opportunity to harvest a renewable resource or participate in wildlife-oriented recreation that is compatible with the purposes for which the refuge was established. Control actions would typically be conducted at night which would eliminate potential user group conflicts as the refuge would not be closed during the day.

3. Anticipated Impacts on Refuge Environment and Community

The impacts of this alternative are the same as described for alternative 2 (hunting). There would be increased trampling of vegetation, especially in grasslands, due to recovery of harvested animals. No adverse impacts to vegetation is expected as most species will have senesced or become dormant. If vehicles are used to recover animals they would be low ground pressure all terrain vehicles. Access and egress with these vehicles is spread out to avoid repeated use of the same path to prevent establishment of trails. As observed with other refuge management actions, visitors may see these paths in the grasslands the following few days, but they would quickly disappear as the vegetation rebounds.

4. Other past, present, proposed, and reasonably foreseeable hunts and anticipated impacts

The impacts of this alternative are the same as described for alternative 2 (hunting).

5. Anticipated impacts if individual hunts are allowed to Accumulate.

The impacts of this alternative are the same as described for alternative 2 (hunting).

Cumulative Impact Summary: This alternative is the same as Alternative 2 (hunting) except that the method of control is conducted by professional shooters instead of the public. As such, the impacts are generally the same. Differences are: Short term temporary disturbances to most other wildlife are reduced as operations are generally conducted at night. There is increased potential for trampling of vegetation but due to seasonal timing impacts would not be significant or cumulative. The general public will lose the opportunity to participate in a compatible wildlife dependent activity while potential conflicts with other programs will be reduced or eliminated.

VIII. Regulatory Compliance

The following documents were submitted in compliance with Federal Regulations for implementation of the proposed action outlined in this EA.

White-tailed Deer Hunt Plan for 2002

Compatibility Determination for White-tailed Deer Hunting

The Final Environmental Assessment for White-tailed Deer Management on Occoquan Bay

National Wildlife Refuge, August 2001

Finding of No Significant Impact

Intra-Service Section 7 Biological Evaluation for Bald Eagles

Letter of Concurrence, Virginia Department of Game and Inland Fisheries

Documentation of Public Notice for review and comment on the EA

Refuge specific hunting regulations

IX. CONSULTATION AND COORDINATION

There were no negative comments received during the public review of the original EA despite broad dissemination to area environmental groups, organizations, the County and State. There

are no changes to the EA other than the addition of the impacts discussion. The general public will be notified of this amended EA via newspaper, announcements posted at the refuge and the refuge office, and via email notices sent to representatives of interested organizations.

X. PREPARERS AND REVIEWERS

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Joseph W. Witt, Refuge Biologist
Sandy C. Spencer, Refuge Biologist

XI. REFERENCES CITED

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APPENDIX

Options Eliminated from Further Consideration

1. Reproductive Intervention (birth control)

Reproductive intervention or birth control is the general category for a number of fertility control methods available, each with varying rates of success. Immunocontraception with porcine zona pellucida (PZP) vaccine injection, is probably the best known and most widely applied. Steroid implantation has been available since the 1970s. Remote prostaglandin injection (Denicola 1997), oral vaccination with a live vector (Miller et al. 1999a), and GNRH vaccines are more recent and lack long-term evaluation of effectiveness. Sterilization is a permanent option, although not widely applicable.

Effectiveness and efficiency of any of the above forms of reproductive intervention is affected by a number of factors including; method of application or delivery, need or ability to capture the animal, the number of treatments needed to ensure effectiveness, size of the population, status of the population (confined or free ranging), and longevity of treatment.

A. Immunocontraception

Immunocontraception (PZP injection) is most effective at preventing pregnancy when hand injected and combined with subsequent boosts. The PZP vaccination produces reversible infertility lasting 1-4 years (Miller et al. 1999b), however, it requires two injections, four weeks apart, to be effective for at least two years (McShea et al. 1997). Effectiveness at reducing population number and growth rate is greatly reduced when dealing with large and open populations due to the need to treat a large percentage of the females over a large area. For a large population, contraception rates of less than 50% of does will curb growth in 30 years, but will not reduce the size. Even rates of greater than 50% require at least a 5-10 year planning horizon to see significant population declines (Seagle and Close 1996). Therefore, the cost, effort, expertise, manpower, and handling time will continue for years before achieving any results.

Another obstacle to PZP immunocontraception is the adjuvant used for the initial injection (an adjuvant is a microbial aid necessary for boosting the vaccine once inside the animal's bloodstream). Complete Froine's, the most commonly used, contains heat-killed tuberculin cells, which causes subjects to test false positive for TB. The FDA, which has jurisdiction over its commercial use, currently does not permit use of this adjuvant on other than tightly controlled or isolated populations and in combination with ear-tagging (in order to prevent the public from consuming escaped deer). There are two other adjuvants undergoing field tests but both are not yet effective as boosters and still pending FDA approval (Rick Naugle, Humane Society of the U.S., August 28, 2000, personal communication).

B. Steroidal implants

Subcutaneous steroidal implants have been used during the past 25 years with varying rates of effectiveness in reducing deer pregnancy (and now remote delivery of this treatment is possible) but the long-term effectiveness is uncertain. In addition, the same factors that confound the PZP method at the population level apply (Connecticut Department of Environmental Protection, Wildlife Bureau, 1988). Because of the uncertainty of long-term health effects on deer and subsequent impacts on the food-web (including human consumption of treated deer), the FDA will not approve application on free-ranging deer at this time (DeNicola et al. 2000).

C. Oral Delivery of Contraceptives

Oral delivery of contraceptives has a number of concerns that make this method ill-advised and impractical: it is not species-specific (risks ingestion by non-target species), bait and supplies are wasted on non-target species, deer sometimes reject treated bait, and it is difficult to manage dosage control. Currently, the method is not working at the field or captive level. Oral vaccinations through live-vector delivery is a relatively new method, and is species-specific, but is not long-acting and so must be delivered on a frequent and regular basis (Alan Rutberg, Humane Society of the U.S., 2000).

D. GNRH Vaccine

Another field method currently being tested is the GNRH vaccine. This shuts down the whole reproductive hormone system of both sexes and its effects are dramatic, even on behavior and antler development. This is a new method and the affect on deer and their behavior needs further evaluation prior to application in the field (Ibid.).

E. Sterilization

Sterilizations must be done annually, the number of which must be calculated based on the number of fertile females in the herd. Great care must be taken to reduce the number of sterilizations in time to prevent a population crash and bottleneck (Boone and Wiegert 1994). Again, this option is not effective for open populations unless performed at a landscape level.

No matter which birth control method is used, more than 50% of the females will need to remain infertile to effect a reduction in population size (Hobbs et al. 2000, Seagle and Close 1996). All of the above described techniques are compromised at the individual and population levels due to the openness of the population. Because these operations entail multiple captures, considerable handling time, facilities for holding captured animals or conducting surgery, risk to personnel and animals, trauma losses, and constant or recurring expense means that at this stage of development they are not viable methods in the field. This situation may change in a few years as applications of these techniques are improved upon.

2. Live Trapping and Relocation

The live trapping and relocation approach entails transporting captured animals to a new location outside the impacted area. Disadvantages, however, far outweigh the advantages. Capture and handling of deer involves risk to deer and handlers. Deer are susceptible to capture myopathy, a form of muscle dysfunction that is stress-related and can result in delayed mortality. Trauma losses can amount to about 4% of capture and transfer efforts (Wildlife Information Publication, Virginia Department of Game and Inland Fisheries, 1999). The mortality potential attendant to handling is amplified by placing individuals in unfamiliar surroundings (Cypher and Cypher 1988).

Finding suitable release sites is increasingly more difficult as most locations cannot accommodate more deer and are experiencing their own population management problems. A further complication to this alternative is the recent increase in Lyme-Disease associated with the Northern Virginia deer population. Northern Virginia deer are infested with a type Lyme Disease-bearing ticks not found in more distant populations (Dan Lovelace, Virginia Department of Game and Inland Fisheries July 2000, personal communication).

3. Habitat Management

This approach manipulates the existing habitat to induce behavioral changes in deer and reduce human/deer conflicts. An example would be to lower the biological carrying capacity by removing forage species, and/or changing landscape elements such as water features or forest edge. This alternative has an appeal for its humane and non-lethal approach but is incompatible with one of the primary management goals for the refuge, which is to promote and maintain its grassland habitat and vegetation cover.

COMMENTS:

Written comments on this amendment may be addressed to:

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Comments may also be submitted by email to:

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Please title your email as EA comments