

# **Wildlife Management Plan**

**For the**

## **Prime Hook Wildlife Area**

**Delaware Department of Natural Resources & Environmental Control  
Division of Fish and Wildlife  
Wildlife Section**

**Written by**

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**Approved by Del Fish and Game Advisory Council**

**on**

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Michael Todd, now an Environmental Scientist with the Fisheries Section, wrote the first Prime Hook Wildlife Management Plan (Todd 1970). His effort was part of the Division's first attempts to manage the lands on a professional basis. While far from a comprehensive plan, it is the first written record of management. The plan is a valuable aid in perpetuating the area's management.

I would also like to acknowledge the valuable assistance of other staff members in the Division of Fish and Wildlife who provided data from statewide surveys, especially Greg Moore, Ken Reynolds, Tom Whittendale, and Bill Whitman. Harry Schellenger, Joe Shockley, and Outten Torbert handle the day to day management of the area. I appreciate their skills and dedication. Thanks also to the Natural Heritage Staff for their survey information and for their review of this plan.

## 1. PURPOSE OF PLAN

The purpose of this plan is developing a written plan of long and short-term goals, which integrates the management of renewable natural resources on the Prime Hook Wildlife Area. The Delaware River and Bay coastal area will be developed at an increasing rate in the next decade. As water, air, and habitat quality diminish, the need for a regional land use plan with meaningful environmental protection will become more apparent. The Prime Hook National Wildlife Refuge dwarfs the Prime Hook State Wildlife Area in both area and habitat complexity, however, the state wildlife area's management should complement the federal efforts to preserve and manage one of Delaware's premier freshwater marshes. Its future and ability to sustain the increased demand for outdoor recreation will depend on a written plan designed to anticipate the conflicts of human and animal use of habitat.

## 2. GENERAL MANAGEMENT OBJECTIVES AND GOALS.

- A. Preserve and protect the forest at Prime Hook and develop a management strategy to enhance its habitat values.
- B. Find new ways to integrate the management of the area with federal efforts to enhance the wetlands for water-dependent wildlife.
- C. Upgrade the agricultural lease to enhance quail nesting cover.
- D. Coordinate with the Division of Highways to improve vehicular access during wet times of the year along County Road 223.
- E. Improve boating access using periodic clean-outs with the Cookie Cutter.
- F. Control invasive species to protect the native flora, including the continuation of the Phragmites spray program.
- G. Incorporate information from the Natural Heritage surveys into the management plan.

## 3. DESCRIPTION OF AREA

### A. *General.*

Prime Hook Wildlife Area (PHWA) is located in eastern Sussex County on Little Neck between Slaughter and Prime Hook Creeks. Prime Hook Creek forms the southern boundary of the tract. Prime Hook National Wildlife Refuge (PHNWR), owned and managed by the U. S. Fish and Wildlife Service, shares the northern, eastern, and southern boundary with Prime Hook Wildlife Area. Not surprisingly, most maps show the Prime Hook Wildlife Area within the Prime Hook National Wildlife Refuge designated only as (State) within the stippled area. The managers of the two public lands refer to each as either State or Federal lands for simplicity.

Prime Hook Wildlife Area is located 2 linear miles east of State Route 1, and accessed via Prime Hook Road (CR 38), and Little Neck Road (CR 223). The only road access to the site is Little Neck Road (CR 223). Waples Pond, which straddles State Route 1 near Milton, is the nearest Fishing Area to PHWA. Prime Hook Road intersects with Route 1- 1/2 mile north of the Waples Pond.

Prime Hook Wildlife Area is one contiguous parcel of 698.2 acres. The habitat is primarily 68 % wetland (475.7 acres). Forest represents 182 acres (26.1 %) of the total. The open field habitat was farmed on a lease basis (35.5 acres or 5.1%) until 1998 or is planted in wildlife food and cover plots (5 acres) by Division of Fish and Wildlife personnel.

The wetlands are swamp within the flood plain along the Prime Hook Creek or part of a freshwater marsh impoundment. Numerous ponds are located within the marsh areas, as well as wooded ponds along the margin of the creek. The forest is primarily hardwood, with tulip poplar (Liriodendron tulipifera), white oak (Quercus alba), and sweetgum (Liquidambar styraciflua), the dominant overstory species. The understory and shrub layers are sparse and the woods have an open appearance. The edges of the marsh and fields have heavy shrub and herbaceous layers including greenbriar (Smilax sp.), summersweet pepperbush (Clethra alnifolia), and Japanese honeysuckle (Lonicera japonicus).

Little Neck Road divides the wooded portion of the area in halves and ends at the marsh. A large metal sign at the edge of the woods marks the entrance to the area. Two large fields on the area were leased for farming until 1998. An old field adjacent to the southern ag-lease field was reclaimed as a wildlife food and cover plot in 1987. Larger privately tilled fields planted in either soybean or corn lies on each side of the dirt road as you enter the wildlife area.

An unimproved boat-launching ramp exists at the terminus of Little Neck Road. A small pier built to help boaters board their boat stands beside the boat ramp. No other structures, besides deer stands, exist on PHWA.

To my knowledge, no family cemeteries are located on the Wildlife Area. DELDOT, Division of Highways, maintains Little Neck Road (C. R. 223).

### ***B. Acquisition History***

The Prime Hook Wildlife Area was formed from lands conveyed to the State of Delaware from Draper Foods, Inc. (in a Deed dated June 14, 1958, recorded in Deed Book 491, Page 315 and by a second Deed dated November 14, 1958, recorded in Deed Book 496, Page 410, both on file in the Deed Records of Sussex County in Georgetown). Parcel #1 (310 acres) and #2 (325 acres) sold for \$25,000 each (\$80.65/acre and \$76.92/acre, respectively). A plat titled "LANDS OF STATE OF DELAWARE, FISH AND GAME COMMISSION, PRIME HOOK NECK, CEDAR CREEK HUNDRED, SUSSEX COUNTY", and prepared by H. F. Bressler, L. S. #139, June 9, 1958, is recorded in Plat Book 3, Plat #4, in the Records of Sussex County, Georgetown, Delaware.

The U.S. Fish and Wildlife Service (USFWS) notified the Division of Fish and Wildlife on 2/14/83 of their intention to construct a water control structure near Prime Hook Creek and Petersfield Ditch, north of State Road 16, to "manage these water levels seasonally, in accordance with Delaware State Law No. 766, to provide wetland habitat for migratory waterfowl, and to provide wildlife-oriented recreational opportunities compatible with wildlife objectives and habitat". USFWS wanted to manage the water levels at 2.8 feet above mean sea level, and could not legally flood State lands. They sought a flowage easement to alleviate any legal troubles. On March 8, 1983, Division Director William Wagner signed a Water Flowage Agreement, previously signed by the Regional Director of the USFWS, Howard N. Lawson. The agreement granted the USFWS a permanent right for the purpose of maintaining and controlling water, in, upon, over, and across the property.



### ***C. Ecological History.***

Prime Hook Wildlife Area lies within the Delaware River/Bay/Atlantic Ocean watershed. Prime Hook Creek flows into the Broadkill River, which enters the Delaware Bay at Roosevelt Inlet in Lewes, Delaware. The freshwater marshes to the east, and along the Prime Hook Creek drainage, that constitute the bulk of PHNWR/PHWA, are a naturally occurring impoundment, formed when sand dune formations along the Delaware Bay blocked the most direct exit to the bay, and forced Prime Hook Creek to flow southward and merge with Broadkill River. Water control structures installed on the southern end of PHNWR complement the existing geomorphology forming the freshwater marsh complex.

“Two thousand years ago Slaughter Creek emptied into a lagoon which entered Delaware Bay through an inlet in the barrier beach. Five hundred years ago, much of the lagoon was completely filled in with organic, rich, fine-grained sediments and several creeks existed. As the drainage to Delaware Bay continued to close, the area became poorly drained and dotted with freshwater ponds.” Maps of 1868 show Slaughter Creek emptying into Prime Hook Creek (cited as Hoyt, 1980 in an excerpt of an untitled USFWS document found in the Prime Hook files - DFW Acquisition files).

Until 1900, the marsh remained unchanged, consisting of a freshwater system dominated with cattails and sedges. In 1906, landowners adjacent to the marsh hired a dredge and dug a canal from Cedar Creek south to the vicinity of Oak Island (Slaughter Canal). Sediment disturbance caused by the dredging led to Phragmites colonization. Where tidal action is sufficient, salt marsh species flourished.

In 1934, a dike was dug by dragline, along the eastern edge of the marsh from Slaughter Beach to Prime Hook Beach to prevent the bay from washing into the marshes. The deep borrow ditch is still evident today: however sections have been filled by wash-outs.

Portions of the marsh were grid-ditched and drained for mosquito control in the 1940's. In the 50's and 60's a high quality marsh was still evident; however, as the marsh dried, Phragmites spread.” (An excerpt from an untitled USFWS document seeking approval for the construction of a water control structure along Fowler's Beach Road within the PHNWR found in the DFW Acquisition Manager's files). “

Phragmites has been actively controlled within the marsh since 1987 using aerial applications of a glyphosate-based herbicide called RODEO, manufactured by the Monsanto Chemicals.

Various small drainage/water control structure projects occurred within the greater Prime Hook marsh complex throughout the years. The marsh might have been grazed or cut for hay. Local people burned the marshes at Prime Hook each winter to retard woody growth (Clifton 1994).

### ***D. Geology***

Parent material for Sussex County soils is sedimentary in nature. Alluvial sources and glacial meltwater run-off transported the material. Most of the soils are sandy or clay with very little rocky material present. The soils were deposited in a shallow Inland Sea, which later became the Delmarva Peninsula (Ireland and Matthews 1974).

### ***E. Topography***

Prime Hook Wildlife Area lies within a coastal plain ecosystem with gentle slopes rising only a few feet per mile. The highest elevation in the County is 78 feet found to the west along the southern boundary of Delaware near Whitesville. Topography at Prime Hook is essentially flat. Some of the better-drained hardwood sites may be several feet above sea level. The ponds and creek are tidal influenced, but flow towards the bay indicating at least a slight elevation gradient exists.

Slight differences in elevation have a strong influence in plant communities and soil types. Even though local differences in elevation are slight, they have a strong influence on natural drainage. Most of the poorly to very poorly drained soils are in slight depressions and only slightly lower in elevation than nearby well drained soils (Ireland and Matthews 1974).

### ***F. Climate***

Prime Hook Wildlife Area has a temperate, humid climate typical of most coastal areas in the Middle Atlantic States. Mean temperature in January is 36 degrees Fahrenheit (F) and 76 F in July. The highest humidity occurs during the month of July (66 %). An average of 49.8 inches of precipitation falls during the year. Snow accounts for only 18 inches of the 49.8 inches of precipitation.

Prime Hook's weather is modified by the ocean. The humidity is higher, and rain evaporates less quickly. The summers tend to be cooler than more inland areas and the winters milder. The predominate breeze during the winter is northwest and during the summer a southeasterly flow.

### ***G. Water.***

Water strongly influences the character of Prime Hook Wildlife Area. Little Neck is surrounded by tidal marshes with low to no salinity. The Prime Hook Creek watershed drains lands to the west as far as Ellendale and north of Milton. Waples and Reynolds Ponds are the only two ponds on the watershed. Sowbridge, Ingram, and North Prong Branches drain into Waples Pond and form the bulk of the Prime Hook Creek drainage.

Prime Hook Creek is navigable by motorboats equipped with small, short-stemmed outboard motors. However, navigation is hazardous due to the frequent tree and branches that fall into the water. Submerged vegetation is common, and living plants grow on submerged material, giving the false appearance of fast ground.

Several ponds occur in the marshes on the area. Poplar Woods Pond is the largest and lies along the northern boundary. Several medium-sized ponds, both named (Stickweed Pond, Twin Ponds, and parts of Broken Marsh) and unnamed, occur within the marsh and are interconnected with ditches.

The ditches that interconnect the ponds fill with submerged and emergent vegetation making regular clean-outs a necessity. The ditches low flow prevents dislodged clean-out material from flushing out to the creek. Prime Hook Creek, however, has a rapid flow, and relatively deep water.

One man-made pond occurs along the southern field. It appears to have been made to drain the field. The fields are wet, but not excessively. Little Neck Road became nearly impassable with large pools of standing water during winter months until 1998.

## **H. Vegetative Cover.**

### **1. INFLUENCE OF SOILS ON PLANT COMMUNITY**

Although the present forest is mixed conifers and hardwoods, soil analysis indicates that the original dominant vegetative type was hardwoods. Except along the creek and river, the soils are high in calcium. Hardwoods contribute calcium, and other base elements during leaf drop. Pure hardwood stands usually have high soil calcium and base counts. Sussex County soils are low in bases indicating that although there were many hardwoods contributing bases, there were also pines present to utilize them. This ratio shows that pines were present historically, but not at the current levels (Ireland and Matthews 1974).

### **2. GENERAL IMPRESSION.**

My first impression of the Prime Hook Wildlife Area was that the woods were filled, by Delaware's standards, with unusually large trees. Yellow poplars and white oaks of immense proportion tower of the dirt road. It is no coincidence that these trees grow here. The soil type is a Sassafras loam, which is rated (I-4), as a soil with the best capability to grow crops on the area.

### **3. DRY SOIL TREE COMMUNITY.**

The forest type on the dry soils is mixed hardwood/pine, with the hardwoods the most prevalent component. Yellow poplars, white, swamp white (Quercus bicolor), southern red (Q. falcata), northern red (Q. rubra), willow (Q. phellos), and water (Q. nigra) oaks, along with mockernut hickory (Carya tomentosa), black cherry (Prunus serotina), and sassafras (Sassafras albidum) are the primary hardwood dominants. Pond pine (Pinus rigida serotina) is the dominant evergreen tree species.

Bill McAvoy, Botanist for the Delaware Natural Heritage Program, noted in a May 20, 1998 survey the presence of a large "rich woods" pocket containing many atypical coastal plains flora. Bill noted the presence of many large canopy-layer oaks and tulip poplars, and a diverse herb layer. One white oak measured 13' 8" C.B.H. Other notable mentions were Christmas fern, bloodroot, and an orchid.

In the spring of 2001 the 2 farm fields (36.1 acres) were enrolled in entirety into the U. S. Department of Agriculture's Conservation Reserve Enhanced Program (CREP). The fields were planted with a variety of trees selected to mimic the existing tree community. Trees were planted in a 10 X 12-foot grid at a 400 tree per acre stocking rate. The following species were planted:

Yellow poplar	2000
Pin oak	1000
Water oak	500
White oak	1500
Water hickory	1000
Swamp white oak	500
Blackgum	500

Loblolly pine	1000
Total	8000

A planting crew of 16 men planted the trees in 3 hours. Eastern red-cedars were planted to flank a road in each field leading to deer stands and food plots. The stocking rate is minimal and natural reproduction from tulip poplar, sweetgum, and red maple is expected to be significant. All oaks were protected with tree shelters (3-foot tubes secured with 4 foot pine treated stakes) to reduce deer damage. The field has a history of johnsongrass infestation (a state listed noxious plant) and we plan to mow between the rows, as well as treat with herbicides to suppress the grass until the trees are large enough to shade out the johnsongrass.

### 3. WET SOIL TREE COMMUNITY.

The wet soil forest type is a sweetgum-green ash (Fraxinus pennsylvanica)-blackgum (Nyssa sylvatica)-persimmon (Diospyros virginiana) association. Green ash and sweetgum dominate in poorly drained bottoms. Blackgum, red maple (Acer rubrum), willow and water oak, black cherry, mockernut hickory, sassafras, and American holly (Ilex opaca) are codominants or understory species beneath pond pines and sweetgums.

Other understory species include sweetbay magnolia (Magnolia virginiana), serviceberry (Amelanchier arborea) and subdominants of the common overstory trees. Highbush blueberry (Vaccinium corymbosum), sweetsummer pepperbush (Clethra alnifolia) and rosebay rhododendron (Rhododendron maximum) represent the shrub layer. Common vines include poison ivy (Toxicodendron radicans), green briar (Smilax sp.), and trumpet creeper (Campsis radicans).

### 4. MARSH AND SWAMP COMMUNITIES.

Herbaceous marsh vegetation is primarily cattail (Typha angustifolia), Walter's millet (Echinochloa walterii), and reed grass (Phragmites australis). Green ash, red maple, and persimmon grow on the higher spots. Swamp vegetation is similar except that more red maple, sweetgum, green ash, and persimmon predominant. Shrub layer vegetation found in the swamp include sweetsummer pepperbush, swamp rose-mallow (Hibiscus moscheutos), and common buttonbush (Cephalanthus occidentalis).

### 5. FIELDS

Two farm fields are located on the area. The fields are 20 and 16.1 acres. The southern field is the largest. Both fields were planted in corn or soybean until 1998. They had been farmed for at least 15 years under a farming lease agreement. A 5-acre field on the southern edge of the south field was reverting to forest in 1986. Four food plots were carved from the sweetgum/red maple stand growing in the field using a bulldozer with a drum chopper and root rake attachments. A cross-shaped hedge was left in the middle of the field, and the 4 food plots were established in each ordinal direction from the hedge. The food plots total 3.8 acres in size.

The fields were farmed for the last time during the 1998-growing season. A severe johnsongrass and a moderate Canada thistle infestation necessitated continuous treatment during the 1999 and 2000. The fields were mowed, disked, and sprayed with herbicides

repeatedly during those growing seasons. Good control was achieved, however the fields could become infested again without vigilant monitoring and treatment.

In 2000 a 38.5-foot wide strip of prairie grasses (big and little bluestem, indiangrass) and wild flowers were planted around the outside of both fields. After laying out an access road to the ends of both fields, trees were planted in the remaining 29.2 acres. About 2.2 acres of annual grains are planted annually in 3 food plots left within the larger fields.

#### **H. Soils.**

##### **1. SASSAFRAS.**

Prime Hook has three important soil classes. All soil classes are high in sand content, but differ in water profiles. Sassafras loam (SfA) is the prevalent soil type within the wooded sections of the area and most of the agricultural fields and food plot. As stated earlier, it is the best soil type on the area having no major limitations. Sassafras sandy loam (SaB) occurs on the higher spot within the southern agricultural field.

Sassafras series soils are deep, well-drained soils on uplands. These soils were formed in loamy and sandy sediments. The loamy material contains considerable amounts of sand.

The native vegetation found most often on Sassafras soils are hardwoods and some loblolly pine. Sassafras soils are rated as good for grasses, grains, and upland herbaceous plants, good for hard and softwood tree species, and not suited to wetland food and cover plants, shallow water developments or ponds. Upland game will do fairly well in this soil series (Ireland and Matthews 1974).

##### **2. SWAMP.**

The other two soil types are heavily influenced by water - Swamp (Sw) and Tidal marsh (Tm), but differ in level of salinity. The swamp soils are fresh to slightly saline (< 4 parts per thousand (ppt)). Swamp soils have fresh water standing on them most or all of the time. This series occurs at the lower end of Prime Hook Creek, just upstream from Tidal marsh. The native vegetation is dense stands of water-tolerant vegetation, including red maple, gum, holly, sweetbay, pond pine, and cypress. Swamp soils are rated as unsuited for grasses and grains, and trees, and good for shallow-water ponds, shallow water developments, and wetland wildlife (Ireland and Matthews 1974).

##### **3. TIDAL MARSH.**

Tidal marsh occurs extensively along the coastal areas. On PHWA it occurs at the upper tidal reaches and is only slightly brackish. The vegetation has been described previously. The ratings are identical to that of Swamp. Tidal marsh soils shrink by 30 -40 percent upon drying, and turn strongly acidic when exposed to air. The change in reaction is mainly a result of oxidation of sulfur compounds (Ireland and Matthews 1974). Food and cover for wetland wildlife are excellent.

## 4. WILDLIFE POPULATION STATUS

No harvest records were kept for game animals other than white-tailed deer and waterfowl. The population status for these species will be based on personal observations and where appropriate the Hunter Mail Survey and second hand reports.

### A. Wildlife Suitability.

Wildlife is a product of the land. Good soils produce above good wildlife populations. The upland soils (Sassafras loams) of Prime Hook are considered good in fertility. Based on soil suitability rating in establishing wildlife habitat developed by the authors of the Sussex County Soil Survey (Ireland and Matthews 1974), the uplands are most suited for the management of upland wildlife habitat. Prospects for developing habitat for woodland wildlife, e.g., white-tailed deer (Odocoileus virginianus), gray squirrels (Sciurus carolensis), raccoons (Procyon lotor), gray foxes (Urocyon cinereus), and songbirds, are rated as good on Sassafras soils, fair on Fallsington sands, and not suited on the other wet soils. Management for open land wildlife, e.g., northern bobwhite (Colinus virginianus), mourning doves (Zenaida macroura), eastern cottontails (Sylvilagus floridanus), woodchucks (Marmota monax), striped skunks (Mephitis mephitis), and opossums (Didelphis virginiana) on Sassafras were judged to have a good chance of success. These ratings are based on a weighted average of the suitability of the plants produced on each soil series. They are not sensitive to habitat patchiness or specialized habitat needs.

The two wet soils, Swamp, and Tidal are well suited to management of wetland wildlife species. Openland and woodland wildlife species should not be managed on the wet soils and are rated as unsuitable. There is little vegetative difference between Swamp and Tidal Marsh vegetation in this setting, due to the impounded nature of the water regime, and the low salinity caused by the influx of freshwater from Prime Hook Creek. Excellent wood duck (Aix sponsa) nesting, brooding, and feeding habitats exist within the swamps.

### B. Qualitative Assessment of Wildlife Species Status.

#### 1. Waterfowl.

##### A. Resident

Excellent wood duck nesting, feeding, and brooding habitat is found within the marsh and swamp portions of the area. Canada geese (Branta canadensis), mallards (Anas platyrhynchos), black ducks (A. rubripes), gadwalls (A. strepera), and green-wing teal (A. crecca) nest in the marshes.

##### B. Migrants

The marshes of Prime Hook hold tremendous flocks of waterfowl during migration. Waterfowl numbers on the entire federal refuge in October 1998 were: snow geese (108 K), green wing teal (53 K), pintail (21 K), canada geese (5 K), black ducks (2550), wigeons (1360), mallards (1240), ringnecks (400), wood ducks (250), gadwalls (95), and shovelers (25) (Whittendale 1999). When Unit 3 of PHNWR, which is closest to PHWA is examined, the waterfowl numbers for the same time period are: snow geese (13 K), green wing teal (11.6 K), pintail (8 K), black ducks (1 K), mallards (550), canada geese (535), wigeon (540), ringnecks (400), wood ducks (100), gadwalls (80), and shovelers (20). It appears that the more wooded sections of the marsh closest to PHWA hold proportionally fewer snows,

greenwings, pintails, canadas, and more blacks, woodies, ringnecks, gadwalls, and shovelers. Highest total numbers of migratory waterfowl occur in November.

## 2. White-tailed Deer.

Deer are plentiful as harvest records show. Deer damage to soybeans is evident, but not severe. The area is heavily hunted during the early shotgun season.

## 3. Upland Game

### *A. Northern Bobwhite.*

I have hunted quail with trained dogs, and never found any bobwhites on the area. They could live along the boundaries close to adjacent fields. I do not believe enough good bobwhite habitats exist to support a huntable population.

### *B. Wild Turkey (Meleagris gallopavo)*

A spring gobbler season has been open on the area since 1994. Turkeys have been heard. The habitat is good, and should support more turkeys in the future.

### *C. Ring-necked Pheasant (Phasianus colchicus)*

Ring necks occur along the marshes closer to the Delaware Bay. Their presence is possible, but unconfirmed.

### *D. Woodcock (Philohela minor)*

Woodcock nesting, feeding, and loafing habitat is available and should support both a nesting and migratory population.

### *E. Eastern Cottontail.*

Rabbits occur on the area along the fringes of the swamp/marsh. Densities are unknown.

### *F. Gray Squirrel.*

Good hardwood mast and den trees abundance supports a healthy gray squirrel population. Delmarva Fox Squirrels were re-introduced on PHNWR south of Prime Hook Creek, and might frequent the area.

## 4. Furbearers.

### *A. Raccoon.*

A trapping lease is available for the area, but rarely bid upon. No good harvest information exists for any furbearer. The habitat seems ample and raccoons should be abundant.

***B. Muskrat (Ondatra zebethicus)***

Good wetland habitat, emergent leafy plants, and a fairly stable water level in this freshwater marsh should support a healthy muskrat population.

**5. Songbirds.**

No data exists for an assessment of the songbird population. Kitt Heckscher, Zoologist with the Delaware Natural Heritage Program says that the Prime Hook area is a globally significant stopover area for transient Neotropical songbirds. Woodlands near bay coasts and riparian areas have significant value to birds during migration stopovers.

The habitat is diverse, older aged (relative to Delaware standards), and should support a variety of breeding songbirds. Christmas Bird Count data may be available to verify species and population densities.

**6. Reptiles and Amphibians.**

No data exists for this guild of animals. A frog call count started in 1997 might provide data. Route selection was randomized, and may miss coverage on the area. Mick McLaughlin surveyed PHNWR for calling frogs in June 2000 and heard 8 species of frogs – green, green treefrog, spring peeper, bullfrog, northern cricket, carpenter, southern leopard frogs, and fowler's toads. Early calling species like N.J. chorus frogs, wood frogs, and leopard frogs were undoubtedly underrepresented.

A snapping turtle trapper from Easton, MD named Rodney Lewis, told me he has trapped the marsh via the federal access points. J. Marion Rowan submitted a Snapping Turtle Report for 2000. He reported catching 185 turtles with 24 pots on Prime Hook Creek, and keeping 158 legal-sized turtles with a collective weight of 2138 pounds. He received \$0.60 per pound.

**7. Raptors.**

Both bald eagles and ospreys nest along the Fowler's Beach Road, but closer to the Delaware Bay on federal lands. Barred, screech, and great horned owls are probably present. I suspect that red-tailed hawks and kestrels are present, but no data is available to document their utilization.

**8. Fish.**

The freshness of the water and abundance of vegetation should foster a healthy and diverse fish community. Large mouth bass fishing is popular along Prime Hook Creek.



## 9. Invertebrates.

### ***C. Special species - endangered or threatened.***

#### 1. Bald eagle (*Haliaeetus leucocephalus*)

A bald eagle nest occurs north of the area in the marsh between Fowler's Beach Road and Prime Hook Beach Road on federal property. The nest was active in 1995 and 1996. The new nest has not been found, but refuge staff thinks the pair is still nesting in the general vicinity.

#### 2. Delmarva Fox Squirrel (*Sciurus niger cinereus*)

Delmarva fox squirrels (DFS) are listed on the federal and state endangered species lists. Once abundant on the entire Delmarva Peninsula less than 10 % of its former range was occupied when it was listed as endangered in 1967. At that time Delmarvas were found in only four counties on Eastern Shore Maryland (Kent, Queen Anne's, Talbot, and Dorchester). A joint reintroduction program successfully placed squirrels in all counties on the Eastern Shore, as well as at sites in Pennsylvania, Virginia, and Delaware. In Delaware squirrels were released at Assawoman Wildlife Area in 1985, on the Haskell Estate west of Wilmington, and at the Prime Hook N.W.R. in 1986.

Delmarva fox squirrels were wild trapped on the Eastern Shore of Maryland at the Blackwater NWR by U. S. Fish and Wildlife Service and released on the PHNWR in 1986. Two releases occurred in early fall and winter. A total of 18 squirrels were released, and 17 survived the initial release. The population is reportedly stable, with at least 50 % of the original population size captured as juveniles each year. Radiotagged Delmarvas have been located north of Prime Hook Creek in the vicinity of Prime Hook Wildlife Area (Reynolds, 1998, personal communication).

## 5. WILDLIFE POPULATION SURVEYS AND INVENTORIES.

A detailed record of animal and plant surveys is useful to document the results of existing wildlife management practices, highlight the need for corrective actions, to protect past practices, and provide continuity in the event of personnel changes. A discussion of the surveys and inventories used on Prime Hook follows.

### A. Surveys.

#### 1. Nest Box Surveys

##### a. *Wood Duck*

Five wood duck boxes have been installed along the south end of Poplar Woods Pond. They are accessible for land, and checked every 45 days from mid-March. Since 1994 we have

been cooperating with the U. S. Fish and Wildlife Service on their Wood Duck Population Monitoring Initiative. We have continued using an intensive-checking regime, but now follow their protocol. The boxes are not checked more often than every 45 days to minimize nesting disruption. Nest habitat parameters were recorded the first year of the study. The results of each year's surveys are shared with the USFWS through the State Waterfowl Biologist, Tom Whittendale.

*b. Squirrel*

No squirrel boxes were installed at Prime Hook Wildlife Area until the spring of 2002. We installed 10 boxes designed for easy access during nest box surveys. They are detachable with a front door and a side entrance.

*c. Bluebirds (Sialis sialis)*

A bluebird trail was established within the Area in February 1988. Boxes were mounted on plastic pipes 3-5 feet from the ground and placed 15 feet from the wood's edge in fields one acre or larger. The entrances were oriented towards the fields. The boxes are at least 300 feet apart to prevent territorial responses. Boxes are checked weekly beginning May 1. A total of 6 boxes are located on the Wildlife Area. The boxes are located in Ag. Fields 1, and 2 - the three largest fields on the Area. Eastern bluebirds, house wrens (Troglodytes aedon), Carolina chickadees (Parus carolinensis), and white-footed mice (Peromyscus leucopus) have used the boxes. Old nest material will be removed to encourage re-nesting. Reproductive data will be collected and recorded on the nest box survey data form.

*d. Bat*

Bat roost boxes will be installed along riparian corridors and within wet woods near the tributaries. The boxes will be checked during the summer months.

## 2. Other Surveys

*a. Wild Turkey*

A spring gobbler count was conducted in the county each spring until 1995. The survey examines the rate of population change and range expansion of a flock of turkeys released in the Cypress Swamp in 1985. The area has been open to spring gobbler hunting on a permit basis since 1993. Harvest records will be used to assess population trends. A brood count is done by seasonal research assistants in parts of the county with recent population expansions.

*b. Northern Bobwhite*

Since the statewide spring singing male count was discontinued in 1989, no comparison data is available to evaluate the management on Prime Hook Wildlife Area. This survey was recently reinstated under the auspices of the Small Game Management Program (Whitman 1991). In the spring of 1995, regional staff assisted running the counts.

The routes were selected randomly, on a county -wide basis, and are not designed to monitor densities in the wildlife area specifically. No covey counts with dogs are planned.

*c. Breeding Birds*

A breeding bird survey will be used to track songbird densities on the area. This survey will provide baseline data valuable in predicting the effects of habitat succession and manipulation on another vertebrate population.

The survey will consist of a 20-stop route spaced at 1/4-mile intervals. At each stop all singing birds will be recorded during a five-minute interval. The survey will be conducted every third summer beginning in early May 2003 and run in 3 two-week intervals. The survey begins at dawn. Observations will be recorded on a cassette tape and transcribed to data sheets. The route will cover the entire wildlife area. The results will be tabulated and analyzed and become a permanent record of the Wildlife Management Plan.

*d. Furbearers- Muskrats\raccoons\otters\mink (Mustela vison).*

The area is leased by competitive bids for fur trapping. Annual trapping data from the trapping lessee harvest report will be included in the plan to provide a permanent source of information on muskrat densities and population trends.

*e. Amphibians.*

In 1997 a National Biological Survey of amphibians was started in the State of Delaware. I have volunteered to help with a nocturnal frog calling counts. The survey will assess presence/absence, as well as densities, and calling intensity. It is hoped that some data to support the management of Prime Hook Wildlife Area will become available from this inventory.

*f. Deer Spotlight Counts*

Trends in deer densities can be monitored using a spotlight count. The technique is most effective in open fields and brushy areas. Only the agricultural fields and food plots lend themselves to this technique, but represent only 5.8 % total acreage. Spotlight counts will not be used at the Prime Hook Wildlife Area. See the Nanticoke or Assawoman Wildlife Management Plans for a discussion of spotlight count techniques.

*g. Wildlife Food and Cover Plots*

A survey was initiated in January 1986 at Assawoman and Nanticoke Wildlife Areas to study the utilization and effectiveness of the food and cover plots. Prime Hook was not included because there were no food plots at that time. The design of the study was rather simple. A person walked the length of the plot and observed what animals flushed and also deduced what animals used the plot by noting what animal sign was present. Notes were kept on species, behavior, number, method of determining use (seen, heard or deduced from sign), and what crops were being used. Although available personnel are not well trained in wildlife identification, preliminary results of this survey have been used to evaluate the usefulness of a particular plot, crop, or cover/crop combinations. The survey proved too time consuming and was discontinued in 1988.

Evaluations of the effectiveness of the plots has continued, however, but more from the standpoint of crop success (or failure), and an informal assessment of wildlife utilization taken periodically during the course of daily activities, i.e., nest box surveys. This informal method of assessment, while less rigorous, will be continued to help measure success.

#### *h. Waterfowl.*

A statewide aerial survey for waterfowl is performed by a biologist with the Division each year. All coastal areas are surveyed from a low altitude (200 feet) flying an east-west grid. The surveys run monthly from October to January. Prime Hook Wildlife Area falls within Survey Zone 7 (which also includes most of Prime Hook National Wildlife Refuge). The results were shared with the regional managers within 1 week of completion until the mid-1990's, then results stopped coming on a regular basis. These results are now available on the Division's website ([www.dnrec.state.de.us/fw](http://www.dnrec.state.de.us/fw)).

### ***B. Inventories.***

#### **1. Flora and Fauna.**

The Natural Heritage databases for flora and fauna will be accessed to develop a comprehensive inventory for Prime Hook Wildlife Area. A simple presence/absence table will list what is currently known about species occurrence.

#### **2. Phragmites.**

Phragmites or Common Reed had severely degraded the quality of wetlands at Prime Hook Wildlife Area until a control program was initiated. Each year the extent of phragmites infestation will be assessed prior to the late summer/early fall spraying season. Continued spraying is anticipated, but to a lesser degree each year.

### ***C. Harvest Information.***

Harvest information is a direct measure used to track wildlife population densities. Although the waterfowl-hunting program is permit based, making harvest reports mandatory; no other species is tracked as accurately at Prime Hook Wildlife Area.

#### **1. Waterfowl.**

Waterfowl hunters using duck blinds on state and federal lands must return a permit card to the federal checking station. Harvest must be reported to protect their hunting privileges, i. e., mandatory. Harvest records are returned to the State Waterfowl Biologist for compilation and analysis. A yearly summary of the harvested species, harvest by blind number, and a summary are provided by early spring each year.

## **2. White-tailed Deer.**

Until 1996 hunters harvesting deer on Prime Hook Wildlife were required to register the deer for biological sampling at a state checking station. Beginning in 1996 private vendors, such as tackle shops and butchers, began supplementing the checking duties. State checking stations were discontinued in 1999. Vendors will collect all data. The Deer Project Leader compiles harvest records and shares the results with the regional managers.

## **3. Upland Game.**

No records are kept for any species of upland game harvested at the Prime Hook Wildlife Area, except those hunters contacted by the Hunter Mail Survey might report animals harvested here.

## **4. Furbearers.**

A trapping lease for the marshes at Prime Hook Wildlife Area exists, but is seldom bid. No consistent trapping records exist for this area.

## **6. COORDINATION MEASURES AND BROAD MANAGEMENT OBJECTIVES.**

The Division's goal is perpetuating the natural diversity of indigenous plant and animal communities and restoring extirpated species when possible. We will encourage, manage, and support the wise use of our wildlife resources as long as their viability is not jeopardized. Our approach will be to manage ecosystems, to maximize plant and animal diversity and thus increase ecosystem stability.

Our first responsibility is to the wildlife and their habitat. A species' viability must be secure before we fulfill our second responsibility - to manage our wildlife resources for recreation, economics, and scientific instruction. We are committed to the concept of multiple-use management provided the practice does not harm the resource or infringe upon the rights of others. Balancing user's needs while conserving the resource requires careful planning and the application of prudent management policies.

1. We are committed to managing ecosystems. We will recommend no action that threatens the viability of a native species or population.
2. We will manage wildlife species as viable, self-supporting, and free-ranging populations. Consideration will be given to all species to maintain diversity and stability and to maximize the variety of human experience.
3. Restoring native species that have become extirpated will be one of our goals provided that their reintroduction does not adversely affect man.
4. We will acquire land for wildlife habitat management purposes when that land is a manageable size, adjoins our property but doesn't create inholdings, or provides habitat critical for a threatened species.
5. We will consider consumptive and nonconsumptive uses and oppose competitive uses that are detrimental to wildlife populations or habitats.

6. Population and habitat manipulations are acceptable management tools provided the viability of a species is not threatened.
7. We recognize hunting, fishing, and trapping as legitimate management tools and as recreational pursuits. We will strive to meet the demands for hunting and trapping as long as species viability is not jeopardized.
8. We recognize that some competitive land uses are essential to human well being; we will mitigate on uses beyond our control and educate competitive users of the trade-off.
9. Fulfilling our goals requires public support. We will attempt to educate people to wildlife benefits and instill a sense of responsibility towards the resource.

**Timber harvest will be used as a habitat manipulation tool and as a revenue source. Small timber sales (less than 15 acres) provide early successional stages of vegetation, promote herbaceous growth, create escape and nesting cover, and increase interspersions. Timber harvests will be planned with the premise that wildlife management objectives have priority over strict income generation.**

**Wildlife management is balancing the needs of both animals and people. The same principle applies on the wildlife areas. Recreation is permitted provided it does not interfere with some critical segment of an animal's life cycle. Nor will one person's recreational endeavors disrupt, interfere, or diminish the enjoyment of another's recreation. Off road vehicles are incompatible with the objectives of this wildlife area and will not be permitted. The wildlife food and cover plots are off limits to unauthorized vehicles, and horseback riding. These areas provide undisturbed nesting areas where human interference is minimized. Picnicking is restricted to the fishing areas. The wildlife area and interior roads will be open for legitimate wildlife management work, animal surveys, educational tours, and other nature appreciative activities.**

## **7. WILDLIFE MANAGEMENT PRACTICES.**

### **A. Statement of Priority of Practices.**

**The Prime Hook Wildlife Area is primarily managed for wetland and upland forest dependent species. Older aged stands of trees are in short supply in Delaware. In recognition of the value and uniqueness of Prime Hook Wildlife Area's oak/tulip poplar/American holly-dogwood forest (S2 ranking), forest interior-nesting songbirds and neotropical migrants will be given equal standing with traditional game species. Species such as Red-shouldered hawks (Buteo lineatus), barred owls (Strix varia), hairy woodpeckers (Picoides villosus), whip-poor-will (Caprimulgus vociferus), red-eyed vireos (Vireo olivaceus), ovenbirds (Seiurus aurocapillus), and Acadian flycatchers (Empidonax vircens) will be given special recognition within the context of management decisions. Species like black duck, wood duck, muskrat, river otter (Lutra canadensis), white-tailed deer, gray squirrel and wild turkey, will have priority in habitat management decisions. Farmland game species, like rabbits, quail, and dove, will have lower priority than before the agriculture lease was terminated, and the fields enrolled in C.R.E.P. Increasing emphasis will be placed on the recognition and protection of amphibians and reptiles. Rare plants and freshwater wetlands will be given special consideration.**

The forest at Prime Hook is older than most woods in eastern Sussex County. Since the age and composition of the forest make it unique, no timber harvests will be done. These areas will be given a high priority in keeping with the Division's explicit policy of protecting species viability and ecosystem diversity and stability.

*Archaeology sites will be protected and perpetuated as they are identified on the wildlife area. Every reasonable precaution will be taken to eliminate or minimize disturbance to prehistoric sites during construction activities (Custer and Mellin 1989). Normal management practices would not be expected to disrupt any sites of archaeological significance due to their limited nature. Before potentially damaging activities are begun the Staff Archaeologist with the Division of Parks and Recreation will be consulted.*

## **B. General Habitat Management Techniques.**

### **1. Wildlife Food and Cover Plots.**

Although wildlife populations increase or decrease in response to management practices that affect vegetation succession, food plots have long been the "public's answer" to optimum wildlife habitat (Clark 1980). Although food plots are not a panacea to wildlife woes they do provide abundant, nutritional food during the "pinch" period, keep some areas in an annual stage of succession and increase wildlife viewing and hunting opportunities. Several game and nongame species utilize the plots.

The food plots are generally planted with a mixture of grains - soybean, cowpeas, Japanese or German Millet, sorghum, buckwheat, and sunflowers. Pure stands of sunflower and corn are planted in the managed dove hunting fields and as a late winter food and cover crop.

Wildlife food plots are planted in grains and grasses to provide both food and cover. Although the plots are referred to as food plots, they should be thought of as food and cover plots.

The wildlife food and cover plots will be planted near brushy cover when possible. The seed types planted for bobwhites specifically are soybeans, millets, lespedezas, cowpeas, and wheat. A balance of domestic and wild seeds will be provided in the plots. No effort to control "weeds" will be made in order to provide both food and cover upon the plots. Plots greater than an acre will be divided in half and put on a two-year rotation. Fields smaller than one acre will not be divided but will have grassy edge. Disked strips in the fallow half will encourage native annuals and expose bare soil for nesting and dusting. Each food plot will have a minimum of 50 feet of grass edge that will be mowed, disked or burned every 3-4 years. Beginning in 1997, a 50-foot border of perennial grasses was established around all new lands entered into an agricultural lease.

The following grasses are recommended for the edges of the wildlife food and cover plots: Cool season grasses/clovers -orchardgrass, alsike or ladino clover (Trilobium spp.), and warm season grasses - switchgrass (Panicum virgatum), Atlantic coastal panicgrass (P. amarulum), big bluestem (Andropogon gerardii), little bluestem (A. scoparius), indiagrass (Sorghastrum nutans). The seeding rate should be heavy enough to establish the stand, but light enough to create 50 % bare ground.

The soil fertility will be maintained using inorganic fertilizers according to soil test recommendations. Leaving the crops unharvested leaves most of the nutrients on-site and in the ground; therefore soils will be tested every three years. Herbicides listed as “practically nontoxic” by the U. S. Environmental Protection Agency will be herbicides of first choice on the wildlife area. Pesticide and herbicide use will be restricted to those demonstrated to be safe around wildlife. Applications will be performed in accordance to the label instructions. Their use will only be considered when no other alternative is feasible.

### ***C. Fallow Disking.***

Annual and perennial native vegetation is very important components of habitat. Annuals and perennials must be maintained in various stages of succession to be of optimum value and use to wildlife. Disking is one way to encourage annual plants to volunteer along with perennials. Seeds lying dormant deep in the ground are brought to the surface and allowed to germinate.

Disking stands of sod-forming grasses allows other annuals to grow and restores diversity of food and cover. Disking may be required at 2-3 year intervals. Strips should be disked in the idle parts of the food plots because it creates edge and encourages nesting. Varying the time of soil disturbance by disking encourages different plants to germinate. Although disking is traditionally done from September 15- March 31 (in areas not planted) to avoid disrupting nesting, disking in all summer months will be done on an experimental basis. Disked strips will be a minimum of 15 feet width.

### ***D. Prescribed Burning.***

Prescribed burning is one of the most economical procedures for manipulating wildlife habitat. Burning is used to reduce plant competition, prepare seed beds, stimulate regeneration of sprouts and seedlings, and create openings in dense stands. Low intensity fires increase both the quality and quantity of forage plants, seed-bearing plants, and insects (Schemnitz 1980).

Small fires that do not burn fast enough to trap wildlife will be used. Most commonly used burn dates are between January 15 – April 15. Burning between these dates will make some seed for wildlife available during this time of food shortage, but take advantage of the high soil moisture and cool soil temperatures common in the late winter. A burning permit issued by the Air Quality Branch (739-4791) within the Division of Air and Waste Management will be obtained prior to the burning season. The following authorities will be notified before burning - the Sussex Communication Room (739-4580), the Fire Control Board (856-6306 non-emergencies), and the Wildlife Section Office (739-5297) in Dover. When appropriate owners of lands bordering the burn will be notified. Although a prescribed burn between herbicide treatments enhances phragmites control, no burns have occurred at Prime Hook within the last 14 years. Otis Clifton, a former federal employee at PRNWR, told me that every spring since early in the 20<sup>th</sup> century, the marshes



were burned for brush control. The frequent fires favored switchgrass, and excluded red maple and sweetgum. Although the phragmites control program has been successful without burning, burning would have enhanced the program. Development of the beachfront, and lack of local support, were primary reasons for not burning.

The oak/tulip poplar forest does not need burning, and no prescribed burns are planned for the future. If a stand of prairie grass is established on the former agricultural fields, burning is important management tool for warm season grass management.

### ***E. Hedgerows.***

Hedgerows can break large fields into smaller ones creating greater edge and escape cover near a food source. Hedges are living fences and serve as a physical and visual barriers (U. S. D. A. et. al. 1972). Wildlife use increases with fewer disturbances. Evergreens provide overhead cover during cold weather and give animals a place to escape avian predators and freezing rain or snow. Native plants will be used so far as possible. Tree and shrub species that provide both cover and winter food are eastern red-cedar (*Juniperus virginiana*), wax myrtle (*Myrica cerifera*), northern bayberry (*M. carolinensis*), and white pine (*Pinus strobus*). Native trees that provide some food and could be planted in hedges (or favored during a timber harvest) are black locust (*Robinia pseudoacacia*), American beech (*Fagus grandifolia*), sweetgum, pines (*Pinus spp.*), mulberry (*Morus spp.*), sassafras, hickories (*Carva spp.*), and oaks (*Quercus spp.*). Species which were recommended widely until their value and appropriateness were questioned included autumn olive (*Elaeagnus angustifolia*), amur honeysuckle (*Lonicera maacki*), barberry (*Berberis spp.*), silky dogwood (*Cornus amomum*), Japanese multiflora rose (*Rosa multiflora*), and VA-70 shrub lespedeza (*Lespedeza bicolor*).

Multiflora rose, autumn olive, barberry, autumn olive will spread when passed by animals. This species have been used on wildlife areas where continuous cultivation keeps them in check. In keeping with the Division's goal of managing for a diversity and restoration of native species, these invasive, non-native species, will no longer be planted on state wildlife areas. These species are no longer recommended, and in some cases are being actively removed.

### ***F. Mowing.***

Mowing sets back succession and stimulates new plant growth. The openings created provide travel lanes and sunning sites as well as shooting/viewing lanes for hunters/wildlife watchers. Strips mowed through brush create more edge by providing openings for sunning, dusting, and feeding. Mowing will be done before or after the nesting season. If an area must be mowed for safety, aesthetics, or brush suppression, a predetermined lane can be mowed regularly and will discourage animals from nesting in the short grass and reduce losses to the mower.

## ***G. Chemical control of noxious weeds.***

**A persistent johnsongrass and Canada thistle problem needs long term management. The former farming leasee did not have an effective control program. In 1999, when the lease was terminated for nonpayment, and the land idled in anticipation of CREP enrollment, the presence of these two noxious weeds was very evident. In 1999 and 2000, and 2001 the Division mowed, disked, and sprayed the weeds, the beginning of an intensive eradication program.**

**Roundup, a systemic herbicide containing glyphosate, has been used exclusively to control johnsongrass. Since the fields were fallow all plants were killed. Despite the 3 years of control efforts johnsongrass and Canada thistle persist. After planting trees within the entire affected area, a change of herbicide was required. In 2002 both fields planted in trees were sprayed with Poast at 2 pints active ingredient per acre. Poast is labeled for use around trees. At the time of writing, its effectiveness is unknown. The herbicide called Plateau used for weed control within the warm season grass stands was applied at 6 ounces per acre to control johnsongrass beginning in 2001.**

**Although not listed as a Noxious Weed, Multiflora rose's invasive nature is unquestioned. Rose growing on the edges of the fields was sprayed with Ally (1/10 oz. /100 gallons of water) in 2001 and 2002. It is a very effective chemical.**

## **H. Species Management Plans.**

### **1. Waterfowl**

#### **a. Waterfowl Habitat Needs**

**Marshes with a 1:1 ratio of plants and open water are thought to provide ideal waterfowl habitat interspersions. This interspersions puts escape and resting cover close to feeding and nesting cover. Wave action and wind velocity are diminished in emergent plant stands. Aquatic insects and submersed plants are more available in water with good clarity. Even balances of plants and open water help reduce wave action and the resultant turbidity.**

**Wood ducks nest on the Prime Hook Wildlife Area. Wood ducks nest in natural nest cavities and artificial nesting structures. Nesting cavities are the prime limiting factor of wood duck populations (Anonymous 1976). There should be a minimum of one usable cavity per 5 acres located within one half mile of water.**

**Brood rearing habitat requirements differ from breeding habitat requirements. Brood habitat for wood ducks and black ducks are somewhat similar. Habitat must have emergent vegetation and/or wooded shorelines for ducklings to escape danger and insect/invertebrate densities must be high to provide protein for proper body development. Aquatic invertebrate densities must be high to provide animal protein for rapid duckling growth and the hen's nesting vigor (Bellrose 1942).**

**The similarities in feeding, brood rearing, and escape cover requirements for these species warrant an uniform approach to habitat management.**

## **b. Waterfowl Habitat Management Recommendations**

As part of a large impounded freshwater swamp, the habitat at Prime Hook Wildlife Area is very dependent on the water regime used by the PHNWR staff.

Management for resident populations of wood ducks centers on providing nesting habitat. When natural cavities are not available in sufficient densities the most common solution is to provide artificial nesting structures or wood duck nest boxes.

The best height for the nesting structure is 4 - 5 feet above the water or over 15 feet above the ground in upland woods, and they must be predator-proof. A 50 inch band of metal, an inverted cone shield or a metal sleeve from 38 - 50 inches wide will protect the nest and incubating hen from raccoons, snakes, mink, and other predators. The structures should be placed singly about 100 feet (or more) apart. The boxes should be arranged to maximize privacy between boxes. They should be over water or adjacent to brood habitat and placed so they are readily visible to the ducks. Human disturbance should be kept to a minimum, particularly near the nesting structure. Areas of unused habitat are generally the result of lack of adequate nesting sites (U. S. D. A. et al 1972).

Recent research indicates that boxes placed over water, in highly visible locations, are more prone to “dump nesting”. Dump nesting describes boxes used for multiple hens for laying eggs. Dump nests have higher than normal clutch sizes, making them much more likely to fail. Since wood ducks evolved as a natural cavity nester, whose secretive nesting behavior favored solitary nesting attempts, current management philosophy calls for placing nest boxes in the woods, at some distance to water, to make the boxes less visible to competing hens, and therefore less prone to dump nesting. I will compare nest box habitat with clutch size for correlations, and take corrective measures if needed.

The habitat supports wood ducks and our present nest box program shows signs of improving. Unused boxes (especially boxes hard to access) will be moved and additional boxes added.

## **c. Waterfowl Hunting Program Recommendations**

Waterfowl hunting is by permit only. Permits are issued at the PHNWR Check Station. The federal management staff does most of the enforcement, with assistance from the Division’s Enforcement Section. Regulations for both state and federal lands should remain as uniform as possible. In 1995 the U. S. Fish and Wildlife Service began charging \$10 per blind. The Division of Fish and Wildlife allowed Prime Hook NWR to charge for state blinds. At the same time, the federal agency assumed responsibility for blind and channel maintenance. At times, the Division has provided financial assistance, but the principal responsibility lies with the Service. I recommend a continuation of the policy of federal responsibility for blind and channel maintenance. The Division should continue assisting with cutting and attaching switchgrass to camouflage the blinds, as well as providing a tractor with a sidearm mower, and labor.

## **2. White-tailed Deer.**

### **a. Deer Habitat Needs**

Nutrient requirements of deer vary with age class, reproduction cycle, and weather (Halls 1973, 1978). Young deer require high levels of protein, phosphorus, and calcium. The deer's diet depends primarily on what food is seasonally available. Daily movements of adults are associated closely with feeding routines. Deer feed most actively early in the morning and during the evening. Deer may travel several kilometers within their home range in their daily search for food. In Delaware where the winters are mild, deer remain on their home ranges year-round. The greater the variety of plants, the greater the chances are of achieving full productive potential.

#### **b. Habitat Management Recommendations**

With deer population levels at all time highs in Delaware, deer management in Delaware is mostly controlling density to acceptable levels. In 1999 protecting plant communities and wildlife plantings from deer depredation is more important than improving deer habitat. Since 1954 when Delaware had its first modern deer-hunting season, the deer herd has grown ten-fold. In the past 15 years, deer harvests have increased annually – another indication of an expanding deer herd.

A 1999 report to the Del. Advisory Council of Fish and Game called Deer Management in Delaware: A Report of Recommendations (Rosenberry and Muller 1999), called for more adaptive deer management strategies.

In 2001 the Division of Fish and Wildlife became the first state wildlife agency in 2001 to adopt the principle of Quality Deer Management (QDM) as a statewide goal.

As stated in the opening sentence of Quality Whitetails –The why and how of quality deer management (Miller and Marchinton, eds. 1995), Quality Deer Management is the voluntary use of restraint in the harvesting of young bucks combined with an appropriate antlerless deer harvest to maintain a healthy deer population in balance with the habitat.

The existing food and cover plots serve as openings. Five acres of reverting fields were cleared in 1987. Hedges of existing native vegetation were left in a cross-shaped hedge, creating four smaller plots at each ordinal point. Beginning in 1999, a greater emphasis on establishing perennial grassy cover will begin. A soybean-based wildlife food mixture will be planted in half of plots. The 30 acres of tilled ground, formerly enrolled in our state farming lease, will be offered for enrollment in the new Conservation Reserve Enhanced Program (CREP) in 1999. Hardwood trees will be planted in the former fields. The area's overall carrying capacity for deer will be somewhat diminished by removing the agricultural crops. I do not anticipate a sharp decline in deer density due to availability of crops on adjacent private lands.

#### **c. Deer Hunting Program**

The deer herd on the Prime Hook Wildlife Area appears stable or slightly decreasing (Table 1). Heavy harvests on federal lands could be depressing the population on state lands.

On a statewide basis, the deer harvest has been increasing (Reynolds 1990). Deer harvest at Prime Hook follows the escalating statewide trend. Reporting rates on the area are not as good as a more tightly managed area like Assawoman. The data must be viewed with a caution. Reports of very high deer hunter participation during opening days (1988 – 1996) are no longer heard. The doe harvest has increased statewide, and may be having the desired effect at Prime Hook. In 1997, deer stands were increased from 4 to 10, in part to

encourage more responsible use of the area, but also to increase hunter participation and a higher deer harvest. Harvest and hunter participation will be monitored.

The deer management program will be evaluated by examining the harvest records and correlating antler beam diameters from yearling bucks taken at Prime Hook with bucks killed statewide. Harvest data will be examined to look at body weights of fawns taken on the area.

Reports on deer damage to crops in various parts of the state prompted the legislature to grant the Division the authority to issue antlerless deer permits to landowners in certain portions of the state or to those persons who could demonstrate deer damage outside those areas. The area surrounding Prime Hook was included in the first Bonus Deer Program (November 1990).

Deer stands are built and maintained by Region 4 personnel. The stands are made of 14 or 16 foot four by fours, and stand 11 or 13 feet off the ground. The steps, seat, and handrails are the most frequently repaired components. Before each season the paths to the stands are cleared of obstacles. The steps and platform are checked.

#### **d. Hunting Program Recommendations**

1. Maintain deer stand number at 10. Since 1997 when 6 stands were installed, no complaints have been voiced. Demand and supply seem to balance. If hunters request more stands, there is room for another 5 stands.
2. Change the hunting regulations to allow archery deer hunters to use portable stands provided they hunt within 100 yards of a stand. This change will improve the hunt and still allow us to maintain safety standards. (Implemented in 1999).
3. Encourage better cooperation between federal refuge staff and state wildlife enforcement officers to patrol Prime Hook during all deer seasons.
4. Explore the feasibility of a joint deer hunting programs with the U. S. Fish and Wildlife Service.

#### **3. Wild Turkey.**

##### **A. Habitat Needs**

Once thought to be a deep woods species, wild turkeys have proven highly adaptable to human land use practices. Wild turkeys were featured within this plan to highlight many of Prime Hook habitat components that are important to wild turkeys. Turkeys need large trees for roost trees, a diverse forest for hard and soft mast, a lush leguminous herb layer, heavy cover close to water for nesting, good insect populations to provide a source of protein for poult development, and an area with minimal human disturbance.

## B. Habitat Management Recommendations

Maintain an older aged forest that contains many mast-producing trees and shrubs. Reforest the open fields, if they are dropped from the State Agricultural Lease Program and enrolled with CREP. Plant trees found within the existing forest, namely tulip poplar, scarlet (Quercus coccinea), white, willow, southern red (Q. falcata), and pin (Q. palustris) oaks, American beech mockernut, pignut hickory (Carva glabra), blackgum (Nyssa sylvatica), red maple (Acer rubrum), sweet gum, and loblolly pine (Pinus taeda).

Continue managing the five acres of food plots as a combination of annual grains. Add a warm season grass component to the food plots, as well as around the reforested fields. The big bluestem, little bluestem, and Indiangrass, with wild flowers mixture used within CREP will be used. The prairie-like meadows and strips should provide good brood-rearing cover.

### 4. Delmarva Fox Squirrel (Sciurus niger cinereus)

#### A. Habitat Needs

Although squirrels eat wide variety of foods (mushrooms, insects, berries, grasses and buds), it is essential that they have a source of mast to carry them through the winter. Oak trees are the most important producers of mast (acorns and other nuts), but hickory (Carya spp.), beech, and walnut (Juglans spp.) are also important.

Squirrels must have den trees to reach maximum populations levels. Dens provide protection from predators and weather. Although they are essential for squirrels, den trees have no value in timber management. The best den trees are usually white oak, maple, beech, and red oak. Den trees that provide food and have durable heartwood are best, e.g., white and red oaks, black walnut (Juglans nigra), chestnut oak (Q. prinus), blackgum and red maple (Madson 1964).

Delmarvas live in mature hardwood forests stands along streams and hays, and small woodlots next to agricultural fields. They also occur in forest tracts dominated by mature loblolly pines near marshes and streams. Woods with an open “park-like” understory, a high percentage of mature mixed hardwoods and pines, relatively closed canopies, and a high proportion of forest edge characterize preferred Delmarva fox squirrel habitat. Prime Hook has an abundance of this habitat.

#### B. Habitat Management Recommendations

Any future managers should know that a Delmarva Fox Squirrel Habitat Conservation Plan reviewed and approved by the Recovery Team may be required prior to any significant habitat modifications on Prime Hook Wildlife Area.

Since Delmarvas could (or perhaps already have) occupy the site, no timber harvests are planned. The present mixed mature hardwood forest will be protected. Protective measures might include spraying gypsy moths, suppressing wildfires, removing insect damaged trees which threaten to severely impair the forest’s health, e.g. southern pine bark beetle, removing trees which impose an unacceptable level of risk to public safety, e. g., hanging over the road or boat launch area.

The reforestation project of the farmed fields will provide an additional 33 acres of mixed hardwood forest in the future.

In the spring of 2002, 10 squirrel boxes suitable for use by Delmarva fox squirrels were installed. They are identical to the boxes used on PHNWR, which allow the box to be removed from the tree during nest box surveys. It is hoped that the presence or absence of DFS can be confirmed in future years without a trapping program.

The following habitat management recommendations are designed for gray squirrels (*S. carolinensis*), but apply well to fox squirrels (Madson 1964).

1. Survey areas for den tree densities and determine if natural den sites are limiting. Den trees should be 15 inches in diameter or larger. Cavities 20 feet high or higher with a 4 inch entrance, and between one and 3 feet deep are ideal. This combination of size and depth is an ideal balance of protection from predators and severe weather. Three den trees per acre are recommended.
2. Install more nest boxes in areas with less than 3 den trees per acre. When less than three natural den trees per acre are available, den boxes may be desirable. Den boxes 17 inches wide and 18 inches high placed over 20 feet high in a mast-producing tree and attached above a usable limb is best. The entrance should face away from the prevailing winds. No bedding or vent holes are needed. Den boxes should be placed away from natural dens. Check and clean out the boxes in March and July each year.
3. Continue to check the nest boxes in March and late June/early July. Clean out and repair boxes when necessary. If non-target species are found using the boxes, they will be left undisturbed and another box placed nearby.
4. Advise neighbors of the legal status of Delmarva fox squirrels, including the need for a conservation plan for any property within 5 miles of the release site on Prime Hook NWR.
5. Identify and save den trees (3 trees per acre) prior to any future timber sale.

**BACKGROUND:** The species dependence on mast crops strongly influences the yearly population fluctuations, however nest site availability is a limiting factor that can be controlled. Nest boxes should improve the habitat in marginal sites and help dampen the population swings.

## ***I. Access***

### **1. Vehicular**

Direct access to the wildlife area comes from a called Little Neck Road (County Road 223). Little Neck Road connects with State Route 1 from Prime Hook Road (C.R. 38), about ¼ mile north of Waples Pond.

Until 1998, the road often became impassable during the winter months, due to deep ruts. Prior to 1985 Delaware Department of Transportation's Division of Highways maintained Little Neck Road to its terminus at our boat launching area. They gradually stopped grading the road to the end, until they only graded the road to the edge of our property. After repeated conversations and promises, a new DELDOT dirt road supervisor agreed to harden the road with recycled asphalt (called Road-a-Mel) in 1998. At present the road is in excellent condition. In the summer of 1999 the road was paved to "tar and chip" level.

The only remaining unimproved road is close to the boat ramp. DELDOT says that their maintenance right-of-way ends before the ramp.

The boat launching area is unimproved. A small pier (3 X 12 foot) is located beside the boat entry point.

## **2. Boating.**

Canals connecting the small ponds used for waterfowl hunting are very shallow. In the past 10 years, we have used a barge with a rotary cutting head called a “Cookie Cutter” to clear out channels within the waterways for outboard motor access. Channels should be cleaned at least every two years, with annual clean-outs the preferred maintenance option. Prime Hook NWR provides the machine, and the Division has helped with equipment transport and operators. Airboats are used for most blind maintenance, and nest box checks.

Prime Hook Creek is deeper than the interior ponds, e. g., Poplar Woods, Stickweed, and Twin Ponds. Outboard motors can be used with care within the creek without a clean out. Trees and limbs must be cleared from the creek and channels on an annual basis.

Since the marsh is impounded, and drawdown for waterbird management purposes each spring, water levels are sometimes lower than preferred by boaters. Complaints from waterfowl hunters and fishermen are routine. As George O’Shea, former assistant manager of Prime Hook National Wildlife Refuge said, “we manage for waterfowl, not waterfowl hunters”. In keeping with the philosophy of “wildlife come first on wildlife areas”, I concur that low water is necessary for impoundment management.

## ***J. Closed Areas.***

No areas within the wildlife area are permanently closed to the public. During the waterfowl-hunting season, no other boating activity may occur on the waterways, including fishing and trapping. Some areas along Prime Hook Creek on the federal refuge are closed to public access during nesting seasons. The wildlife area is closed each night to public access from dusk to dawn, except to lawfully hunt.

## ***K. Special Projects***

Rick McCorkle with the U. S. Fish and Wildlife Service’s Delaware Estuary Program approached me in August 1999 about interest in a reforestation project under the auspices of Partners in Wildlife and Ducks Unlimited. Ducks Unlimited is exploring the costs involved in underwriting the cost of reforestation projects with riparian and bottomland habitats. I proposed that the 33-acre fields might be a project possibility.

Keith Clancy, a member of the Delaware Native Plant Society, asked for permission to plant native trees from local seed sources at Prime Hook. In the fall of 2000 they used tree seeds (acorns, nuts, and achenes) collected on-site and planted the tree seeds at the entrance to Field #1 as part of a reforestation project within the farm fields. The site is 1 acre in size planted in rows and marked with vinyl flags. White, southern and northern red, and



willow oaks, hickories, and tulip poplar. By the summer of 2001 most of the trees germinated (approximately 85%) and were marked with flagging. The Society wants to maintain the site and use it as a demonstration site to promote native tree plantings.

The idea of installing wood duck nest boxes in sites more upland to decrease the incidence of “dump-nesting” might be tried in the coming years.

#### ***L. Conservation Reserve Enhance Program (CREP) Lease***

Under the terms of the Conservation Reserve Enhanced Program (Contracts #103 – Permanent Wildlife Habitat, and #104 – Hardwood Trees) the fields can not be disturbed for the entire contract period (15 years until 9/30/2015). The prairie grass strips (5 acres) and mixed hardwood trees (29.2 acres) must be protected from any practice that would destroy their function as a buffer to Prime Hook Creek.

A report attesting to the practices’ integrity must be filed with the Farmers’ Service Agency (FSA) office in Georgetown each year. Rental payments of \$101.14 per acre of grass per year (\$510), and \$134.50 per acre of trees per year (\$3927.00) are paid to the State of Delaware each October by the Credit Commodity Corporation (CCC). Contract numbers must be updated with the Federal Aid Coordinator and the Division Accounting section to ensure the funds are directed from the State Treasury to the Division accounts.

## **7. MEASURES FOR TESTING EFFECTIVENESS OF THE PLAN.**

### ***A. Introduction.***

Aldo Leopold, considered the " father of wildlife management", described the field of wildlife management as the art and science of producing wildlife for the needs of man and animal. Wildlife populations are cyclic and both density independent and dependent - that is affected by both the environment and the actions of members of their own kind. This dynamic relationship often makes density calculations "relative' in terms of time and space rather than an absolute estimate. Testing the effectiveness of a habitat manipulation on an animal population is never a simple exercise in "cause and effect". Often the wildlife manager uses generalized techniques to achieve a balance between plant and animal communities. Balancing the food and cover requirements of several species into an integrated wildlife management plan requires the wildlife manager to use not only proven techniques but also imagination and intuition.

There are many means for increasing plant interspersion and diversity within a field. Each planting, mowing, or burn affects plants differently. Some grasses seed heavily after a mowing, others respond to burning. Efforts to increase interspersion of plant communities may help one animal species while hindering another. A mowed strip might encourage the re-growth of succulent greens beneficial for rabbits, but disturb a nesting bobwhite. Testing a wildlife management technique is often a qualitative procedure and a matter of weighing the needs of one species with the competing requirements of another species. The following description lists some measures employed as "indicators" of success.

## ***B. Harvest***

Harvest records for deer, waterfowl, and wild turkey exist for Prime Hook. Waterfowl harvest data is collected by Prime Hook NWR staff through the checking station. Data collection is good. Data is not generally reported specific to the state wildlife area. This data is analyzed by the Division's waterfowl biologist, published within a federal aid report, then disseminated to the regional managers. Hunting effort and harvest by species are available.

Deer harvest data is collected offsite at state check stations or at local tackle shops. Hunters are asked where the deer was harvested, either on public or private lands. If this question is not asked, harvest on the wildlife area probably is reported as killed on private lands. The partial decentralized approach to checking deer at local vendors initiated in 1996, then complete closing of state check stations in 1999 exacerbated the problem. I suspect that at Prime Hook Wildlife Area, the lack of accountability that comes with no permit requirement, and the checking of deer by lay persons at local stores will result in spotty data collection. I think legal deer harvest is under-reported, and will continue to do so.

## ***C. Hunter Mail Survey.***

Harvest data for upland game species can provide valuable data for managing the populations on Prime Hook. The Statewide Hunter Mail Survey has too small a sample size and relies too much on the hunter's memory to have much value as a predictive tool to evaluate habitat and population management on a Wildlife Area.

The hunter mail survey is a useful tool to evaluate hunter demographics, attitudes, economics, and satisfaction with the hunt, but should not be used to measure animal population trends. The survey would be more useful if selected hunters were notified before the sampling period. The hunter could then keep an accurate and complete journal of his/her activities.

## ***D. Permit System.***

The present system of requiring waterfowl hunting permits and blind assignment through the federal refuge system seems to work. Demand is very high for waterfowl hunting opportunities, and any other system would result in confusion and abuse. As stated previously, deer and upland game harvest data collection could use improvement, but the relatively low numbers of hunters does not justify the expense of setting up a separate permit system.

Although I hear persistent complaints about fairness of the joint federal/state waterfowl checking station operation, I can not offer comment. The working agreement between agencies has benefits for both, and should be continued.

### ***E. Surveys and Inventories***

The following list of surveys and inventories has previously been described. They will be used to measure the effectiveness of the proposed management plan.

1. Nest box checks for wood duck, and bluebirds.
2. Surveys of wildlife food and cover plots.
3. Records of wildlife food and cover plot history.
4. Records of prescribed burning and spraying.
5. Survey of the breeding bird populations.
6. Survey of breeding amphibian and reptiles.
7. Survey of plants.

### ***F. Habitat Inventories***

#### **1. Wildlife Food and Cover Plot Management**

Written records of food plot management practices describing the chronology of plantings and treatments were started in 1986. Staff members were asked to recall what was planted in each plot as far back as they could remember. The information was used to establish crop rotations and plan future crops.

Records of the time of fertilizing, plowing, disking, planting, mowing, and burning are logged in the Food Plot History Form. Seeding and fertilizing rates are recorded to evaluate soil fertility and crop suitability on each plot.

Beginning in 1996 records for Prime Hook food plots were transferred to the Assawoman Shop files. In 2002 Joe Shockley was responsible for data collection and updating.

#### **2. Burning and Spraying Records**

Burns are done in the cool, wet days of late winter and timing can be critical in achieving desired plant response. The effects of prescribed burns on food and cover plots, woods, and marsh vegetation will be recorded to help plan future habitat manipulations.

Phragmites and noxious weeds are sprayed on a regular basis. Since phragmites is coordinated statewide, the Phragmites Spray Program Coordinator keeps spraying records of herbicide application rates, volumes, and general weather information. Regional staff handles noxious weed control, and records of spraying will be kept in the Assawoman shop.

### **3. Forest Management Plan**

The recommendations of the Delaware State Forest Service in the form of a Forestry Management Plan will be included with this plan upon its completion. The forest management plan will include a timber cruise that describes the forest by forest type, relative species composition, timber volume and market value. Using these surveys and economic predictions as a rough guideline, the regional biologist can integrate wildlife and forestry objectives into an acceptable format for a Wildlife Area.

### **4. Incidental observations**

Valuable data on species abundance and distribution on the Area can be gathered incidental to other activities. Field personnel can turn casual sightings into valuable management tools by using a general observation record system. This form is found in the appendix.

## **8. SPECIAL EQUIPMENT NEEDED**

No special equipment is needed on Prime Hook. The use of the Cookie Cutter for channel maintenance, and possibly the Hydroax for brush control is available through the federal refuge.

## **9. RECREATION PROGRAMS**

*A. Hunting –see previous sections under Hunting Programs.*

### *B. Fishing*

Freshwater fishing is very popular on Prime Hook Creek. Conflicts between fisherman and duck hunters during the early duck season occur. Boating access is primarily through the Federal refuge at the office, and upstream below Waples Pond. The water is too low during the summer, particularly during a federal drawdown of the impoundments, for consistent boating access from the state ramp. Lots of brush clogs the streams, making good fish cover, but limiting access by larger boats. To my knowledge, no bass tournaments are held on the area. In 1999, a sign stating that boat access limited to duck hunters during waterfowl hunting seasons was installed.

### *C. Interpretative Tours.*

#### **1. Driving Tour.**

The area is too small and access too limited for a driving tour of Prime Hook Wildlife Area. The new visitors center at Prime Hook National Refuge should meet the need for public information and education.

## **2. Hiking Trails.**

No hiking trails are planned for Prime Hook Wildlife Area. Vehicular traffic is light and should permit safe walking conditions.

## **9. FUTURE NEEDS**

### ***1. Possible land swap with USFWS.***

The Prime Hook Wildlife Area Wildlife Management Plan (Todd 1970) mentioned a proposal to swap 695 acres (the entire Prime Hook Wildlife Area) with the U. S. Fish and Wildlife Service for lands around Waples Pond. A land swap would benefit both agencies. The USFWS would gain an inholding, and the Division of Fish and Wildlife would have enhanced fishing and hunting opportunities. I would like to explore the feasibility of such transaction.

### ***2. Agricultural Lease***

Enroll the 30 acres of agricultural lands into the CRP or CREP programs. Plant trees within the former agricultural lands. *(This goal of enrolling the ground into CREP was accomplished between review and approval in 2002. Hardwood trees were planted in both fields. Three food plots were left out of the lease.)*

### ***3. Road Maintenance Agreement with DELDOT***

Enter into an agreement with DELDOT Division of Highways to maintain Little Neck Road in its entirety. Include a paved turnaround area at the end of the road. Ask for help improving the boat ramp.

### ***4. Biological Survey***

Contract with the Natural Heritage staff for a complete faunal and floral survey.

### ***5. Noxious Weed Control***

Johnsongrass and Canada thistle are present within the CREP fields. Control methods and results are documented within the Habitat Management section of this plan. This program needs constant vigil. It is hoped that the johnsongrass and thistle can be kept in check with herbicide until the trees grow large enough to shade the noxious weeds out.

## **6. User Survey**

Although a better understanding of the user needs would be helpful at Prime Hook, no survey is proposed. Its limited access, relative small size, and lack of other physical amenities do not encourage use outside the waterfowl and deer hunting seasons. Some fishing occurs along the creek and ponds, but most users access from Waples Pond or the ramp at the Refuge Office, and are probably unaware of the difference between federal and state boundaries. A survey of those people using the unimproved ramp on stateside probably is not needed.

## **10. PROVISIONS FOR COMPLIANCE CHECKS**

### ***A. Law Enforcement Checks***

Effective management of wildlife populations depends on good law enforcement. State Wildlife Areas should be a model of good wildlife management for landowners to emulate. If hunters believe there is a reasonable chance of apprehension for game law violations, scofflaws will be deterred.

There seems to be an underlying assumption on the part of Enforcement Agents that the people who use State Wildlife Areas generally comply with the regulations. I think they are correct, but should infrequent enforcement field checks on State Wildlife Areas change the perception amongst wildlife area users that they are likely to be checked, compliance will deteriorate rapidly. Regional managers have been cross-trained in law enforcement and may prove effective in providing this deterrence. However, both enforcement agents and biologists need to work together more in and out of the hunting season. Better coordination between the federal refuge staff and Fish and Wildlife Enforcement agents is needed.

### ***B. Biological Monitoring***

Animal surveys such as the breeding bird survey, food plot survey, quail covey count, turkey call counts, and waterfowl production estimates, e.g., brood counts and nest box data will become a permanent file in the plan.

Habitat manipulations will be monitored on a long-term basis by evaluating and revising the plans for burning, permanent clearings, hedges, timber reforestation, and freshwater wetland enhancement projects. The success or failure of a particular food and cover plot planting will be documented each year. Soil fertility, weed and pest control programs will be monitored on a five-year cycle. A forestry plan will be developed by the Delaware Forestry Service and included in the plan.

## **11. Construction Projects.**

No construction projects are planned nor anticipated. Little Neck Road was improved in 1999 with recycled asphalt, and “tar and chipped” in June 1999. I will encourage DELDOT to harden the road to the end by creating a turn-around.

## **12. Anticipated Challenges.**

Greater emphasis on widening management objectives will bring new challenges. Accommodating hiking, birdwatching, boating, and nature enthusiasts with our hunting program will require a more responsive approach. Hunters and nonhunters must be made aware of each other's needs. I anticipate resistance from hunters to the idea of sharing the woods. Nonhunters will have safety concerns, both real and perceived. As a manager, I will try to educate and persuade the publics of each other's positions.

Requests for hiking trails are anticipated. Trail construction will involve a careful balancing of critical habitat and recreational needs. Prime Hook has a very limited potential for trail development due to the high water tables. Trails could be laid out within the former agricultural fields at the time of reforestation.

More interpretative signs on multiple species management will be needed to educate nontraditional area users.

## **13. Teaming With Wildlife Project Proposals.**

1. Complete inventory of fauna and flora. Contract with Natural Heritage staff.
2. Improve boating access for canoes and kayaks at the ramp. Post signs explaining wetland management projects within the impoundments.
3. Develop hiking trails within the less sensitive areas.
4. Reforest the fields with native hardwoods.
5. Increase wood duck nest box density. Move wood duck nest boxes to more wooded sites.

## **14. PERSONNEL**

### ***A. Current staff***

Region 4 of the Division of Fish and Wildlife covers most of Sussex County. However, the Cedar Creek watershed in the northeast corner of the county and Abbott's Mill - an old mill, pond, and barn southwest of Milford are excluded from the region. Delaware Nature Society leases Abbott's Mill for educational purposes. Region 3 staff manages Abbott's Mill.

The Region 4 staff is 2 Conservation Technician IV's (Paygrade 8), and 4 Conservation Technician III's (Pay Grade 7). The staff is divided into 2 crews with responsibilities lying along an east-west gradient. The East Crew is responsible for Prime Hook. Harry Schellenger, Conservation Technician IV, Joseph Shockley, and E. Outten Torbert, Conservation Technician III's are based at Assawoman Wildlife Area. They are also responsible for Assawoman & Piney Point Wildlife Areas, as well as the following Fishing

**Areas: Lewes, Masseys Landing, Rosedale Beach, Love/Arnell Creek (The Boat Hole), Pepper Creek, Waples, Millsboro, and Ingrams Ponds.**

**A 2682-acre complex of leased lands for public hunting lies within Region 4. The two crews divide responsibility for these areas geographically. The Assawoman Crew is responsible for the Barr Tract southeast of Georgetown, and the Nanticoke Crew maintains the lands lying along the southern tier of the county – Whitesville, Edwin Bell, and Ralph's Corner.**

**No state personnel are involved with the waterfowl hunting check station located on the Prime Hook NWR. A seasonal employee runs the drawings at Assawoman Wildlife Area. The seasonal employee works 4 hours a day during all deer firearms and waterfowl hunting seasons. The pay is above minimum wage at \$7.00 per hour in 2001.**

### ***B. Future staffing.***

**As the number of properties within the region expand (40 tracts on 14,964 land acres and 646 water acres – 8/28/02), the need for an expanded staff grows. My greatest need is a qualified Wildlife Technician. The position would involve applied wildlife management duties. I have delegated the responsibility of implementing the wildlife management plans to the Conservation Technician IV's, but the responsibility is largely outside the scope of the position. The region's needs are unmet in several critical areas including systematic biological survey, habitat management planning and documentation, user surveys, hunter bag checks, public outreach, and the implementation of wildlife management plans.**

**I request the creation of a new technician level position to coordinate biological and habitat work, as well as act as an assistant to the Regional Manager. I also need two additional Conservationist III's to provide better maintenance work.**

## **15. BUDGET.**

### ***A. Funding Sources***

#### **1. Federal Aid Projects.**

**Funding to operate the Prime Hook Wildlife Area comes from various sources. The majority of funds are federal aid monies derived from the Pittman-Robertson Wildlife Restoration in Aid Act Fund. The Federal Government supplies 75 % of the funds, which is derived from an 11 % excise tax on sporting goods. The Division matches the other 25 % with its own money and resources. The P-R project, which pays for the actual operation of the Wildlife Area, is called W-5-D.**

**W5D pays for the acquisition and maintenance of the following items on Prime Hook: 0.6 miles of road, 10 deer stands, 8 duck blinds, 1 parking lot, 1 boat ramp (unimproved), 3168 feet of channel, 1 Area sign, 60 boundary signs, 4 acres of food plots, 23 acres of mechanical**



**habitat manipulations, 15 acres of chemical vegetation control, 15 acres of controlled burning, and 11 nest boxes (5 wood duck and 6 bluebird nest boxes).**

**Endangered species work is funded with a project called E-1. Delmarva fox squirrels have not been sighted on Prime Hook, but money is available to manage habitat if needed.**

**No fishing area money is spent at Prime Hook. Funds for fishing area maintenance are listed as F-2-D.**

## **2. Accounting**

**As the regional manager I track spending by logging all receipts. The regional budget lists expenditures by federal aid project, e. g., W-5-D, and by budget code category. The budget code category uses the line items within the W-5-D federal aid project. Each year the expenditures are sorted by project and budget category. Annual files are maintained at the Regional Office at the Assawoman Wildlife Area.**

**Items not tracked within the regional budget are items that are paid directly to the Dover office. Items include electricity, telephone, heating fuel and propane, and motor fuel.**

**A five year capital equipment plan is attached here listing the Region's major capital needs through Fiscal Year 2005.**

## 16. APPENDICES.

### A. List of Tables

### B. List of Figures.

### D. Budget and Expenses.

## E. Wildlife Species List – Prime Hook Wildlife Area

Source of information for this list is a combination of personal observation supplemented with data collected by the Division's Natural Heritage Staff

### KEY TO ABBREVIATIONS

WHEN - YR - Year-round resident SFM - Spring or fall migrant  
 W - Winters only S - Summers only  
 ABUNDANCE – C – Common U – Uncommon R – Rare E –  
 Endangered ? - Unknown T – Threatened \* exotic

## MAMMALS

SPECIES PRESENT WHEN ABUNDANCE

### MAMMALS

WHITE-TAILED DEER	YES	YR	C
GRAY SQUIRREL	YES	YR	C
EASTERN COTTONTAIL	YES	YR	C
RACCOON	YES	YR	C
OPOSSUM	YES	YR	C
STRIPED SKUNK	YES	YR	C
RED FOX	YES	YR	C
GRAY FOX	YES	YR	C
RIVER OTTER	YES	YR	C
MUSKRAT	YES	YR	C
LEAST WEASEL	?		
WOODCHUCK	NO		
BEAVER	YES	YR	C
SHORT-TAILED SHREW	?		
MEADOW VOLE	YES	YR	C
STAR-NOSED MOLE	?		
EASTERN MOLE	?		
MASKED SHREW	YES	YR	?
WHITE-FOOTED MOUSE	YES	YR	
DEER MOUSE	?		
WOODLAND JUMPING MOUSE?			

DELMARVA FOX SQUIRREL	?		
RED SQUIRREL	NO		
SOUTHERN FLYING SQUIRREL	YES	YR	?
MINK	?		
SHORT-TAILED WEASEL	?		
COTTON RATS	?		
SPERM WHALE	NO	?	E
BLUE WHALE	NO	?	E
FINBACK WHALE	NO	?	E
SEI WHALE	NO	?	E
HUMPBACK WHALE	NO	?	E
RIGHT WHALE	NO	?	E

## BIRDS

	NORTHERN BOBWHITE	YES	YR	C
	RING-NECKED PHEASANT	YES	YR	U
	WILD TURKEY	YES	YR	C
	MOURNING DOVE	YES	YR	C
	PIED-BILLED GREBE	YES	W	U
	AMERICAN BITTERN	YES	S/SFM	U
	LEAST BITTERN	YES	S/SFM	R
	GREAT BLUE HERON	YES	YR	C
	GREAT EGRET	YES	S/SFMU	C
	SNOWY EGRET	YES	S/SFM	C
	GREEN-BACKED HERON	YES	YR	C
	BLACK-CROWNED HERON	YES	SFM	R
	YELLOW-CROWNED HERON	YES	SFM	U
	GLOSSY IBIS	YES	S/SFM	U
	TUNDRA SWAN	YES	W/SFM	U
	MUTE SWAN*	YES	SFM/YR	U
	CANADA GOOSE	YES	W/SFM/YR	C
	SNOW GOOSE	YES	W/SFM	C
	WOOD DUCK	YES	YR/SFM	C
	AMERICAN BLACK DUCK	YES	YR/SFM/W	C
	MALLARD	YES	YR/SFM/W	C
	BLUE-WINGED DUCK	YES	SFM	R
	GREEN-WINGED DUCK	YES	SFM	C
	GADWALL	YES	SFM	U
	NORTHERN PINTAIL	YES	SFM	C
	SHOVELER	YES	SFM	U
	AMERICAN WIDGEON	YES	SFM	U
	RUDDY DUCK	YES	SFM/W	C
	CANVASBACK	YES	SFM/W	C
	REDHEAD	NO		
	RINGNECK	YES	SFM/W	C
	GREATER SCAUP	YES	SFM/W	U
	LESSER SCAUP	YES	SFM/W	U
	BUFFLEHEAD	YES	SFM/W	C
	GOLDENEYE	YES	SFM/W	U
	COMMON MERGANSER	YES	SFM/W	C
	HOODED MERGANSER	YES	SFM/W	U
	RED-BREASTED MERGANSER	YES	SFM/W	U
	OLDSQUAW	NO		

BLACK SCOTER	NO		
SURF SCOTER	NO		
WHITE-WINGED SCOTER	NO		
ATLANTIC BRANT	NO		
BLACK VULTURE	YES	SFM/W	C
TURKEY VULTURE	YES	YR	C
BALD EAGLE	YES	S/SFM	E
OSPREY	YES	S/SFM	C
NORTHERN HARRIER	YES	SFM/W	C
RED-SHOULDERED HAWK	YES	SFM	U
RED-TAILED HAWK	YES	YR	C
BROAD-WINGED HAWK	YES	SFM	C
AMERICAN KESTREL	YES	YR	C
MERLIN	YES	SFM	?
PEREGRINE FALCON	YES	S/SFM	E
SHARP-SHINNED HAWK	YES	SFM/YR	C
COOPER'S HAWK	YES	SFM	?
GOSHAWK	NO		
BLACK RAIL	?		
CLAPPER RAIL	NO		
KING RAIL	?		
VIRGINIA RAIL	YES	SFM	?
SORA	?		
COMMON MOORHEN	?		
AMERICAN COOT	YES	SFM/W	C
PIPING PLOVER	NO		
KILLDEER	YES	S/SFM	C
AM. OYSTERCATCHER	NO		
BLACK-NECKED STILT	YES	S/SFM	R
WILLET	YES	S/SFM	C
SPOTTED SANDPIPER	YES	SFM	U
AMERICAN WOODCOCK	YES	SFM/W	C
LAUGHING GULL	YES	YR	C
HERRING GULL	YES	SFM/W	C
RING-BILLED GULL	YES	YR	C
GULL-BILLED TERN	?		
COMMON TERN	YES	S/SFM	U
FORSTER'S TERN	YES	S/SFM	U
LEAST TERN	?		
BLACK SKIMMER	?		
ROCK DOVE	YES	YR	C
BLACK-BILLED CUCKOO	?		
YELLOW-BILLED CUCKOO	YES	S/SFM	U
COMMON BARN OWL	?		
EASTERN SCREECH OWL	YES	YR	C
GREAT HORNED OWL	YES	YR	C
BARRED OWL	?		
COMMON NIGHTHAWK	?		
CHUCK-WILL'S WIDOW	?	S/SFM	C
WHIP-POOR WILL	?	S/SFM	C
CHIMNEY SWIFT	?	S/SFM	C
RUBY-TH. HUMMINGBIRD	?	S/SFM	C
BELTED KINGFISHER	YES	S	C
RED-HEADED WOODPECKER	?	S/SFMW	U
RED-BELLIED WOODPECKER	YES	YR	C
DOWNY WOODPECKER	YES	YR	C

HAIRY WOODPECKER	YES	YR	C
NORTHERN FLICKER	YES	YR	C
PILEATED WOODPECKER	YES	YR	C
EASTERN WOOD PEWEE	YES	S	C
ACADIAN FLYCATCHER	YES	SFM	U
WILLOW FLYCATCHER	?		
LEAST FLYCATCHER	?	S	U
EASTERN PHOEBE	?	S	C
GR.CRESTED FLYCATCHER	YES	S	C
EASTERN KINGBIRD	YES	S	C
HORNED LARK	YES	SFM	C
PURPLE MARTIN	YES	S	C
TREE SWALLOW	YES	SFM	C
N. ROU.-WINGED SWALLOW	?		
BANK SWALLOW	?		
BARN SWALLOW	?	S	C
BLUE JAY	YES	YR	C
AMERICAN CROW	YES	YR	C
FISH CROW	?		
CAROLINA CHICKADEE	YES	YR	C
TUFTED TITMOUSE	YES	YR	C
WH.-BREASTED NUTHATCH	YES	S	U
BROWN-HEADED NUTHATCH	?	S	U
RED-BREASTED NUTHATCH	?		
CAROLINA WREN	YES	YR	C
HOUSE WREN	YES	S	C
SEDGE WREN	?		
MARSH WREN	?		
BLUE-GRAY FLYCATCHER	YES	SFM	U
EASTERN BLUEBIRD	YES	YR	C
VEERY	YES	SFM	C
WOOD THRUSH	YES	S	C
AMERICAN ROBIN	YES	YR	C
GRAY CATBIRD	YES	S	C
NORTHERN MOCKINGBIRD	YES	S	C
BROWN THRASHER	YES	S	C
CEDAR WAXWING	?		
EUROPEAN STARLING	YES	YR	C
WHITE-EYED VIREO	YES	S	C
YELLOW-THROATED VIREO	?		
WARBLING VIREO	?		
RED-EYED VIREO	YES	S	C
BLUE-WINGED WARBLER	?		
NORTHERN PARULA	?		
YELLOW WARBLER	?		
CHESTNUT-SIDED WARBLER	?		
YELLOW-THR. WARBLER	?		
PINE WARBLER	?		
PRAIRIE WARBLER	?		
CERULEAN WARBLER	?		
BLACK & WHITE WARBLER	?		
AMERICAN REDSTART	?		
PROTHONOTARY WARBLER	YES	S	C
WORM-EATING WARBLER	?		
SWAINSON'S WARBLER	?		
OVENBIRD	YES	S/SFM	C

LOUISIANA WATERTHRUSH	?		
NORTHERN WATERTHRUSH	?		
KENTUCKY WARBLER	?		
COMMON YELLOWTHROAT	YES	S	C
HOODED WARBLER	?		
YELLOW-BREASTED CHAT	YES	S/SFM	C
SUMMER Tanager	?		
SCARLET Tanager	?	S	C
NORTHERN CARDINAL	YES	YR	C
BLUE GROSBEAK	YES	S	C
INDIGO BUNTING	YES	S	C
RUFOUS-SIDED TOWHEE	YES	YR	C
CHIPPING SPARROW	YES	YR	C
FIELD SPARROW	YES	YR	C
VESPER SPARROW	?		
GRASSHOPPER SPARROW	?		
HENSLOW'S SPARROW	?		
SHARP-TAILED SPARROW	?		
SEASIDE SPARROW	?		
SONG SPARROW	YES	YR	C
SWAMP SPARROW	YES	YR	U
RED-WINGED BLACKBIRD	YES	YR	C
EASTERN MEADOWLARK	YES	W	C
BOAT-TAILED GRACKLE	?		
COMMON GRACKLE	YES	YR	C
BROWN-HEADED COWBIRD	YES	YR	C
ORCHARD ORIOLE	?		
BALTIMORE ORIOLE	?	S	U
HOUSE FINCH	YES	YR	C
HOUSE SPARROW	YES	YR	C
BROWN PELICAN	?		

## REPTILES

COMMON SNAPPING TURTLE	YES	YR	C
BOG TURTLE	?		E
WOOD TURTLE	?		R
SPOTTED TURTLE	?		R
STINKPOT	?		C
EASTERN MUD TURTLE	?		
N. DIAMONDBACK TERRAPIN	NO		
EASTERN PAINTED TURTLE	YES		C
EASTERN BOX TURTLE	YES		C
HAWKSBILL SEA TURTLE	NO		E
LEATHERBACK SEA TURTLE	NO		E
KEMP'S RIDLEY SEA TURTLE	NO		E
GREEN TURTLE	NO		T
LOGGERHEAD TURTLE	NO		T
NORTHERN FENCE LIZARD	?		C
FIVE-LINED SKINK	?		C
BROAD-HEADED SKINK	?		
SIX-LINED RACERUNNER	?		R
NORTHERN WATER SNAKE	?		C
RED-BELLIED WATER SNAKE	?		U

EASTERN GARTER "	?	C
EASTERN RIBBON "	?	? R
E. SMOOTH EARTH "	?	R
N. RED-BELLIED "	?	? R
N. BROWN "	?	? C
EASTERN HOGNOSE	?	? C
EASTERN WORM "	?	? ?
NORTHERN RINGNECK "	?	? ?
SOUTHERN " "	?	? ?
ROUGH GREEN "	?	? ?
NORTHERN BLACK RACER	?	C C
BLACK RAT SNAKE	YES	C C
CORN "	?	? ?
NORTHERN SCARLET "	?	? ?
EASTERN MILK SNAKE	?	C
EASTERN KING SNAKE	?	? U
NORTHERN COPPERHEAD	?	

## AMPHIBIANS

RED-SPOTTED NEWT	NO	C
E. TIGER SALAMANDER	NO	E
SPOTTED "	NO	? ?
MARBLED "	?	? ?
NORTHERN DUSKY "	NO	C
EASTERN MUD "	?	? ?
RED-BACKED "	YES	C
FOUR-TOED "	?	? ?
NORTHERN TWO-LINED "	?	? ?
EASTERN SPADEFOOT TOAD	?	? ?
E. NARROWMOUTHED TOAD	?	R
AMERICAN TOAD	?	R
FOWLER'S TOAD	YES	C
SPRING PEEPER	YES	C
GREEN TREEFROG	YES	C
COPE'S GRAY TREEFROG	?	E
GRAY TREEFROG	?	C
NEW JERSEY CHORUS FROG	?	C
NORTHERN CRICKET FROG	YES	C
GREEN FROG	YES	C
BULLFROG	YES	C
SOUTHERN LEOPARD FROG	YES	C
PICKEREL FROG	?	C
WOOD FROG	?	C
CARPENTER FROG	?	? ?

### 13. LITERATURE CITED.

#### LITERATURE CITED

- Anonymous. 1976. Nest boxes for Wood Ducks. U. S. Fish and Wildlife Service. Wildlife Leaflet 510. U. S. Dept. of Interior, Washington, D. C. 15 p.
- Bellrose, Frank C. 1942. Ducks, Geese, and Swans of North America. Stackpole Publishing Co., Harrisburg.
- Clark, James. 1980. A wildlife management plan for the Patuxent River Naval Air Station. Unpublished manuscript. Lexington Park, Maryland. 88 p.
- Clifton, Otis. 1994. Personal communication. Prime Hook National Wildlife Refuge. U. S. Wildlife Service. Department of the Interior.
- Custer, Jay F. and Glen R. Mellin. 1989. Archaeological survey in southwestern Delaware, 1987 - 1988. Bull. Archaeological Soc. of Delaware. Vol. 26. 68 p.
- Halls, L. K. 1973. Managing deer habitat in loblolly-shortleaf pine forest. J. For. 71(2):752-757.
- \_\_\_\_\_. 1978. White-tailed Deer. p. 43 - 66. in Big Game of North America - ecology and management. Stackpole Publishing Co., Harrisburg.
- Ireland, W., Jr. and E. D. Matthews 1974. Soil Survey of Sussex County, Delaware. U. S. D. A., Soil Conservation Service.
- Madson, J. 1964. Gray and Fox Squirrels. Olin Mathieson Chemical Corp., Peoria. 112 p.
- Miller, K.V. and R. L. Marchinton, ed. 1995. Quality whitetails: the why and how of quality deer management. 321 pp.
- Reynolds, K. 1990. Personal communication. Del. Division of Fish and Wildlife. Dept. of Natural Resources and Environmental Control.
- Reynolds, K. 1998. Personal communication. Del. Division of Fish and Wildlife. Dept. of Natural Resources and Environmental Control.
- Reynolds, K. 1999. Personal communication. Del. Division of Fish and Wildlife. Dept. of Natural Resources and Environmental Control.
- Rosenberry, C. S. and L. I. Muller. 1999. Deer Management in Delaware: A Report of Recommendations to the Del. Advisory Council of Game and Fish by the Deer Task Force. 12 p.
- Schemnitz, S. D. (ed.). 1980. Wildlife Management Techniques Manual. 4th edition. The Wildlife Society. Bethesda, Maryland. 686 p.
- United States Department of Agriculture and the Delaware Department of Natural Resources and Environmental Control. 1972. Delaware Wildlife Management Guide. Hyattsville, Maryland. 50 p.



**Whitman, W. 1991. Personal communication. Del. Division of Fish and Wildlife. Dept. of Natural Resources and Environmental Control.**

**Whittendale, T. 1999. Federal Aid Report. 1998. Del. Division of Fish and Wildlife. Dept. of Natural Resources and Environmental Control.**