

Rancocas Natural Area Management Plan

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Division of Parks and Forestry
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Introduction

The Rancocas Natural Area occupies 58 acres within the Rancocas State Park (Figures 1 and 2). The park is located in Westampton Township, Burlington County, New Jersey, and contains roughly 1,252 acres. The natural area is adjacent to land currently leased from the Division of Parks and Forestry by the NJ Audubon Society for its Rancocas Nature Center (Figure 2).

The management plan provides an outline for conserving and protecting the natural resources and associated values of the Rancocas Natural Area, as summarized in the management objective of this natural area. It provides a brief overview of the physical and biological features of the area and describes the current objectives and concerns for managing the natural area.

The Natural Areas System was established and is administered pursuant to N.J.S.A. 13:1B-15.4 et seq. and N.J.S.A. 13:1B-15.12a et seq. A "Natural Area" is defined as: "an area of land or water, owned in fee simple or as a conservation easement by the Department, which has retained its natural character, although not necessarily completely undisturbed, or having rare or vanishing species of plant or animal life, or having similar features of interest, which are worthy of preservation for present and future residents of the State" (N.J.A.C. 7:5A-1.3). Rancocas was added to the Natural Areas System in 1978 through promulgation of rules associated with the Natural Areas System Act of 1975.

The Division of Parks and Forestry, through Lebanon State Forest, serves as the local agency responsible for administration and implementation of policy and land management practices affecting Rancocas Natural Area. As part of its responsibilities to implement management policies and practices, Lebanon State Forest may consult with other Divisions, organizations and individuals, as well as the ONLM, as necessary to achieve the management objective of this plan.

The Office of Natural Lands Management (ONLM) is responsible for overall administration of the Natural Areas System, promulgation and revision of rules governing System lands, and preparation of management plans. The ONLM also periodically monitors implementation of the management techniques outlined in management plans, and may propose amendments to plans as needed.

Management Objectives and Concerns

The management objective of the natural area is the "preservation of freshwater marsh and southern floodplain habitat, including one of the largest stands of wild rice in New Jersey." Several activities are consistent with this objective:

- Identify the natural area boundary with natural area signs.
- Monitor and assess the impact of public use in the natural area.
- Promote natural resource education in the natural area.
- Maintain and enhance interpretive loop trail.
- Monitor and control erosion on foot paths not maintained as trails.
- Monitor and control invasive exotic species.
- Protect archeological features.
- Maintain and enhance habitat for threatened and endangered species.

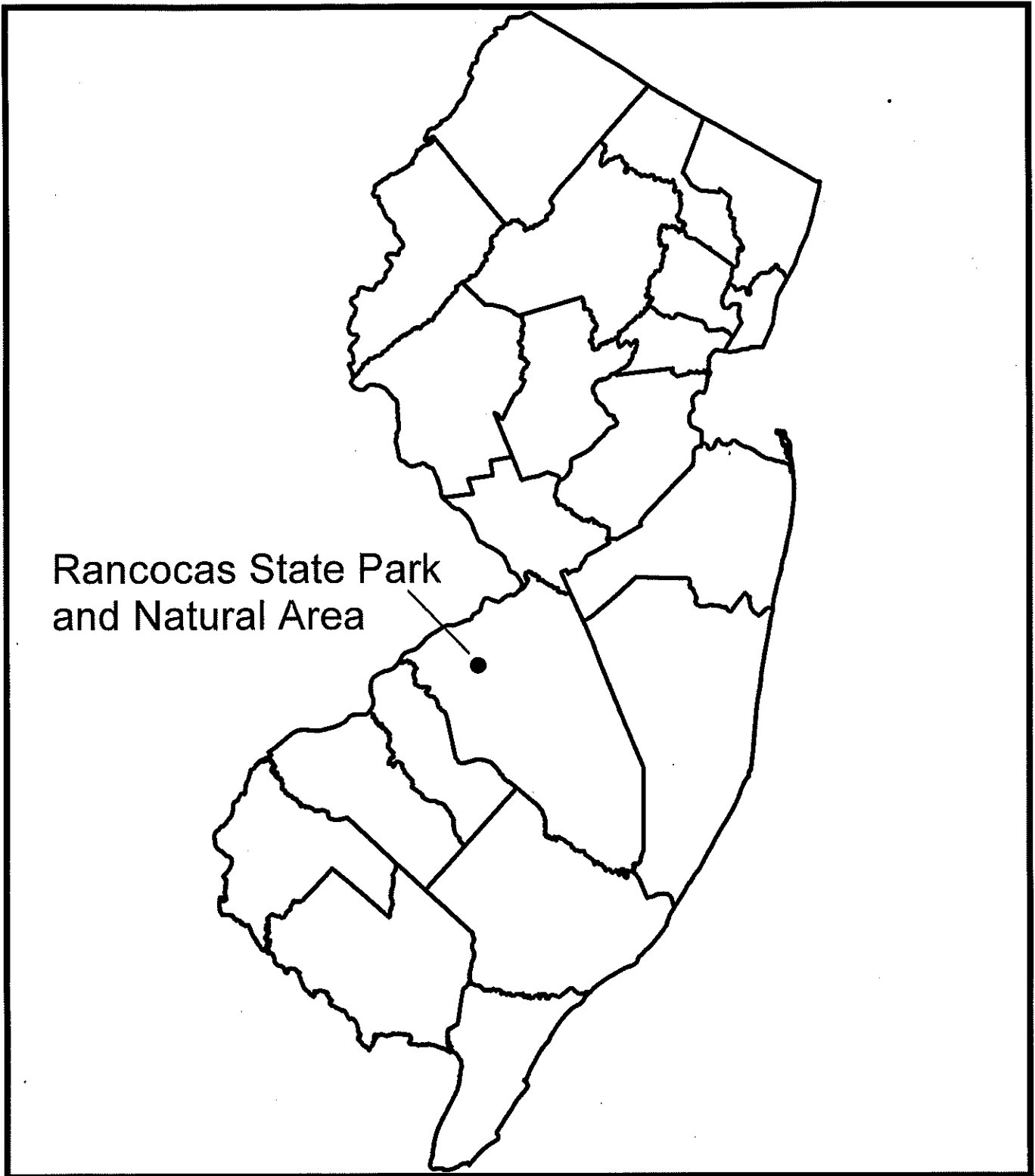
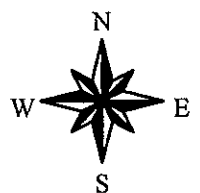


Figure 1. Rancocas Natural Area
General Location

90000 0 90000 180000 Feet



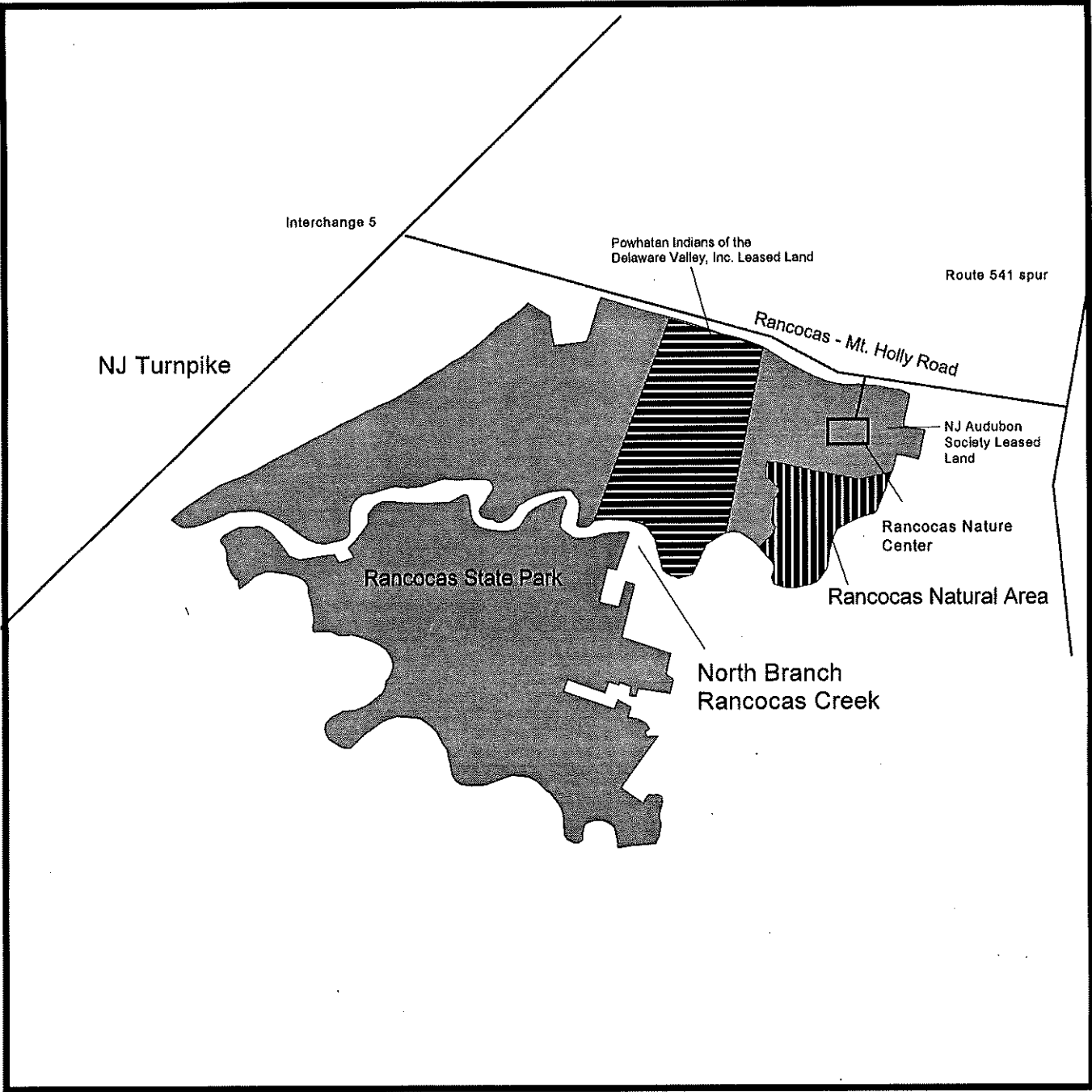
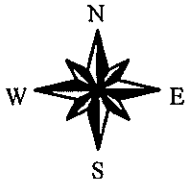


Figure 2. Rancocas Natural Area
Location relative to the NJ Audubon Society,
Rancocas State Park and the
Powhatan Indians of the Delaware Valley, Inc.



History

The Rancocas Creek and surrounding land from Mount Holly to the Delaware River is rich in early American history, custom and folklore. In the late 1700's and early 1800's, the Rancocas Creek was heavily used as a transportation route from Mount Holly to the Delaware River and Philadelphia. Although a considerable amount of information exists on the history and past practices of the areas surrounding the Rancocas Creek, information pertaining specifically to the natural area is limited.

The NJ Department of Environmental Protection (DEP), Office of Historic Preservation, reports that American Indians inhabited areas all along both branches (North and South) of the Rancocas Creek throughout much or all of the 12,000 years of prehistory (Deborah Fimbel, pers. comm. 1996). The North Branch of the Rancocas Creek flows along the southern boundary of the natural area. The NJ State Museum, Archaeology/Ethnology Bureau, reports that known prehistoric archaeological resources appear to be located within the boundaries of the natural area and within a one mile radius. While the natural area may have been utilized during prehistoric times for its plant and animal resources, historically, its predominantly wet soils have limited agriculture and development, activities which often lead to the discovery of prehistoric remains through the disturbance of soil (Deborah Fimbel, pers. comm. 1996). An archaeological survey of the area would be needed, however, to confirm the existence of prehistoric remains in the natural area.

Karl Anderson, Director of NJ Audubon's Rancocas Nature Center, which also lies within the state park and surrounds the natural area on two sides, is familiar with the history of the natural area. Anderson provided excerpts from a writing by C.H. McIlvain which briefly describes the activities of Charles Longstreth Mather within the natural area.

Charles Longstreth Mather bought the area, which includes the natural area and was part of the Rodger's estate, in 1855. At the time of purchase, Mather and his family resided in an existing brick house that was built in 1768. Sometime between 1859 and 1890, the house burned down and a new one was immediately erected.

Mather planted crops and marketed wood from the forest. He also dug large deposits of muck from the lowlands, which he applied to the upland soils to increase crop productivity. He built a large lime kiln in which thousands of bushels of oyster shells were burned and turned into lime which was also spread over the cropland. By banking, damming and draining, Mather reclaimed large quantities of the flooded meadow lands which occupied many acres of his farm. He was successful at creating productive pasture in much of the flooded meadows, where he grazed cattle for a number of years. He also tried shipping molding sand from his farm to Philadelphia.

In 1977, the NJ Audubon Society entered into a lease agreement with the Division to use the buildings at the entrance to the natural area as a nature center and to lease the adjacent 127 acres, excluding the 58 acres of natural area, for outdoor education and interpretation (Figure 2). Initially, the term of the lease was for five years, with the option to renew the lease for successive five-year periods. In 1984, the term of the lease agreement was set at 25 years. In 1977, Karl Anderson joined the staff of the nature center. Shortly thereafter, 12 people hired through the federal Comprehensive Employment and Training Act (CETA) to help create trails through the natural area and repair buildings. Approximately 10,000 people a year visit the NJ Audubon Society Nature Center, of which roughly 3,000 use the natural area, for walking, bird watching, and natural resource education and interpretation

(Karl Anderson, pers. comm. 1997). To promote outdoor education, the NJ Audubon Society developed a self-guiding trail with numbered stops to correspond with a self-guided trail brochure. A portion of this loop trail traverses the natural area.

In 1983, the Powhatan Renape Nation entered into a 25 year lease agreement with the Division of Parks and Forestry to use roughly 237 acres of Rancocas State Park as a native American spiritual and cultural interpretive center. The land is located adjacent to the western boundary of the land leased by the NJ Audubon Society and to the west of the natural area (Figure 2). The Rankokus ("Living Stars") Reservation is active today for cultural programs, classes and meetings. Visitors to the reservation can observe a Powhatan ancestral village, watch Indian craftspeople demonstrate their skills, or visit the library, museum or gift shop.

Physical and Biological Features

Location

Rancocas Natural Area can be accessed through the NJ Audubon's Rancocas Nature Center located at 794 Rancocas-Mt. Holly Road in Hainesport, NJ (Figure 1 and 2). The Nature Center is located approximately 1.0 mile east from Interstate 295. The administering office is located at Lebanon State Forest in New Lisbon, roughly 16 miles to the east, making patrol and enforcement difficult. The Rancocas Nature Center, however, is located on-site at the entrance to the natural area and assists in monitoring and protection of the natural area.

Boundary

The current boundary is consistent with Natural Area System Rules (N.J.A.C. 7:5A-1.12), which indicate that the natural area boundary must conform with physical features identifiable in the field or the extent of state ownership. The North Branch of the Rancocas provides the southern and part of the eastern boundary while a small tributary to the North Branch exists along the western edge of the natural area. The northern boundary is formed where upland hardwood forest meets a planted pine stand (Figure 3). Currently, the boundaries are marked with either State Park signs or NJ Audubon Society "Preserve" signs.

The roughly 1,200 acres of state park surrounding the natural area contains a wide variety of plant and animal species and provides abundant habitat. These lands were examined in the field on several occasions for their potential to be included within the natural area boundary. The lands adjacent to the natural area to the north and west are leased to the NJ Audubon Society and are, therefore, not eligible for inclusion in the Natural Area System (N.J.S.A. 13:1B-15.12a7). Additional lands to the south and east of the natural area within Rancocas State Park were also examined for their potential to be included within the natural area. These areas were mostly located on the south side of the Rancocas Creek which limits direct access. Further, these areas include several private in-holdings, which make monitoring and management difficult.

Geology

The Rancocas Natural Area is located in the Atlantic Coastal Plain physiographic province. This physiographic province runs along the eastern shore of the United States from Cape Cod to the tip of Florida and westward across Alabama, Mississippi, Louisiana, and Texas to Mexico. In New Jersey, the Coastal Plain is a low lying area that was submerged during periods when sea level was higher than at present and subsequently exposed during glacial periods when sea level was lower than it is now. The formations found on the Coastal Plain are marine sediments and fluvial deposits. The Coastal Plain in New Jersey is divided into subprovinces that include the Inner and Outer Coastal Plain, differentiated by the age of the underlying deposits (Wolfe 1977). The Rancocas Natural Area is located in the Inner Coastal Plain.

The Atlantic Coastal Plain has a geologic framework of gently southeastward dipping unconsolidated clay, marl, silt and sand of Late Cretaceous and Tertiary age (Wolfe 1977). The lowland which is characteristic of the Inner Coastal Plain extends from Salem to Trenton and continues to Perth Amboy and the Raritan Bay. The deep entrenchment and down-dip migration of the Delaware River exposed the formations that crop out along the edge of the Inner Coastal Plain (Wolfe 1997).

Soils

The following soil descriptions are based on the U.S. Department of Agriculture (1971) Soil Survey of Burlington County, New Jersey, unless otherwise noted. Two soil series support the wide diversity of vegetation comprising the mixed central hardwood forest in the upland portion of the natural area. A Collington Fine Sandy Loam is present in the northern-most section and comprises roughly one third of the natural area, while a Klej Sand exists along the eastern edge of the natural area adjacent to a portion of the North Branch of the Rancocas Creek.

Alluvial land and tidal marsh soils occur throughout the remaining half of the natural area. In these areas soil materials are so variable that they cannot be placed in a series. In the southern-most portion of the natural area, Marsh, Tidal is predominate. A small tributary stream exists along the western boundary of the natural area, which feeds the North Branch of the Rancocas Creek. In this stream corridor, the soils are mainly Alluvial, Loam.

Collington Fine Sandy Loam

This series consists of well-drained loamy soils that contain moderate amounts of glauconite. They occur mainly in high positions and have slopes of 2 to 5 percent. Because of their high available water capacity and moderate organic-matter content, these soils are moderately high in fertility and respond well to added fertilizer. These soils are, however, typically very strongly acid.

Klej Sand

This series consists of deep, nearly level and gently sloping sandy soils that have a fluctuating water table that is moderately high late in winter. Located along the North Branch of the Rancocas Creek on the eastern boundary of the natural area, this soil is subject to flooding when the stream rises to its highest levels. These soils characteristically have low fertility, organic-matter content and available moisture. However, on terraces adjacent to the creek, fertility and available water are expected to be greater.

Alluvial Land, Loamy

In this soil, located in the corridor of a tributary stream on the western boundary of the natural area, soil textures vary considerably according to the position of the land and source of the material. Although the surface layer is sandy loam in most places, there are areas where the sand components are dominantly fine or where the texture may be as fine as clay loam. This soil is usually moderately well-drained to very poorly drained and along the main branches of the Rancocas Creek where the streams have been cut deeply, stream overflow is not frequent.

Marsh Land, Tidal

This soil located in the southern half of the natural area consists of highly organic silt flats near sea level where they are flooded twice daily. The native vegetation is salt-tolerant grasses and sedges. Salt hay was formerly harvested from these soils.

Topography and Surface Hydrology

The topography of the Coastal Plain is generally of low relief with 80 to 90 percent of the land area at or below 100 feet in elevation (Tedrow 1986). Slopes across most of the Coastal Plain are less than five to ten feet per mile and are ten to fifteen feet per mile in the inner coastal plain (Wolfe 1977). The terrain in the natural area slopes gradually downward from an elevation of roughly 30 feet at the entrance to the north to 5 feet at the stream edge along the southern boundary.

Streams of the Coastal Plain flow in open valleys at only slightly lower elevations than the broad divides. The natural area is located in the Delaware River drainage basin along the stream valley of the North Branch of the Rancocas Creek, which flows generally southeast to northwest and is located in the northwestern section of Burlington County. The total area of the region drained by the Rancocas Creek, its tributaries, and a few small streams, comprises about 360 square miles (Churchill 1993). The Rancocas Creek extends roughly 30 miles from Mt. Holly to the Delaware River. The seasonally tidal North Branch of the Rancocas Creek forms the southern boundary of the natural area, while an un-named tributary to the North Branch forms the western boundary.

Biotic Communities

Mesic Coastal Plain Mixed Oak Forest

Occupying approximately 15 acres in the northern quarter of the natural area (Figure 3), the dominant tree types comprising this mixed oak-beech forest and successional woodland include black locust (*Robinia pseudoacacia*), sweet gum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), white oak (*Quercus alba*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*) and an occasional American beech (*Fagus grandifolia*), black gum (*Nyssa sylvatica*), river birch (*Betula nigra*), and tulip poplar (*Liriodendron tulipifera*). In the area surrounding the old homesite, a few scattered mature sycamore (*Acer platanoides*), black walnut (*Juglans nigra*), and sugar maple (*Acer saccharum*) are present.

Throughout the area, the oak range in size from 16-24" in diameter (with a few scattered larger

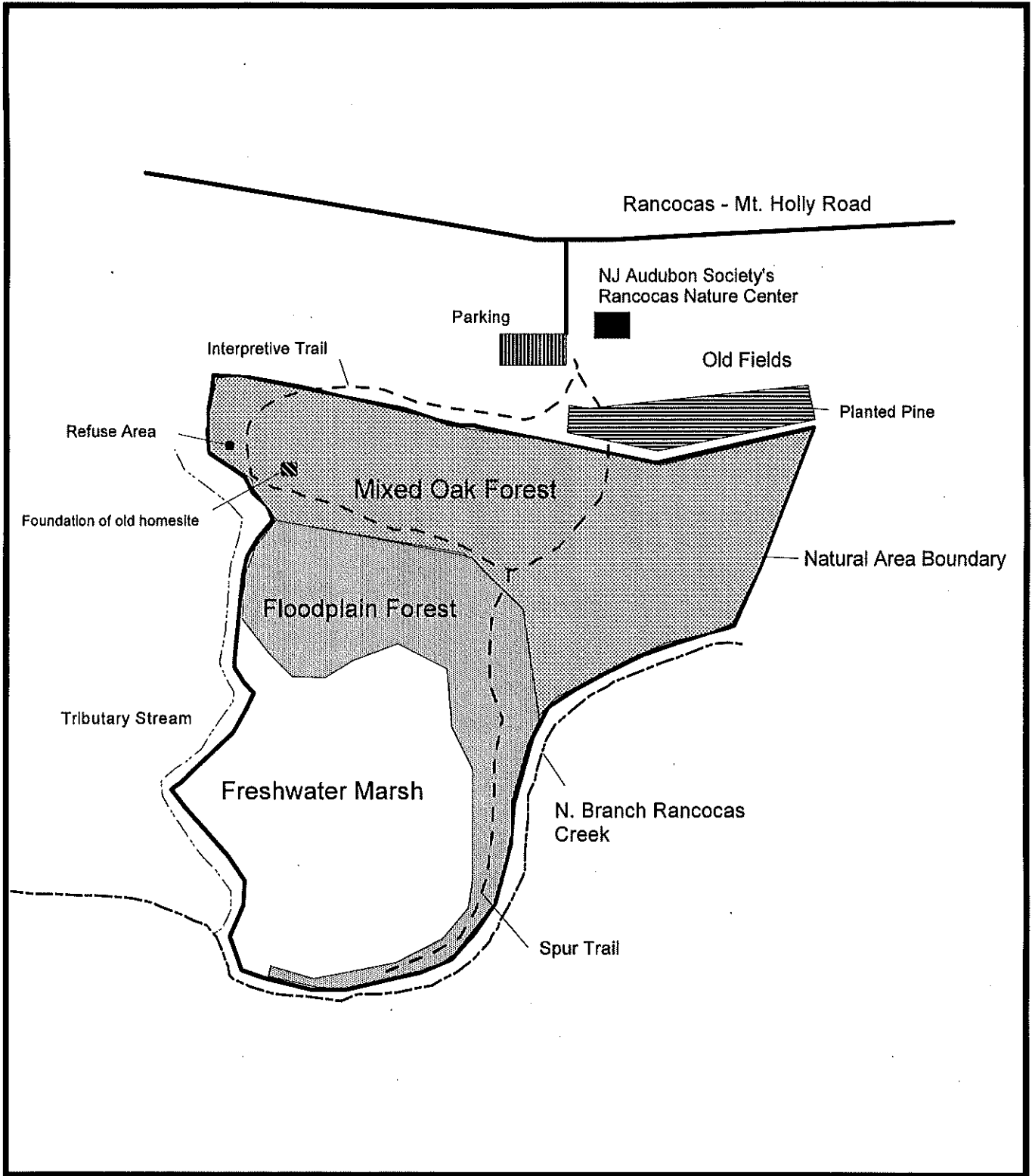
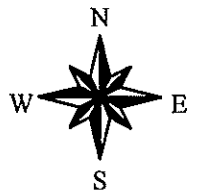


Figure 3. Rancocas Natural Area Boundary and Biotic Communities



individuals present) and reach 100' in height, while the smaller black locust, sweet gum, black cherry and red maple average 8-14" diameter and reach 50-60' in height. Frequently, a larger 18-22" diameter sweetgum is present. The largest sugar maple, black gum, black walnut and sycamore attain 110' in height and are 20-30" in diameter. Along the northern boundary of the natural area a small localized group of Virginia pine (*Pinus virginiana*) occurs scattered among the hardwoods as well as an occasional European larch (*Larix decidua*). These species range from 10-16" in diameter and reach 50-60' in height.

The understory contains dogwood (*Cornus florida*), sassafras (*Sassafras albidum*), black cherry (*Prunus serotina*), American holly (*Ilex opaca*), hickory (*Carya sp.*) and an occasional red cedar (*Juniperus virginiana*). These species range from 4-8" in diameter and 20-30' in height. Some of the larger trees have sparse crowns and, in several areas, individual large trees have died or fallen. Where these large gaps in the canopy occur, a dense understory growth containing spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corybosum*), arrowwood (*Viburnum dentatum*), wineberry (*Rubus phoenicolasius*), sweet pepperbush (*Clethra alnifolia*), pokeweed (*Phytolacca americana*) and greenbriar (*Smilax sp.*), with multiflora rose (*Rosa multiflora*) mixed in small scattered clumps are present.

In areas where light has entered through openings in the canopy, the herbaceous layer is dominated by Japanese stilt-grass (*Microstegium vimineum*), an invasive exotic species in New Jersey. Long-bristled smartweed (*Polygonum cespitosum*), partridge berry (*Mitchella repens*) and hayscented fern (*Dennstaedtia punctilobula*) appear scattered within the dense stilt-grass. Other herbaceous species that have been noted by Karl Anderson include violets (*Viola sp.*), white snakeroot (*Eupatorium rugosum*), wintergreen (*Chimaphila maculata*), wild licorice (*Galium circaezans*) and goosegrass (*Galium aparine*). Several vines are also present including Japanese honeysuckle (*Lonicera japonica*), fox grape (*Vitis labrusca*), Virginia creeper (*Parthenocissus quinquefolia*), ground ivy (*Glechoma hederacea*) and poison ivy (*Rhus radicans*). Karl Anderson has also noted oriental bittersweet (*Celastrus orbiculata*). The understory shrub layer and herbaceous layer, however, are virtually absent in many portions of the mixed oak forest, particularly where a complete canopy is present. The few scattered clumps of arrowwood or blueberry that do exist are heavily browsed by deer.

A portion of the interpretive loop trail is contained within this community type, which makes most of this stand easily accessible. A remnant foundation from the old farmhouse and a small refuse area are also contained in this area on the western edge (Figure 3). An old drainage ditch bisects the area from east to west.

Floodplain Forest

This area is accessible from a spur trail off the loop trail in the upland forest and occupies roughly one-quarter (approximately 15 acres) of the natural area (Figure 3). The vegetation present is characteristic of a Inner Coastal Plain swamp hardwood forest. Pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), sweetgum and red maple comprise the dominant trees in this area. These trees range from 18-24" in diameter and reach approximately 80-90' in height. Red maple, black gum and river birch are smaller than the oak and sweetgum, yet occupy a codominant position in the canopy. These species range from 10-14" in diameter and are roughly 50-60' in height. An occasional scattered persimmon (*Diospyros virginiana*) ranging from 10-16" in diameter can also be found. The understory contains American holly (*Ilex opaca*), sweetbay magnolia (*Magnolia virginiana*) and umbrella magnolia (*Magnolia tripetala*), a few scattered Virginia pine ranging from 4-10" in diameter and 25-35' in height. The shrub layer consists of mountain laurel (*Kalmia latifolia*), arrowwood, sweet pepperbush, highbush blueberry and partridgeberry. Scattered throughout the herbaceous layer are skunk cabbage

(*Symplocarpus foetidus*), jewelweed (*Impatiens capensis*), enchanter's nightshade (*Circaea lutetiana*), and purple water horehound (*Lycopus virginicus*).

Many dead branches are present on the forest floor and some of the crowns of the larger mature trees are beginning to decline. In these areas, enough light is reaching the forest floor to stimulate regeneration, which is mostly made up of small oaks, sassafras and red maple. Some shrubs and vines such as multiflora rose and greenbriar are also present.

Freshwater Tidal Marsh Complex

Located in the southern portion of the natural area, this marsh occupies roughly half (approximately 28 acres) of the total acreage of the natural area (Figure 3). This freshwater tidal wetland supports a large population of wild rice (*Zizania aquatica*). This species usually forms extensive stands on the mid-tidal flats and lower reaches of freshwater tidal rivers (Metzler 1984). It has great importance as a resting and feeding area for waterfowl, shorebirds and a variety of terrestrial birds, especially during their fall migration (Metzler 1984). Other species present include tearthumbs (*Polygonum sp.*), common smartweed (*Polygonum hydropiper*), bur marigold (*Bidens sp.*), cattail (*Typha latifolia*), threesquare (*Scirpus sp.*), arrow arum (*Peltandra virginica*) and pickerelweed (*Pontederia cordata*) (Eberhardt 1980). Vegetation along the lowland forest and marsh border includes: highbush blueberry, swamp azalea (*Rhododendron viscosum*), winterberry (*Ilex verticillata*), smooth alder (*Alnus serrulata*), silky dogwood (*Cornus amomum*), marsh mallow (*Hibiscus palustris*), skunk cabbage (*Symplocarpus foetidus*), royal fern (*Osmunda regalis*), and cinnamon fern (*Osmunda cinnamomea*).

Wildlife

The variety of vegetation and cover types that exist and the age and size distribution of the plant species present in the natural area provides habitat for a diversity of wildlife species. Over the years, Karl Anderson has compiled and continues to maintain a comprehensive list of birds, mammals, reptiles and amphibians that have been observed in the natural area. Many of the species listed below are based on his observations.

Birds

Numerous species of birds were observed, including the pileated woodpecker (*Dryocopus pileatus*), bank swallow (*Riparia riparia*) and rough winged swallow (*Stelgidopteryx ruficollis*), solitary vireo (*Vireo solitarius*) and white-eyed vireo (*Vireo griseus*), and many warblers including the northern parula (*Parula americana*), prairie (*Dendroica discolor*), hooded (*Wilsonia citrina*), blue-winged (*Vermivora pinus*) and magnolia warbler (*Dendroica magnolia*). Various finches, orioles and sparrows have also been observed. Predatory birds such as the red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*) and sharp-shinned hawk (*Acciptier striatus*), as well as less often seen birds such as the Great horned owl (*Bubo virginianus*), long-eared owl (*Asio otus*) and eastern screech owl (*Otus asio*) have been noted in the natural area. A long list of waterfowl have been observed on the North Branch of the Rancocas Creek and in and around the freshwater marsh area. Among these species are: American woodcock (*Philohela minor*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*) and black (*Anas rubripes*) ducks, Great blue heron (*Ardea herodias*), green heron (*Butorides striatus*), pied-billed grebe (*Podilymbus podiceps*), killdeer (*Charadrius vociferus*), spotted sandpiper (*Actitis macularia*) and common snipe (*Capella gallinago*).

Mammals

White-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), red (*Tamiasciurus hudsonicus*) and gray (*Sciurus carolinensis*) squirrel, flying squirrel (*Glaucomys volans*), chipmunk (*Tamias striatus*), woodchuck (*Marmota monax*), eastern cottontail rabbit (*Sylvilagus floridanus*), opossum (*Didelphis marsupialis*), and skunk (*Mephitis mephitis*), as well as red (*Vulpes fulva*) and gray fox (*Urocyon cinereoargenteus*), big brown bat (*Eptesicus fuscus*) and red bat (*Lasiurus borealis*), long-tailed weasel (*Mustela frenata*), and muskrat (*Ondatra zibethica*) are among the mammals that have been observed in and around the natural area. In 1997, Karl Anderson reported observing beaver workings along the North Branch of the Rancocas Creek. Neither beaver or beaver workings were observed, however, during a field inspection in April 1997.

In 1997, the NJ Division of Fish, Game and Wildlife conducted a deer mortality survey of the Rancocas State Park and Powhatan Indian Reservation, areas which surround the natural area. Their findings showed that several deer died during the 1996-97 winter through malnutrition and starvation. They concluded from their findings that death from malnutrition, especially during a mild winter, is indicative of a deer population that has exceeded the carrying capacity of the land (Susan Predl, pers. comm. 1997).

Whitetail deer populations in and around the natural area are predicted to be higher than the average density in surrounding Deer Management Zones established by the NJ Division of Fish, Game and Wildlife. The natural area is located in Deer Management Zone 48, which currently has an average of 27 deer per square mile. Based on deer mortality surveys conducted by the NJ Division of Fish, Game and Wildlife during the winter 1996-1997 and subsequent necropsies of recovered carcasses, the Division estimates the deer density in the Park, natural area and surrounding Indian land to be at 50 deer per square mile. They also noted exceptionally high browse lines, which is indicative of high deer densities.

Reptiles

Reptiles that have been observed in and around the natural area include the northern water snake (*Natrix sipedon sipedon*), northern brown snake (*Storeria dekayi dekayi*), eastern garter snake (*Thamnophis sirtalis sirtalis*), northern black racer (*Coluber constrictor*), black rat snake (*Elaphe obsoleta obsoleta*), eastern milk snake (*Lampropeltis triangulum triangulum*), as well as the common snapping turtle (*Chelydra serpentina*), common mud turtle (*Kinosternon subrubrum subrubrum*), spotted turtle (*Clemmys guttata*), eastern box turtle (*Terrapene carolina carolina*), eastern painted turtle (*Chrysemys picta picta*) and red-bellied turtle (*Chrysemys rubriventris*).

Amphibians

Eastern spadefoot (*Scaphiopus holbrooki holbrooki*), Fowler's toad (*Bufo woodhousei fowleri*), northern spring peeper (*Hyla crucifer*), gray treefrog (*Hyla versicolor*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*), southern leopard frog (*Rana utricularia*), wood frog (*Rana sylvatica*), red-backed salamander (*Plethodon cinereus cinereus*), four-toed salamander (*Hemidactylum scutatum*), and red-spotted newt (*Notophthalmus viridescens viridescens*) have all been observed in the natural area by Karl Anderson over the last 20 years.

Threatened and Endangered Species

A search of the NJ Natural Heritage Database (NJDEP 1997) to assess the potential for threatened and endangered species did not produce any rare species records. The Natural Heritage Database did produce one record, however, for a rare natural community, specifically the Freshwater Tidal Marsh Complex, located within the natural area adjacent to the North Branch of the Rancocas Creek.

In 1997, Karl Anderson reported hearing barred owls (*Strix varia*), a state threatened species, in the natural area and on occasion observed a cooper's hawk (*Accipiter cooperii*), a state endangered species, using the pine stand adjacent to the north edge of the natural area. Based on the presence of several large stick nests in the pine stand, he speculated that one or both of these species may be nesting in the pine stand. In April of 1997, ONLM staff conducted a field survey for barred owls and Cooper's hawks. While two barred owls were observed in and around the pine stand and responded to calls in this area, none were found on nests. Although the large stick nests that Anderson reported in the pine stand did seem to have fresh branches and twigs on them, no Cooper's hawks or barred owls were observed using any of the four nests found. Although the pine stand is not within the boundary of the natural area (Figure 3), it provides suitable habitat for the rare species mentioned and should therefore be managed consistent with the objective of protecting and maintaining rare species habitat.

During an inspection of the natural area in September of 1997, Brian Vernachio, a Naturalist with the Rancocas Nature Center, reported that a Cooper's hawk nested in the late spring in hardwoods located in the southeastern section of the natural area. The nest was not located during the field inspection. It is suspected by Mr. Vernachio that the Cooper's hawk attempted to nest in the pines, but because the nest was located close to the trail where the nest experienced frequent disturbance, the bird moved to an undisturbed section of the woods.

In 1997, Karl Anderson reported that American waterwort (*Elatine americana*), had been observed by Dr. Alfred E. Schuyler, Academy of Natural Sciences, in the intertidal mud along the Rancocas Creek. This tiny species is found in muddy, usually fresh, shallow water of intertidal riversides (Hough 1983). The New Jersey Natural Heritage Program ranks this species S2 or imperiled in New Jersey because of extreme rarity (6 to 20 occurrences).

Introduced Features

Remnants of a foundation, which are believed to be from the original Rodger's farmhouse, dating back to 1768, exist in a few scattered fragments on the western edge of the upland mixed oak forest (Figure 3). An interpretive loop trail, containing numbered markers, traverses roughly 1 mile through the northern section of the natural area. From this loop trail, several small spur trails originate, one of which leads to the Rancocas Creek and one that crosses the small stream on the western boundary of the natural area (Figure 3). A small refuse area also exists on the western edge of the upland oak forest (Figure 3).

During the past few years, Karl Anderson has staked off and surveyed the soil in and around the foundation of the old homesite. To date, however, this archeological search has not produced significant artifacts.

None of the deposited material or garbage on the western edge of the property has been removed or disturbed and brambles and vines are beginning to grow through and over it.

Public Use

Roughly 3,000 people visit the natural area each year for nature interpretation and study, walking, bird watching and botanizing (Karl Anderson, pers. comm. 1996). Although they are not blazed or marked, except for numbered markers on the interpretive loop trail, the trails in the natural area are obvious from continual use. Over time, soil compaction may result from continued heavy use. However, erosion is not apparent.

Hunting is not permitted in the natural area, where it appears a resident deer population exists. Herds of 8-10 deer were observed on several different field visits in the vicinity of the planted pine stand on the northern boundary of the natural area. In areas such as this, where the deer density exceeds the carrying capacity of the land, deer can adversely impact native vegetation (Susan Predl, pers. comm. 1997). Over-browsing of native vegetation by deer herds too large for the available land area suppresses native vegetation and allows exotic species not readily eaten by deer, such as Japanese barberry, to increase in density and distribution, thus displacing native vegetation.

Exotic Species

During a field inspection of the natural area conducted in September 1997, several transect lines were run through the floodplain and mixed oak forest. At varying intervals along each transect line, sample observations were made to determine the frequency and distribution of invasive exotic species. Introduced non-native species, such as Japanese honeysuckle, Japanese barberry, black locust, Norway maple (*Acer platanoides*), multiflora rose (*Rosa multiflora*), Japanese stilt-grass (*Microstegium vimineum*), and oriental bittersweet (*Celastrus orbiculata*), were all recorded in the natural area.

The distribution and density of these species, however, varies throughout the area. Although only sparsely distributed throughout the natural area, multiflora rose dominates the abandoned agricultural fields that are adjacent to the natural area and the potential for this species to spread into forest openings is high. Black locust is present in a small (1-3 acre) section of the natural area in the upland hardwood community. Norway maple and Japanese barberry are only found occasionally. While oriental bittersweet can be found often, it is mainly on the edges of the natural area. Japanese stilt-grass, however, dominates the herbaceous and shrub layer throughout much of the upland and is currently the most aggressive threat to native vegetation. This species was the most widely distributed and frequently recorded species present, particularly in the mixed oak forest.

In many places throughout New Jersey, exotic species such as these have become invasive. Invasive exotics often out-compete native vegetation and are thus able to dominate large areas. Throughout history invasive exotic species have been known to displace or sometimes even destroy native vegetation.

In order to determine the impact of invasive exotics on native species in the natural area, further study and field experimentation of the ecological relationship between native and exotic species is needed. This is particularly true in this natural area where other factors such as deer pressure may play an important role in species succession.

Management Issues and Techniques

Natural Area System Rules

Relevant sections of the rules and regulations concerning Natural Areas and the Natural Areas System appear in Appendix. An important function of these rules is to provide general interim management guidelines for all natural areas for which management plans have not been prepared. Upon preparation of a management plan interim management guidelines may continue or may be superseded by management techniques more appropriate to fulfill the management objective of the natural area. Should an issue arise that is not addressed in the management techniques below, the interim management techniques at N.J.A.C. 7:5A-1.9 (Appendix) will apply and should be consulted. The following analysis outlines management practices and uses supplemental to existing rules.

Management Objective and Classification

The management objective for the Rancocas Natural Area is "preservation of freshwater marsh and southern floodplain habitat, including one of the largest stands of wild rice in New Jersey." The following management recommendations and techniques are derived from issues discussed in previous sections of this plan and the interim management guidelines found in Appendix A. Techniques are based, in part, on consultation with appropriate agencies, individuals and the Natural Areas Council, and are designed to protect the features of the natural area and further its management objective. Section VI includes a summary and activity schedule of the management recommendations and techniques described below.

Throughout this section, administering agency refers to the Division of Parks and Forestry, through Lebanon State Forest. It is recognized that the State Park Service is understaffed and, as a result, some management activities may need to be extended beyond the projected implementation dates.

Mesic Coastal Plain Mixed Oak Forest

Management Issues

The main management concern in the mixed oak forest is the increase in frequency and distribution of invasive exotic species in openings where large trees have died or fallen, and the spread of these species into other parts of this community type.

1. Among the cover types in this community is an area of approximately three to five acres of forest dominated by immature black locust, red maple and sweetgum. These trees range from 8-14" in diameter and are densely spaced. Little understory vegetation is present in this area, except where an individual has died or fallen. In these forest gaps, Japanese stilt-grass has become heavily established. It is suspected that much of the native vegetation is repeatedly browsed by deer, whereas the Japanese stilt-grass is less preferred by deer, giving it a competitive advantage. Of the few regenerating red maple, sweetgum and blueberry stems that were present, all were heavily browsed. Red maple and black locust are typically shorter lived and more susceptible to disease, insect damage and windthrow, as compared to sweetgum. It is anticipated that, as these shorter lived species begin to decline, the area will

become more open, allowing sunlight to reach the forest floor. Given the relative proximity and frequency of Japanese stilt-grass and other invasive exotics, such as multiflora rose, in this area, measures should be taken to control invasives and protect native vegetation from over browsing by deer.

In the areas of this community dominated by large, mature trees, where openings in the canopy have already occurred, the openings should be managed to control established invasive exotics, such as Japanese stilt-grass, multiflora rose and Japanese barberry, from increasing in frequency and distribution.

Management Techniques

1. Japanese stilt-grass is a shade-tolerant annual that prefers moist areas such as river banks, floodplains, swamps, woodland thickets and roadsides (Lafleur 1996). Since it was first described and collected in 1919 in Tennessee, it has spread northward reaching Ohio, Pennsylvania and all coastal states from Connecticut to Florida (Lafleur 1996). Japanese stilt-grass is also called Chinese packing grass, because it was once used to protect porcelain during shipping. It is believed that it was first introduced into the United States in this manner (LaFleur 1996). The seed germinates in June, flowers in late August and produces seed from September to November. Individuals produce roughly 100 seeds, but under optimal conditions one plant may produce more than 1,000 seeds (LaFleur 1996). Seeds usually remain viable for seven years. According to LaFleur (1996), this species can spread rapidly in disturbed as well as natural areas, and can replace native herbaceous vegetation in three to five years.

Control of this species has been achieved with some success through pulling by hand (Andrea Stevens, pers. comm. 1997). This technique is, however, time consuming and not practical or cost-efficient over large areas. Repeated cutting by mowing or weed whacker may be effective if performed before plants set seed, but late enough in the season to minimize the germination of additional seed.

Chemically treating individual exotics may be a more effective and cost-efficient method of reducing undesirable species. Care must be taken when applying herbicides to avoid non-target species and areas where erosion may allow chemicals to migrate to adjacent wetland areas. Given the potential for erosion and proximity to wetland areas, relying solely on chemicals to control exotic plants at this site is not recommended. A combination of mechanical and chemical methods may provide the best compromise and effectiveness.

To determine the most effective and cost-efficient method of controlling Japanese stilt-grass, small (1-acre or less) areas will be treated using several control techniques. Mechanical and chemical treatments will be applied singly and in combination. Before and after treatment, an inventory and assessment of the treated area should be conducted to determine the response of native vegetation and impact of each treatment on target species. In some cases, repeated efforts to control exotic species may be required. In addition, seeding may also be needed on a small portion of some treatment areas. This will allow for rapid reestablishment of native vegetation after treatment.

Mechanical control methods will include cutting by mowing or weed whacker and removal by hand pulling. Pre-emergent and post-emergent herbicides will be delivered using hand held or backpack sprayer. Seeding and site preparation, including soil scarification may occur on some sites depending on the availability of local native seed and the ability of existing seedbanks to respond to treatment.

As these control techniques are developed they may be applied to additional sections of the natural area.

Floodplain Forest

Management Issues

The primary objective for management of this community is maintenance of habitat as a buffer for the adjacent freshwater tidal marsh complex, the maintenance of trails for recreational use and the protection and creation of habitat for endangered species. Concerns include erosion and damage to vegetation from foot paths not maintained as trails, and a spread in the frequency and distribution of invasive exotics in the understory shrub and herbaceous layer.

1. Public use of foot paths not maintained as trails can cause soil compaction, erosion and damage to vegetation. Currently, a small foot path exists which leads to the edge of the North Branch of the Rancocas River. This path then follows a small strip of land along the river and adjacent to the tidal marsh area, until ending at a point on the river (Figure 3). In several places along the trail the vegetation has grown over and into the path limiting access. This encroaching vegetation has often been broken or damaged to gain access to the trail. In other places, the river has washed over the small strip of land and several small, wet, muddy areas exist. These areas seem to be continuously fed by water draining from the marsh into the river and are wide enough to make passage difficult at times.
2. In several locations along the floodplain forest and marsh border, light entering the first 20 to 30 feet of forest edge has stimulated Japanese stilt-grass growth, allowing it to become frequently established in this community.

Management Techniques

1. It is recommended that the trail be clearly identified, marked, and maintained to provide needed access to the southern extent of the natural area. Several small wooden plank walkways should be placed over the wetter spots along the trail to provide easy access and prevent soil disturbance. The trail which leads to the southern limit of the natural area should annually be maintained by keeping it clear of brush, logs and encroaching branches and by installing wooden walkways in extremely wet locations. Wooden walkways approximately 24 to 30 inches wide and of varying lengths, constructed from pressure treated lumber attached to round support pilings every four feet, provide a cost-effective and efficient method of accessing wet areas. These devices are simple to construct, easily placed and moved, and can be designed to fit the required space. Well maintained, easily accessible trails with erosion control devices, walkways over wet areas, and clear identifiable routes will reduce the number of new trails created by visitors attempting to access different portions of the natural area.
2. The frequency and distribution of Japanese stilt-grass should be monitored and control measures initiated as needed to reduce its occurrence in portions of this community where it has displaced native vegetation.

Freshwater Tidal Marsh Complex

Management Issues

The main management objective for this community is maintenance of the extensive stand of wild rice. The primary concern is a change in water flow to and through the area from beavers or other

external activities, and a degradation of water quality from external factors such as development.

1. The freshwater tidal marsh complex is a unique natural ecosystem that provides habitat for a variety of plant and animal species, and offers important feeding area for migratory birds. External activities such as development, road construction and industry could degrade water quality and adversely impact habitat quality in this ecosystem.
2. In 1997, Karl Anderson reported observing beaver activity along the North Branch of the Rancocas Creek. Neither beavers nor beaver activity were observed during a field inspection conducted in April 1997. An increase in beaver activity could, however, change or restrict water flow, thus impacting the wetland condition of the marsh.

Management Techniques

1. In general, annual field inspections by the ONLM should consider changes in water quality and hydrology as a result of external factors. If necessary, an assessment should then be made of the impact of these external factors on the ecosystem. Although it may be difficult to control or manage some of the external factors that may affect the marsh ecosystem, continual monitoring and identification of potential problems may prevent an inadvertent adverse impact. In addition, educating the public and providing information concerning the importance of the Rancocas watershed, will help increase awareness and protection of the freshwater marsh. Communication with the Rancocas Watershed Conservation Foundation and the Rancocas Conservancy, local advocacy groups established to address problems associated with the rapid development and suburbanization of the watershed, will also aid in maintenance and protection of this resource.
2. Annual monitoring should consider beaver activity along the North Branch of the Rancocas Creek and whether or not this activity is impacting the natural area. Controlling beavers should be considered if their activity is observed and determined to be adversely affecting the features of the natural area. Removal of individual animals through trapping is the most effective, practical, and environmentally safe method of control (Miller and Yarrow 1994). The NJ Division of Fish, Game and Wildlife's Wildlife Control Unit should be consulted to determine the appropriate method, regulations and procedures for successful beaver removal.

Wildlife

Management Issues

Given the restriction on hunting within the park and natural area, the main management concern relative to wildlife is the effect an abundant or over-crowded deer herd has on native vegetation and regeneration. Beaver activity is discussed above.

1. A 1997 assessment by the NJ Division of Fish, Game and Wildlife of the deer herd in and around the natural area, concluded that the herd size exceeds the carrying capacity of the land (Susan Predl, pers. comm. 1997). They also noted exceptionally high browse lines, which is indicative of a high deer density. The impact of this deer herd on the understory regeneration and herbaceous vegetation is apparent. Throughout much of the area, tree seedling regeneration is absent. Where an occasional stem does occur, it has been repeatedly browsed. Herbaceous vegetation has suffered also from over-browsing and what has resulted is an abundance of Japanese stilt grass.

Management Techniques

1. Opening the area to hunting for a limited number of days during the season, and/or limiting the type of hunting, can be used effectively to reduce the deer herd while minimizing the impact to the natural area and its users. Currently, hunting provides the most effective and cost-efficient method of reducing deer density. Development of a hunting season in the natural area should be carefully coordinated with the NJ Division of Fish, Game and Wildlife to ensure that the proper management objective is achieved and appropriate hunting regulations are followed. Coordination with the NJ Audubon Society's Rancocas Nature Center is also important to avoid use conflicts between hunters and visitors. Currently, the nature center and natural area are closed on Mondays, which may provide an opportunity for hunting without interruption of other uses.

Threatened and Endangered Species

Management Issues

The main objective for management of threatened and endangered species is the protection and enhancement of suitable habitat for barred owls and Cooper's hawks. The primary concern is the loss of the pine through gradual conversion to hardwoods.

1. Suitable habitat for both the barred owl and Cooper's hawk is present in and around the natural area. Within the natural area tidal marsh, floodplain forest, and upland mixed oak forest offer habitat frequently utilized by both species. Adjacent to the natural area a pine plantation and abandoned agricultural fields compliment the diversity of habitat types present. All of the areas mentioned receive up to 3,000 visitors per year. In some cases, continual disturbance may disrupt nesting of one or both species causing them to relocate. Therefore, periodic monitoring is needed to continually reassess the status of threatened and endangered species.

Management Techniques

1. To help ensure the preservation of rare species and to provide for consideration of these species in future planning in the natural area, the ONLM should perform periodic surveys for rare species. A survey of all habitats in and around the natural area, especially the pine stand adjacent to the natural area, conducted while both barred owls and Cooper's hawks are nesting, usually late March through early April in New Jersey, will provide the best period for observation. Both species become active in early spring and most trees have not leafed out, which aides in observation and identification. Broadcast calling for barred owls in the early morning or late evening hours is an effective method of locating this species. Based on the findings of these rare species surveys and information tracked by the NJ Natural Heritage Database, the ONLM will provide the administering agency and the NJ Audubon Society's Rancocas Nature Center with general and locational information about each species.

Boundary

Management Issues

1. The main objective in identifying the boundary is to establish and define the area being

managed. This should be accomplished through placement of standard wood sign at the entrance to the natural area and through placement of natural area signs along the boundary. Placement of boundary signs is especially important along the eastern edge of the property where several private residences join the land leased by the NJ Audubon Society and uncontrolled, easy access can be gained to the natural area. Boundary signs will also help clearly identify the area to the public and reduce inadvertent impacts to the natural area features.

Management Techniques

1. The administering agency, in cooperation with ONLM, shall post State Natural Area boundary signs along the boundary, where practicable, at a maximum of ten per mile. These signs should be erected so that they are visible from a distance and should be maintained annually. In addition to boundary signs, a standard wooden sign should be erected at the entrance to the natural area. The ONLM, in cooperation with the administering agency and the NJ Audubon Society, should post boundary signs before any management activities are initiated to avoid conflicts that may arise with adjoining neighbors. The placement of an entrance sign and boundary posting should be completed by December 1998.

Introduced Features

Management Issues

The main objective for managing introduced features is limiting the impact of these features on the natural area. The concern is the presence of a small dump pile and possibility of additional dumping.

1. The presence of refuse material on the western edge of the upland oak forest poses a management concern because it allows people to believe that dumping is an accepted use of the woodlot. Considering, however, that the area is also located several hundred yards from the main parking area and office, and that much of the refuse has been overgrown by vines and brush, removal of large material may be difficult and disturb the site unnecessarily.
2. Many of the wooden trail markers have rotted below ground and broken off. Trail markers should be maintained and replaced as needed to aid the public in identifying the interpretive loop trail.

Management Techniques

1. Currently, the presence of this small refuse pile has value in the educational role it serves. Small items such as bottles and cans should be removed, however, to discourage further dumping. In the future, the ONLM and NJ Audubon Society should continue to monitor the refuse pile to determine if its presence has encouraged additional deposition of debris or garbage. In the event that additional dumping becomes a problem, "no dumping" signs should be erected immediately and all of the deposited material removed, disposed of and/or recycled as feasible.
2. NJ Audubon Society will continue periodic painting and replacement of trail markers as necessary to keep them maintained. In the long run, however, other materials such as Greenline should be considered as an alternative to wood in marking the interpretive trail. Greenline is consistent with the State Park Service sign manual specifications, is decay resistant and flexible, and has been successfully used in many state parks throughout New Jersey.

Public Use

The main objective for managing public use is limiting any adverse impact to the natural area features. The main concern of public use is disturbance to threatened or endangered species during the nesting season.

Management Issues

1. Heavy visitation throughout the year may disturb threatened and endangered species causing displacement of the species and nesting failure.
2. As outlined at N.J.A.C. 7:5A-1.9(e)7, research and specimen collection are permitted uses in the natural area. To date, these uses have not been determined to have caused an adverse impact to natural area features.

Management Techniques

1. Current uses of the natural area, such as walking, bird watching, and nature study and interpretation are all uses that should continue. To date, these uses are compatible with preservation of the species and natural communities that occur within the natural area and have not been determined to have an adverse impact. If, in the future, the ONLM and NJ Audubon Society determine that current uses are causing a displacement of a specific threatened or endangered species, then the use may be limited or suspended. At such time, consideration should be given to closing or relocating certain trails to alleviate the problem. Monitoring of the impact to a species and trail closing would be most easily accomplished by NJ Audubon Society the on-site agency.
2. Applications to conduct research or collect specimens should be forwarded to the administering agency and reviewed in cooperation with the ONLM. Together with ONLM, the administering agency shall coordinate a response within a reasonable date of application.

Management Summary and Activity Schedule

The following is a tentative outline of recommended management activities and techniques. Although a time frame for accomplishing such tasks is indicated, many activities are ongoing and may need to be reevaluated periodically and revised as needed. Although the ONLM is the lead agency responsible for coordinating and initiating many of the listed activities, it is expected that many of the accomplishments will be reached through a cooperative effort among the ONLM, administering agency and the NJ Audubon Society's Rancocas Nature Center. When applicable, specific activities that may be achieved more efficiently or served more appropriately by an individual agency have been listed next to that agency, as indicated in the schedule.

ACTIVITY SCHEDULE RANCOCAS NATURAL AREA MANAGEMENT PLAN					
ACTIVITY	DESCRIPTION	DATE	LOCATION	RESPONSIBLE AGENCY	COMMENTS
Post Boundary and erect entrance sign	Place natural area signs along boundary at max. 10/mile	1998 Annually	Boundary	All	Maintain Annually
Initiate exotic species control research	Select sites, layout plots, collect baseline data, initiate treatments	1998	All areas	ONLM	Provide report with recommendations to Admin. Agency and NJ Audubon.
Survey for T&E Species		Annually	All areas	ONLM	Provide report with recommendations to Admin. Agency and NJ Audubon.
Monitor Beaver Activity		Annually	River and marsh area	ONLM and Audubon	Determine impact and report need for action.
Assess need and implications of a controlled deer hunt		Annually	All areas	All	Determine impact and report need for action.

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Appendix

INTERIM MANAGEMENT PRACTICES FOR NATURAL AREAS

From Natural Areas System Rules
(N.J.A.C. 7:5-1.1 et seq.)

7:5A-1.9 INTERIM MANAGEMENT PRACTICES

- (a) Interim management practices shall be implemented by the administering agency, provided that:
 - 1. The practice will have no direct or indirect adverse impact on natural features of concern and will further the management objective of the natural area;
 - 2. Approval of the Commissioner is not required by provision elsewhere in this subchapter; and
 - 3. The practice is consistent with terms of any conservation easement held by the Department.
- (b) Interim management practices listed at (e) or (f) below which require the approval of the Commissioner shall first be submitted to the Council for its review and recommendation.
- (c) Upon finding that an interim management practice listed below at (e) or (f) would be detrimental to achieving a specific management objective, the Council shall recommend to the Commissioner the substitution of a more appropriate interim management practice. Should the Commissioner concur with the recommendation of the Council, the Commissioner may approve substitution by a more appropriate interim management practice.
- (d) Where there are conflicts between general practices described below at (e) and practices specific to a natural area classification described below at (f), the latter shall apply.
- (e) The following interim management practices apply generally to all natural areas upon designation to the System and until and unless superseded by the provisions of an adopted management plan:
 - 1. Natural area boundaries shall be made clearly evident by posting signs at a maximum density of ten signs per mile; entrance points shall be posted to indicate to users that they are entering a natural area; boundary signs shall be of a standard size and format as approved by the Commissioner and provided by the Division;
 - 2. Boundary fences that are needed to protect the natural area may be installed provided the fence shall not have a detrimental effect on movement of wildlife, or other natural conditions;
 - 3. Vehicular access lanes may be maintained within a natural area but may not be enlarged in any manner except upon approval of the Commissioner.

4. Existing firebreaks within a natural area may be maintained for safety purposes; temporary firebreaks made by mowing, raking, plowing or wetting, may be used in conjunction with prescribed burning for habitat management;
5. Existing structures may be maintained in a natural area; new structures and enlargement of existing structures may be undertaken upon approval by the Commissioner, provided the structures directly or indirectly contribute to the management objective; new structures, of a temporary nature, may be constructed for research purposes in accordance with N.J.A.C. 7:5A-1.10;
6. No measures, such as cutting of grass, brush, or other vegetation, thinning of trees, opening of scenic vistas, or planting, shall be taken to alter natural processes or features for the purpose of enhancing the beauty or neatness of a natural area;
7. Except as otherwise provided in this section, there shall be no introduction, removal or consumptive use of any material, product, or object to or from a natural area; prohibited activities include grazing by domestic animals, farming, gathering of plants or parts thereof, mining or quarrying, and dumping, burying, or spreading of garbage, trash, or other materials; structures or materials may be removed as follows:
 - i. Old interior fences may be removed, giving consideration to leaving posts to mark boundaries between former land uses;
 - ii. Rubbish or any other waste material may be removed; and
 - iii. Structures having no historic, scientific or habitat value may be demolished and removed unless such structures are deemed essential for administrative purposes;
8. Water levels within a natural area shall not be altered except to restore water levels which have been altered due to sudden natural phenomena or man-induced conditions off-site, but routine repairs to existing water control structures may be undertaken;
9. All wildfires shall be brought under control as quickly as possible; after a fire within a natural area, there shall be no cleanup or replanting except as approved by the Commissioner to achieve the management objective or for reasons of health and safety;
10. Prescribed burning, to eliminate safety hazards and to manage habitat, may be conducted upon approval of a proposal for prescribed burning by the Commissioner; use of vehicles and equipment shall be specified in the proposal for prescribed burning;
11. Habitat manipulation may be undertaken if preservation of a particular habitat type or species of native flora or fauna is included in the management objective of the natural area and upon approval by the Commissioner of a specific habitat manipulation plan;
12. Gypsy moth control activities may be implemented as an interim management practice upon a determination by the State Forester that egg mass counts and prior year defoliation will result in severe tree mortality without intervention, and after approval of

a gypsy moth control plan by the Commissioner; to the extent practicable, biological controls, rather than chemical means, shall be used to control gypsy moths;

13. There shall be no physical manipulation of a natural area or application of chemicals known as adulticides for the purpose of controlling mosquitoes; the application of larvacides may be permitted in salt marshes only and only as follows:
 - i. The application of *Bacillus thuringensis* var. *israeliensis* (BTI) may be initiated by a mosquito control agency at any time; and
 - ii. The application of other larvacides may be initiated upon approval by the Commissioner of a specific mosquito control plan submitted by a mosquito control agency; the plan shall identify the specific area where a larvacide application will be made, the types and amount of larvacide to be applied, the need for the application, and the reason why BTI cannot be used for this application;
14. Control of invasive plant species by biological or mechanical methods, including spot treatment of herbicides, may be performed upon approval of an invasive species control plan by the Commissioner;
15. Research activities and the collection of specimens may only be conducted in accordance with N.J.A.C. 7:5A-1.10 and upon approval of the administering agency; and
16. Public use of natural areas shall be allowed only to the extent and in a manner that will not impair natural features; the administering agency may restrict access and use as necessary to protect the natural area; the following are permissible public uses of natural areas:
 - i. Hunting, trapping, and fishing are permitted in accordance with N.J.A.C. 7:25-5 and 7:25-6; except for the stocking of fish and game, habitats may not be manipulated for the purpose of enhancing hunting, trapping, or fishing;
 - ii. Occasional camping along trails, boating, and swimming may be permitted in specified locations of natural areas in accordance with N.J.A.C. 7:2-2, 7:2-5, 7:2-7, 7:2-8, and 7:25-2, and are further limited as follows:
 - (1) No permanent structures may be erected;
 - (2) No motorized methods of boating or camping are permitted;
 - (3) Trailside shelters of the type called lean-tos are permitted, but there may not be two such shelters within three miles of each other; and
 - iii. Trails may be constructed and maintained as follows:
 - (1) Construction of new trails may be initiated subsequent to approval of a trail plan by the Commissioner. Maintenance of existing trails may be

- conducted upon approval of the administering agency;
 - (2) Rare plants may not be removed for the purpose of maintaining existing or constructing new trails; and
 - (3) To the extent possible, natural materials shall be used on and along trails; and
 - iv. All pets shall be kept caged or leashed and under immediate control of the owner except that dogs used while legally hunting shall be exempt from the leashing requirement.
- (f) The following interim management practices, unless superseded by an adopted management plan, apply to the appropriate specified natural area classifications:
1. Location markers identifying interpretation points of interest may be installed except within ecological reserves;
 2. Trail blazes may be used within any natural area;
 3. Existing vehicular access lanes may not be enlarged in any manner within an ecological reserve;
 4. New vehicular access lanes may be constructed only within buffer areas and upon approval by the Commissioner;
 5. The alteration of natural processes or features for the purpose of enhancing public use of the natural area may be conducted by the administering agency only within buffer areas; and
 6. The following management practices shall not be permitted within ecological reserves:
 - i. New, existing, or temporary firebreaks;
 - ii. Construction of new trails;
 - iii. Alteration or restoration of water levels;
 - iv. Prescribed burning;
 - v. Erosion control measures;
 - vi. Gypsy moth control activities; and
 - vii. Manipulation of vegetation and wildlife habitats.