

TILLMAN RAVINE NATURAL AREA  
MANAGEMENT PLAN

DIVISION OF PARKS AND FORESTRY  
OFFICE OF NATURAL LANDS MANAGEMENT  
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## ABSTRACT

Tillman Ravine Natural Area, a 500 acre portion of Stokes State Forest, was placed in the Natural Areas System in 1978. The Natural Area is located in Sussex County, Walpack and Stillwater Townships, and is within the Ridge and Valley physiographic province. This portion of Stokes State Forest was designated to the System for its geologic significance and because it supports northern mesic forests of hemlock-mixed hardwoods and mixed oak. The forests and landscape at Tillman have been described as primeval in character and have long been a popular scenic and interpretive area for Stokes State Forest.

This management plan has been developed pursuant to N.J.A.C. 7:2-11.5 which mandates that management plans be prepared for all areas designated to the Natural Areas System. Management will be aimed at prescribing uses and practices that will be allowed and implemented in order to maintain and, if possible, enhance the natural features which the site contains.

The following general management techniques are recommended in this plan. Chapter III contains detailed information on issues and prescribed management techniques and should be referred to for additional information.

### Classification

Tillman will be designated a Class II natural area primarily to insure its continued use as an educational tool for a variety of organizations, school groups and individuals.

### Boundaries

The present natural area boundaries are to be expanded to include a nine acre swamp which forms the headwaters of Tillman Brook.

### Public Access and Use

Brinks Road shall be closed at the second (southern-most) parking area. No expansion of the existing trail system or development of new trails will be allowed. Steps will be taken to curtail illegal camping.

Additional measures shall be taken to control the flow of people and confine the public to the trail system including greater delineation of existing trails using on-site materials, removal of fallen trees and other trail obstructions, and trail stabilization using shale from off-site sources.

### Structures

Existing structures which serve the purpose of the natural area (parking areas, restroom facilities, wooden bridges, signs) shall be maintained.

Within one year of adoption of this plan, boundary signs identifying Tillman Ravine as a natural area shall be posted along Mountain, Brink and Woods Roads and along boundaries where no physical demarcation exists in the field. These and existing trail head signs shall be maintained.

#### Hunting, Fishing and Trapping

Recreational hunting, fishing and trapping will continue as permissible uses. Habitat manipulation or management to increase numbers of game species will not be permitted.

#### Disease and Insect Control

Because a single gypsy moth infestation resulting in 75 percent or greater defoliation can result in mortality of hemlock trees, short term control measures using B.t. applied during the early stages of infestation are allowable upon a determination by the Park Superintendent and State Forestry Service's Insect and Disease Specialist. Should the B.t. application be ineffective, application of other pesticides is permissible upon approval by the Division Director.

#### Fire Control

All fires are a severe threat to the integrity of the ecosystem at Tillman and shall be contained and extinguished as quickly as possible.

#### Rare Plant Species

The New Jersey Natural Heritage Program shall conduct a limited survey of Tillman for potential populations of rare plant species. All plant location information will be provided to the Park Superintendent as confidential, and shall not be available to the general public. Newly discovered rare plant populations shall be brought to the attention of the State Park Service and Office of Natural Lands Management to determine potential impacts from public use. The Park Superintendent is responsible for monitoring known populations.

#### Threatened and Endangered Wildlife Species

In general, habitat manipulation is not required to manage populations of threatened and endangered wildlife species that potentially exist within the natural area. Although habitat manipulation shall be discouraged, plans for such activity may be submitted to the Natural Areas Council for review and recommendation to the Division.

#### Research

Specific areas proposed for future research include rare plant and threatened and endangered wildlife studies, and effect of acid rain on the watershed.

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## INTRODUCTION

Stokes State Forest, which is administered by DEP's Division of Parks and Forestry, occupies 15,319 acres within the northwestern portion of New Jersey. The forest is located along the Kittatinny Mountain ridge north and west of Branchville in Sussex County. The 500 acre Tillman Ravine Natural Area is located within the southwestern portion of the forest (Fig. 1). The natural area is bounded on the north by Brink Road, on the east by Woods Road, on the South by the Delaware Water Gap National Recreation Area, and on the West by Brink and Mountain Roads (Fig. 2).

In 1928 the State of New Jersey purchased 235 acres, which contained Tillman Ravine, as part of the Stokes State Forest expansion. A picnic area, a trail system and an interpretive program were established in the ravine area which became a major attraction of the State of New Jersey.

Additional lands purchased through Green Acres Bond monies have increased the Tillman Ravine area to approximately 500 acres.

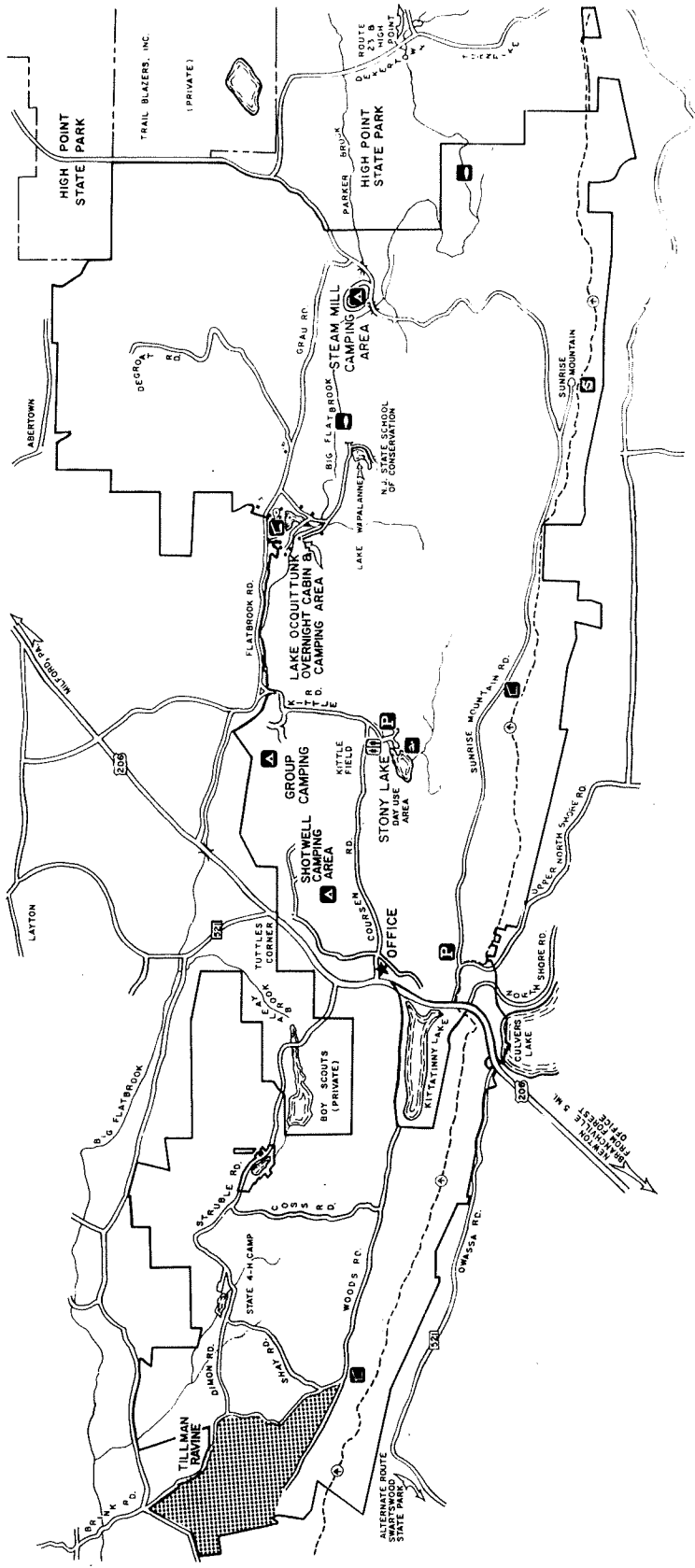
Tillman Ravine has been described "as near primeval as any area within New Jersey" (Cottrell, 1960). The ravine, a scenic and nature interpretive area for Stokes State Forest, has been managed to preserve its integrity through limited manipulation.

Earlier measures to protect the Tillman Ravine area include removing picnicking, banning fires and rerouting interpretive trails to less sensitive locations. The specific dates when these changes occurred are not known; however, some early brochures and maps printed in the 1940's and 50's on Stokes State Forest and the Tillman Ravine Area indicate that these changes did take place.

N.J.S.A. 13:15.4 defines natural areas as "areas of land or water which have retained their primeval character, although not necessarily completely natural and undisturbed, or having rare or vanishing species of plant and animal life or having similar features of interest which are worthy of preservation for the use of present and future residents of the State."

In 1978 Jerry F. English, then Commissioner of the Department of Environmental Protection, officially designated Tillman Ravine Natural Area as part of the Natural Areas System through the New Jersey Administrative Code 7:2-11.22. The area was included in the System because it contained anticline geologic forms, the effects of water erosion on exposed rocks, a near natural habitat, and unusual and outstanding forest types composed of hemlocks, mixed hardwoods and mixed oaks.

The New Jersey Administrative Code mandates that management plans be prepared for all of the areas in the Natural Areas System. The primary purpose of a management plan is to develop techniques to ensure perpetuation of sensitive natural features. Other uses may be permitted provided they are compatible with protection of natural features of the site. Those environmental factors and sensitivities that characterize Tillman Ravine Natural Area serve as a basis for management. The management strategy that is developed through this plan will protect the features of the natural area while allowing uses which are compatible.



**Legend**

- CAMPING
- PARKING
- RESTROOM
- SWIMMING
- FISHING
- CABINS
- APPALACHIAN TRAIL
- TRAIL SHELTER
- NATURAL AREA
- SCENIC SHELTER

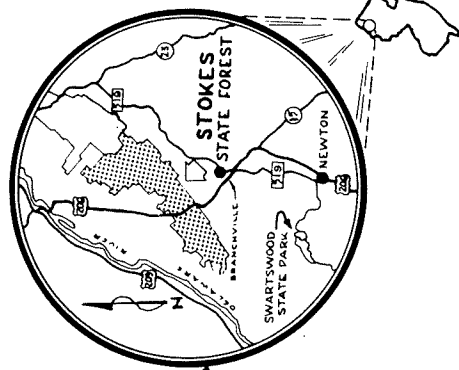


Figure 1  
Location/Stokes State Forest Map

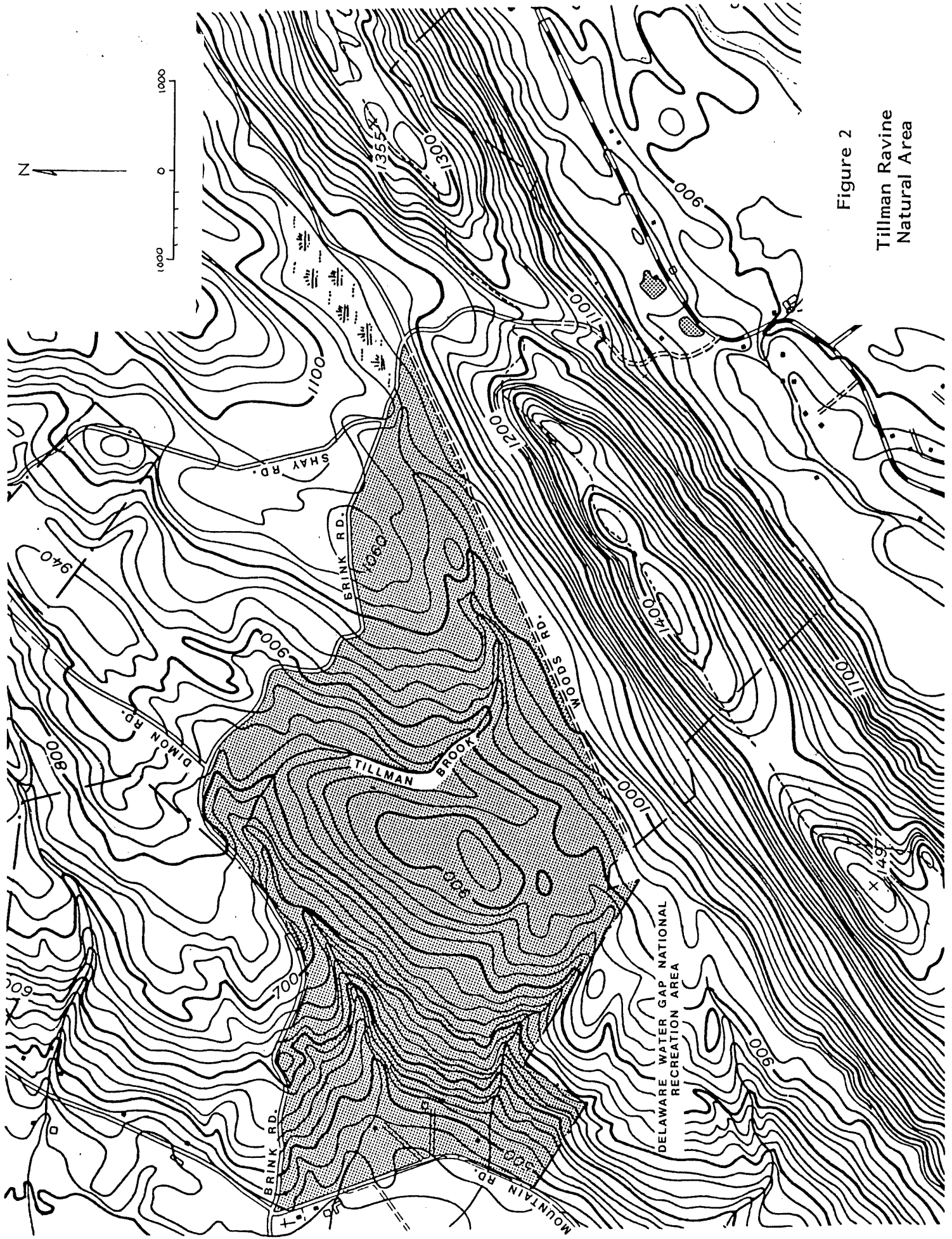


Figure 2  
Tillman Ravine  
Natural Area



## SITE DESCRIPTION

### Geologic History

Tillman Ravine Natural Area lies in the Appalachian Ridge and Valley physiographic province. The Ridge and Valley province has a northeast-southwest orientation and spans 1,200 miles in the eastern United States as a narrow belt of ridges and interconnecting valleys. In New Jersey, the province consists of the Delaware Valley, and Kittatinny Valley which are separated by the Kittatinny Mountain. Tillman Ravine Natural Area is located on the western face of the Kittatinny Mountain.

The geologic history of the Ridge and Valley province began approximately 550 million years ago during the Paleozoic Era and is marked by periods of deposition, erosion and folding and faulting.

The tremendous pressures exerted on the earth's surface during the formation of the Ridge and Valley province are evident in the natural area by the anticline geologic forms (convex fold of bedrock material). Exposed bedrock that can be seen along the lower falls is the fracture zone of a large fold. Tillman Brook is cutting into the shale along this cleavage zone. A small fold can be seen in exposed bedrock at the upper falls.

The bedrock of the Kittatinny Mountain consists of the High Falls formation overlying Shawangunk conglomerate. Bedrock of the natural area is the High Falls formation. The High Falls formation, also known as the Bloomsbury formation, is composed of red, green and olive-colored cross-bedded and laminated sandstone and shell with some pea conglomerate. The High Falls formation consists of sediments which were eroded from uplifted lands to the northeast, carried by the northwestward flowing rivers, and deposited as bar and levee deposits along meandering stream courses which were reworked within a shallow sea (Wolfe, 1977).

Most of Northern New Jersey was covered by pleistocene glaciers. The most recent, the Wisconsin Stage, 80,000 to 18,000 years ago, has the most visual affects on the Ridge and Valley province and Tillman Ravine Natural Area today. In general, glacial ice of the Wisconsin Stage advanced in a south-southwest direction. Striae and boulders found on the northern portion of the Kittatinny Mountain ridge indicate that ice overtopped the ridge moving from east to west.

As the glacier withdrew, meltwaters of the ice sheet followed weaknesses in the rock material such as fractures and bedding. Tillman Ravine is the product of meltwater following and eroding along the line of least resistance, the fracture zone which was formed by the folding of bedrock materials. The portion of Tillman Brook within the ravine is in a youthful stage of the erosion cycle with a deep, narrow, "V" shaped valley. Stream erosion is almost entirely restricted to down cutting along joints and beds of the High Falls slate. The Ravine has been further altered by cycles of freezing and thawing of the soil.

Near the bottom of Tillman Ravine in the lower falls is a structure which is commonly called the Teacup. This structure is an excellent example of a pothole. Potholes are formed by the swirling motion of sand and rock carried by rapidly moving water during times of high runoff. The

semicircle just below the Teacup is a former pothole that was finally breached. Just above the Teacup is a ledge where a pothole is beginning to develop (Tillman Ravine Trail Guide).

Approximately 75 feet upstream from the pothole the stream valley is ten to fifteen feet wider. During a flood in 1955, the waters of Tillman Brook flowed at such high velocity that blocks and fragments of the High Falls shales were removed from the banks and carried downstream. A portion of the bank was converted into a cliff in a matter of a few hours by these flood waters.

### Soils

The soils in the Tillman Ravine Natural Area were formed in glacial till which was left after the recession of the last glacier approximately 10,000 to 15,000 years ago. In general the soils are bedrock outcrops and very stony and extremely stony loams. They are found on sharp ridgetops, escarpments and side slopes of Kittatinny Mountain.

The major soil types in the natural area in descending order of abundance, are Oquaga extremely stony loam, Wartsboro very stony loam, Rock outcrop - Oquaga association, and Norwich very stony silt loam (Soil Survey of Sussex County, New Jersey, 1975).

The Oquaga series consists of moderately deep, well drained to excessively drained soils underlaid by shattered sandstone and shale bedrock. These strongly acid soils formed in glacial till derived primarily from acid, red sandstones, shale, and slate. The Oquaga extremely stony loam has slopes of 8 to 25 percent and a depth to bedrock of about 25 inches.

The Wartsboro series consists of deep, moderately well drained soils that have a fragipan in the subsoil. A fragipan is a subsurface layer that is primarily silt and fine sand which is seemingly cemented. These soils are on uplands. They are formed in moderately coarse textured glacial till derived predominantly from acid gray and brown quartzite, conglomerate, and sandstone. They are strongly acid soils with a moderately high natural fertility. The Wartsboro very stony loam is characterized by stones 5 to 30 feet apart on the surface area and in the surface layer and slopes of 8 to 20 percent which are complex and vary within short distances.

The Rock Outcrop-Oquaga association is 40 to 60 percent bedrock outcrop, rock rubble or soil material that is less than 10 inches thick and 25 to 33 percent extremely stony Oquaga soils. Slopes range from 25 to 35 percent. Bedrock is generally outlined in a northeast to southwest direction. The bedrock faces have cracks and crevices that are filled or partly filled with soil material in which trees and shrubs grow. The Oquaga soils are on the lower slopes.

The Norwich series consists of deep, nearly level, very poorly drained soils that are shallow over a fragipan. They are formed in glacial till deposit that is high in reddish sandstone, siltstone, and shale and are strongly acidic. The Norwich very stony silt loam has slopes of 3 to 9 percent and is in areas where alluvium has been deposited.

These soils characteristics severely limit use of the natural area to forest land, wildlife habitats and watershed protection. The steep slopes and the stony nature of the soils cause the natural area to be susceptible to erosion from trail use and recreational use. Special design and intensive maintenance are needed to control this problem.

### Climate

New Jersey is characterized by a continental climate of very warm summers and cold winters with variations in daily and weekly temperatures. Climatic conditions of Sussex County are humid and temperate and are only slightly influenced by the Atlantic Ocean. Summer temperatures are frequently in the 90°F range but seldom exceed 100°F. Winter temperatures are not generally below 10°F for long periods. The frost line is less than 30 inches below the soil surface. The average length of the growing season is approximately 154 days with the average date of the last killing freeze May 4th and average date of the first killing freeze October 5th (Soil Survey of Sussex County, New Jersey, 1975).

Precipitation is well distributed throughout the year and ranges from 40 inches to 43 inches. The months of heaviest rainfall are July and August. Precipitation generally takes the form of thunder storms during the summer months with about 32 storms occurring annually. Precipitation generally takes the form of snow during the winter months with an annual accumulation of nearby 50 inches. Winter rains sometimes warms the soils enough to thaw them (Soil Survey of Sussex County, New Jersey, 1975).

The length of daylight in New Jersey, measured at New Brunswick, varies from about 9.5 hours in December, nearly 12 hours in March and September, and 15 hours in June. The average percentage of clean sunny days in Northern New Jersey are 65 percent in the summer; 60 percent, autumn and spring; and 55 percent, winter (Robichaud and Buell, 1973).

Due to the topography of the Ridge and Valley province there is a great diversity of local climates. Microclimates of the general area have not as yet been measured; however, differences along ridge tops and valleys, north and south slopes and ravines may be pronounced and significant (Buell et al., 1966).

In Tillman Ravine sunlight is reduced to about 20 percent of the total available light due to the steep walls of the ravine and the forest canopy of the hemlock forest. The reduction of sunlight (solar energy) and the cooling effect of Tillman Brook causes a mesic condition with cool temperature in the ravine.

### Surface Hydrology

Tillman Brook, a tributary of the Flat Brook, flows generally in a southwesterly direction; it begins approximately 1,500 feet northeast of the natural area, flows for approximately 12,000 feet through the natural area, and joins the Flat Brook just east of Wallpack center, approximately 1,100 feet west of the natural area. Tillman Brook begins as a small stream which broadens into a swamp area of approximately 9 acres northeast of the natural area (Fig. 3). The brook is fed by spring seeps as it flows through the natural area, the volume being seasonal depending on the water

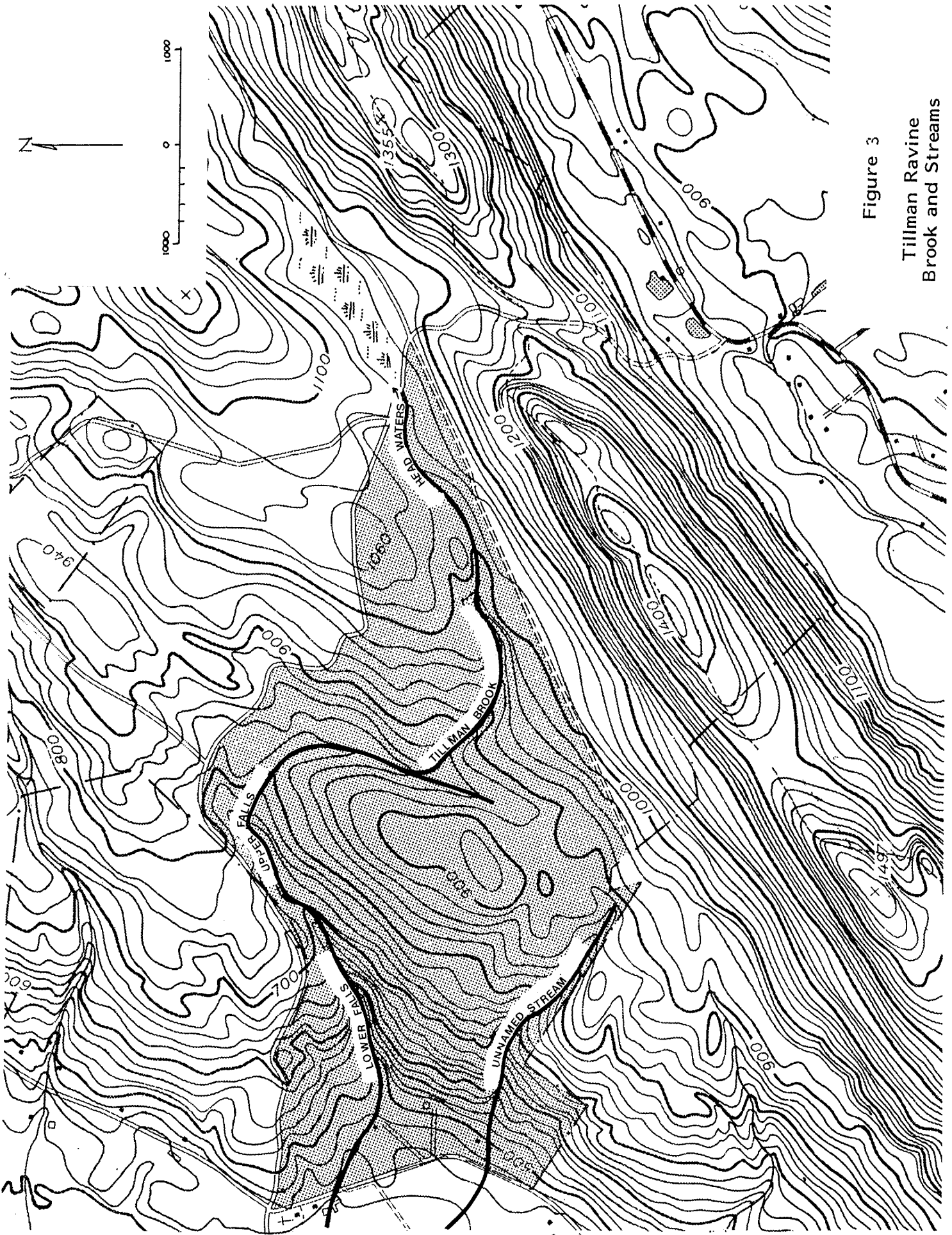


Figure 3

Tillman Ravine  
Brook and Streams

table and spring runoff of the surrounding area. During years with an unusually dry summer most portions of the brook are dry from August through November. The portion of the brook which flows through the natural area drops 610 feet in elevation over its course from about 1,050 feet above sea level at Brink Road to about 440 feet above sea level at Mountain Road. The upper and lower falls account for 300 feet of this drop.

A small stream, an unnamed tributary to Tillman Brook, is found in the southwest portion of the natural area (Fig. 3). This stream begins in the area boundaries, flows in a westwardly direction and joins Tillman Brook approximately 600 feet west of the natural area.

Division of Fish, Game and Wildlife personnel, while surveying the fish population of Tillman Brook by electrofishing on September 12, 1984, noted that the conductivity of the brook appeared to be very low. This may be acid rain impacting the Tillman Brook watershed (Soldwedel, personnel communication).

No other information is currently available on the water quality of Tillman Brook; however the Division of Water Resources has been monitoring water quality of the Flat Brook. Since Tillman Brook is a tributary to the Flat Brook and the water quality of this brook would contribute to the water quality of the Flat Brook, it is assumed that the water quality of Tillman Brook is as good or better than that of the Flat Brook.

The Flat Brook is considered to have some of the best quality surface water of New Jersey. The watershed of the Flat Brook is mostly State and Federally owned and is primarily undeveloped mountainous forest land (Robinson 1982). The Annandale - Stokes Unit Youth Correctional Institution is discharging pollutants into the Flat Brook watershed; however, this institution is far removed from the Tillman Brook basin and located along the Flat Brook proper. Discharges by this facility would not affect the water quality of Tillman Brook.

### Vegetation

One of the main features of the natural area is the exceedingly fine example of a hemlock-mixed hardwood forest which is readily accessible (Kuhnen, no date). The cool, moist microclimate and the acid soils of the ravine favor some specialized plants which are more typical of areas farther north in New England and New York State (Robichaud and Buell, 1973).

This forest type locally varies in the size and age of trees and in the tree composition. In the ravine some of the hemlocks have been measured to be 122 feet high, having a trunk diameter of 46 inches and being estimated at over 160 years old (Tillman Ravine Trail Guide). Robichaud and Buell (1973) describe this hemlock forest as:

"almost completely hemlock including trees and developing seedlings and saplings...In openings, a sassafras or sprouts of a chestnut tree may be seen. Large clumps of rhododendron occur in this forest and there are occasional representatives of witch hazel, laurel and blueberry shrubs. [The shrub layer of a hemlock-mixed hardwood forest is generally poorly developed with shrubby plants appearing in clumps

or singularly]. The spicebush may be seen along the bank of Tillman Brook. The forest floor, as typical in hemlock-dominated woodlands, is covered with hemlock needles and there is little plant ground cover; partridge berry is the only herb of importance although in Spring trailing arbutus and several herbs can be seen."

On the upper crest of the slope of the ravine some large white pines are mixed in with the hemlock. These in turn grade into mixed oak forests (Kuhnen, no date) (Fig. 4). Just north of the upper falls the hemlock forest has a higher percentage of hardwood trees and is relatively young, as compared to the age of the hemlocks in the ravine. In openings of the canopy, vigorous growth of hemlock seedlings and saplings can be observed.

North of the natural hemlock forest, bordered by Brink Road, is an even age Red Pine plantation. Historic aerial photos indicate this area was once used for agricultural purposes. The area was later planted in Red Pine by the Civilian Conservation Corp in the 1930's. Saplings and seedlings found in the plantation are hemlock, beech and maple with a few white pine. Similar to the hemlock-mixed hardwood forest, the plantation lacks a developed shrubby plant and ground cover layer, a few plants appearing singly or in small clusters. There is another plantation along Brink Road which is south of the ravine. This plantation does not have the developing saplings and seedlings which can be observed in the northern plantations, but is similar in that a shrubby plant layer and ground cover is lacking.

In the mixed oak forests of the natural area the oaks may locally share dominance with beech, hickory, birch and maples. Hemlock and white pine are dominant in locales of sloping topography and along some portions of Tillman Brook and its small tributaries. The understory of the mixed oak forests include flowering dogwood, sassafras and other small forest trees. An occasional American chestnut sprout gives evidence that this tree was once common in these forests. In contrast to the poorly developed shrub and ground cover layers of the hemlock-mixed hardwood forest, the mixed oak forests have a developed shrub layer and ground cover layer. Shrubs include maple-leaved viburnum, huckleberry, black haw, witch hazel, arrowwood and spicebush. Ground cover includes may apple, solomon's seal, jack-in-the-pulpit, trout lily and many species of ferns.

In the southwest portion of the natural area, adjacent to Mountain Road is an old field. This field was last in cultivation in 1974 and since that time it has been undergoing secondary succession. Presently, perennial and biennial plants have spread over the entire field; these plants include little bluestem, Queen Ann's lace, common mullein, black-eyed susan and various clovers and grass species. Saplings and seedlings of red cedar, black cherry, sassafras, aspens and maples can be found growing among the herbaceous plants. These trees will become dominant and eventually will be replaced by beech, birch, maples and white pines (Fig. 4).

During the fall of 1980, the staff of Stokes State Forest conducted a systematic survey of the vegetation of the natural area. Since many of the herbaceous plant species were not in flower at the time of this study, information from various botanical references was used to supplement the field data. Appendix A is a list of plant species that is the product of

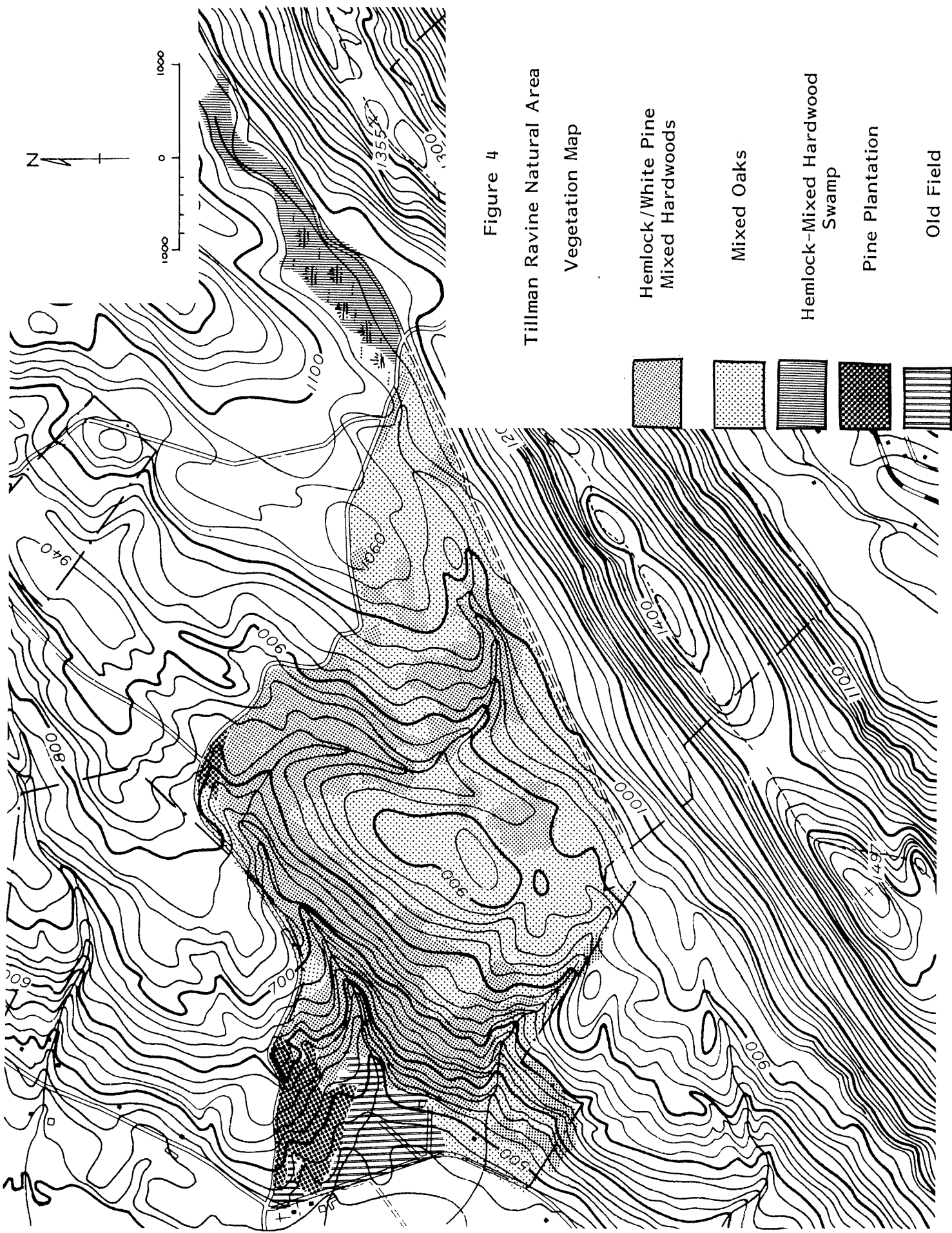


Figure 4  
Tillman Ravine Natural Area  
Vegetation Map

- Hemlock/White Pine Mixed Hardwoods
- Mixed Oaks
- Hemlock-Mixed Hardwood Swamp
- Pine Plantation
- Old Field

this survey. Plants are arranged in groups according to the forest type in which they were found.

### Wildlife

Wildlife habitats of the Tillman Ravine Natural Area range from an undisturbed forest (the hemlock forest) to a highly disturbed 10 year old field. Some of the wildlife found in the natural area have a preference for woodland or old field habitat while other wildlife utilize both.

Appendix B is a list of mammals, reptiles and amphibians provided by the Division of Fish, Game & Wildlife which are likely to occur on the site. It is doubtful that all the listed species are found there at all times, but Tillman Ravine probably makes up at least part of the annual home range of some of the species. Appendix C is a list of birds of Tillman Ravine compiled by Richard Kane of the New Jersey Audubon Society on June 23, 1985.

Population densities of deer and wild turkeys are quite high in vicinity of Tillman Ravine. The minimum average fall population density of whitetails is approximately 22 deer per square mile. There are approximately five wild turkeys per square mile in the area. (Division of Fish, Game and Wildlife game assessment)

The Wild Turkey was once a common bird to New Jersey's woodland; however, due to man's manipulation of the woodland around 1840, this species disappeared. In 1977, DEP's Division of Fish, Game and Wildlife, in cooperation with the National Park Service, reintroduced wild turkeys in the Delaware Water Gap National Recreation Area. Since the fall of 1977 wild turkeys have been observed in the upper portion of Tillman Ravine.

The ravine is important to these birds because the spring seeps of Tillman Brook provide water and food and the hemlock forest provides roosting locations and shelter during storms and inclement weather. During spring the turkeys will mate in the ravine area and later move to brooding ranges along field edges in June and July (Robert Ericksen, personal communication).

Other wildlife which are attracted to the spring seeps of Tillman Brook are wood ducks, raccoons, muskrats, river otters as well as many woodland species. (Robert Eriksen, personal communication).

The Division of Fish, Game and Wildlife personnel surveyed the fish populations of Tillman Brook on September 12, 1984. The sampling method used was electrofishing (backpack unit). Young-of-the-year brook trout, Salvelinus fantinalis, and blacknose dace, Rhinichthys stratulus were taken below the falls. Blacknose dace, R. stratulus, slimy sculpin, Cottus cognatus, and american eel, Anguilla rathata, were taken upstream of the falls. This data verifies that brook trout naturally reproduce in Tillman Brook and is the basis for its retaining its "Trout Production Waters" classification (Soldwedel, personnel Communications).

During the fall thousands of birds migrate southward along the Kittatinny Mountain Ridge. Fall hawk tallies taken at Sunrise Mountain and other locations along the Kittatinny Ridge indicate that there are large



numbers of ospreys and broad winged, sharp-shinned, cooper's and red-tailed hawks. Other hawks and falcons include the bald eagle, peregrine falcon, pigeon hawk, goshawk, golden eagle and rough-legged Hawk. Small migrants include warblers and thrushes, which do not have the aerial acrobatic displays of the raptors. (Leck, 1975). All of High Point State Park, Stokes State Forest and National Park Service land along the Mountain ridge serve as resting and feeding locations for these migrating birds.

#### Rare Plant Species

Tillman Ravine Natural Area contains seven species of threatened plants and has the potential of containing four additional species of threatened plants (Snyder, personal communications)

The seven rare plant species known to that occur in the natural area are: blunt-lobed grape fern, Botrychium oneidense; bunch flower, Cornus canadensis; mountain holly, Ilex montana; heart-leaved twayblade, Listera cordata; red spruce, Picea rubens; rock spikemoss, Selaginella rupestris; and a white violet, Viola incognita. Snyder (1984) considers red spruce, P. rubens in jeopardy of becoming extirpated in New Jersey and all known populations should be immediately protected.

Four rare plant species are known to occur within a one mile radius of the natural area and, if searched for, may be discovered within the natural areas boundaries. These species are: two-leaved toothwort, Dentaria diphylla; rhodora; Rhododendron canadense; balsam ragwort, Senecio paupercula; and white mandarin, Streptopus amplexifolius. Snyder (1984), considers rhodora, R. canadense, and white mandarin, S. amplexifolius in jeopardy of becoming extirpated in New Jersey and all populations should be immediately protected.

All the species listed are known to have ten or less extant stations in New Jersey. The three species which are in jeopardy of becoming extirpated will no longer exist in New Jersey if known populations are not protected.

#### Threatened and Endangered Wildlife Species

Tillman Ravine Natural Area contains potential habitat for the timber rattlesnake and cooper's hawk, which are endangered, and the barred owl, red-shouldered hawk, wood turtle, red-headed woodpecker and long-tailed salamander which are threatened (Jim Sciascia, personal communication).

Records of the Endangered and Non-game Species Program show that timber rattlesnakes have been found within one half mile of the natural area. The wooded ridges found in the natural area are the known habitat for rattlesnakes and this endangered species may be expected to be found there. Wood turtles have been found in Stokes Forest in the vicinity of Tillman Ravine. This threatened turtle species prefers a habitat of wooded streams such as Tillman Brook. High quality aquatic habitat is preferred by the long-tailed salamander which is also threatened.

Cooper's hawks have been observed nesting in Stokes State Forest as recently as 1981. The deciduous forest with dense understory found within the natural area is definitely a potential breeding area for this

endangered hawk species. Barred owls have been heard during breeding season near Tillman Ravine in the very recent past. The breeding habitat of the threatened species is a deciduous woodland near streams and wetlands. A red-shouldered hawk nest has been found one quarter of a mile from the ravine as recently as 1981. This threatened species utilizes deciduous, riparian forest for nesting.

### Man-made Features

Since its acquisition as part of Stokes State Forest, the Tillman Ravine area has been both a scenic and an interpretive area. Facilities to accommodate public use are concentrated along Brink Road and on the western slope of the ravine. These facilities include parking areas, restrooms and a trail system (Fig. 5).

There are two parking areas adjacent to Brink Road; the northern parking area has a 9 car capacity and the southern parking area has a 25 car capacity. Both parking areas are paved and surrounded by a rail fence. Adjacent to the southern parking area is a self-contained restroom facility. A second restroom is located along a trail between the two parking areas.

The self-guided interpretive trail system consists of a mile of delineated foot paths which are interconnected and have access points from the parking areas. Each parking area trail access has an information board and directional sign. The trails are bordered with logs in many places, stone material has been laid in some sections and other erosion control measures have been taken to off-set the affects of public use. The trail crosses Tillman Brook in four locations. Three rustic wood bridges and a stepping stone bridge are used at these crossings.

Other man-made features are not found in the natural area but do border it. Brink Road is paved along the northwest boundary and is a dirt road on the northeastern boundary. Woods Road, the eastern boundary of the natural area, is a dirt road. In the vicinity of the northern parking lot, a small picnic area is located across Brink Road outside of the natural area.

### External Features

One of the most significant features external to Tillman Ravine Natural Area is the nine acre swamp located adjacent to the northeast boundary. This swamp area, locally known as the "Rhododendron Swamp" constitutes the head waters of Tillman Brook. The tree composition of this swamp include hemlock, yellow birch, red maple and swamp white oak with a dense shrub layer of rhododendron.

Four rare plant species have been found in the swamp area (Snyder, personal communications). They are: blunt-lobed grape fern, Botrychium oneidense; bunch flower, Cornus canadensis; mountain holly, Ilex montana; and red spruce, Picea rubens. The red spruce is of particular importance in that it is in jeopardy of becoming extirpated in New Jersey (Snyder, 1984).

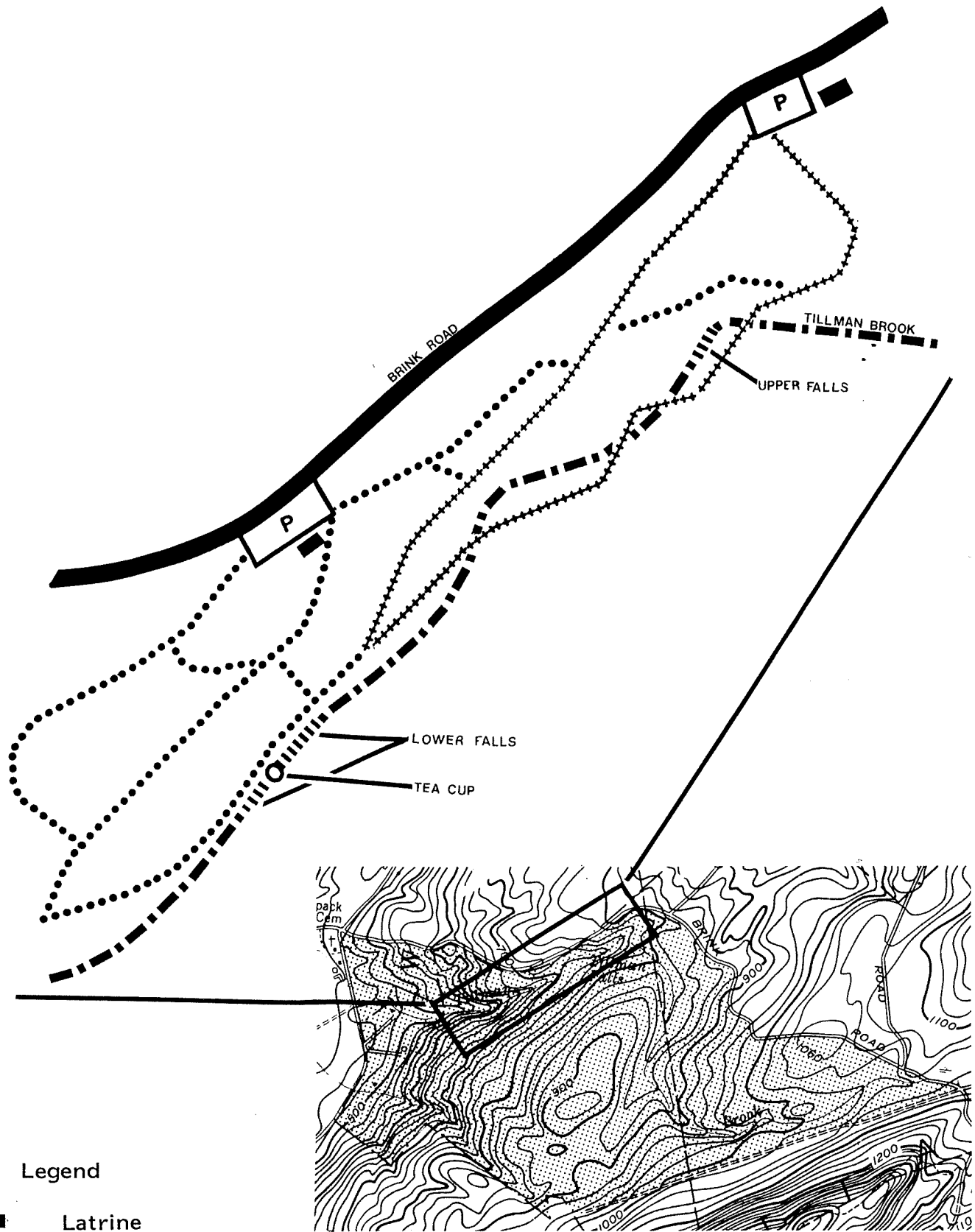


Figure 5

Trails and Structures

Since it is the headwaters of Tillman Brook, any intrusion to the swamp will adversely affect Tillman Brook and the natural area. Activities which would affect water levels of the swamp, will affect flow rates of the brook in the natural area. Activities which affects water quality of the swamp will also affect water quality of the brook.

### MANAGEMENT TECHNIQUES

The overall objective of the Natural Areas System is to preserve habitats for rare and vanishing species of plants and animals, to protect places of natural interest and scenic beauty as illustrations of New Jersey's natural heritage and to provide places for scientific study and citizen enjoyment.

Tillman Ravine was included in the Natural Area System because the hemlock ravine serves as an excellent example of a portion of New Jersey's natural heritage and it is known for its scenic beauty. There are a number of other areas in the System preserved as hemlock ravines, yet compared to these, Tillman Ravine is relatively undisturbed. It is, however, readily accessible to the public. It is a valuable educational tool and can be used for conducting scientific research. The management plan for Tillman Ravine Natural Area will set a series of management strategies for the protection of its features, while allowing continued public use at its present level.

Prior to developing a management strategy to protect the resources of a natural area, the issues which effect past, present and future use must be clearly defined. Some of these issues have been either identified or suggested in the Site Description portion of this plan, while others will be mentioned for the first time in this section. Those issues which this plan identifies are not mutually exclusive, but are part of the overall system. Management techniques regarding one issue may not have a direct or immediate affect, but may have future impacts on one or more components of the area.

#### Classification

Sensitivity to human intrusion serves as the criteria for a particular area's designation into one of three classifications: Class I; Class II; or Class III. Class I areas have features which are so fragile and highly sensitive to the impacts of man that protection can only be afforded through entry by permit or with department personnel. Class II areas have features which are sensitive to the impacts of man. Restricting access for interpretive purposes and recreation which is compatible with interpretive use is sufficient to protect these sensitive features. Class III areas have features which have some degree of sensitivity to human intrusion; however, there would be no significant damage or alterations through permitted recreational uses.

The features of Tillman Ravine Natural Area do exhibit a sensitivity to human disturbance: The slopes of the ravine could be eroded if indiscriminately used; erosion could affect the hemlocks which would in turn affect the microclimate of the area thus causing a possible change in plant composition; or plants could be removed or trampled.

These sensitivities could be ameliorated by allowing access to the area through permits or with department personnel only. To do so, however, would lead to elimination of a portion of the Stokes State Forest interpretive program as well as use of the area by the School of Conservation and other organizations and school groups. It would defeat the purpose of providing a

natural area as an educational tool. Similar protection of sensitive features of the natural area can be afforded through restricting and directing access for interpretive purposes at their current levels. Therefore the Tillman Ravine Natural Area will be designated a Class II natural area.

#### Boundaries of the Natural Area

The present natural area includes the hemlock ravine proper, a mixed oak habitat, old field and red pine plantations which are clearly identified by boundaries: Brink Road, Woods Road, Mountain Road and the Stokes State Forest Boundary. The nine acre swamp which is located northeast of the natural area is the headwaters of Tillman Brook. This swamp is an important component of the Tillman Ravine Natural Area system; however, it is located outside of the existing boundaries. Any activities that take place in this swamp area may affect portions of the natural area. Further, the swamp is a known habitat for four rare plant species. This swamp is suitable for inclusion within the natural area boundaries because of this direct relationship to the existing area.

With the adoption of this management plan steps will be taken by the Director of the Division of Parks and Forestry to include the swamp as part of the Tillman Ravine Natural Area. The boundaries of this addition will encompass an area beginning at the intersection of Brink and Shay Roads, along a line extending from that intersection at an azimuth of 60° GN. to the 1080 foot contour line; thereafter, along the 1080 foot contour line to its point of intersection with Woods Road, at approximately 4,150 feet northeast of the intersection of Brink and Woods Roads; thereafter southwest along Woods Road to the intersection with Brink Road (Fig. 6).

The old field and pine plantations within the existing boundaries (Fig. 4) do not fulfill the legislative definition of a "primary natural area". These habitats do not reflect the natural heritage of the State, do not support rare species and are not significantly noted for their scenic beauty. Nevertheless, they serve an important function as buffers to the ravine proper along Brink and Mountain Roads. These roads also serve as natural area boundaries which are easily identifiable in the field. For these reasons, the old field and pine plantation will remain, as buffers, within the Tillman Ravine Natural Area. No active management of these areas are proposed at this time, but such uses may be considered in the future as amendments to this plan.

The swamp, headwaters of Tillman Brook, is critical to the water quality of the natural area and soil conditions severely limit use. Interpretive trails will not be permitted north of Brink and Woods Roads and perimeter signs are the only permanent structures which shall be allowed.

#### Public Access and Use

A number of roads leading to the natural area and its remoteness from the Stokes Forest office contribute to limited control of public access and use. During the winter months this problem is aggravated by the closure of Struble Road, which becomes Dimon Road, causing access to the natural area to be on roads through non-State owned land.

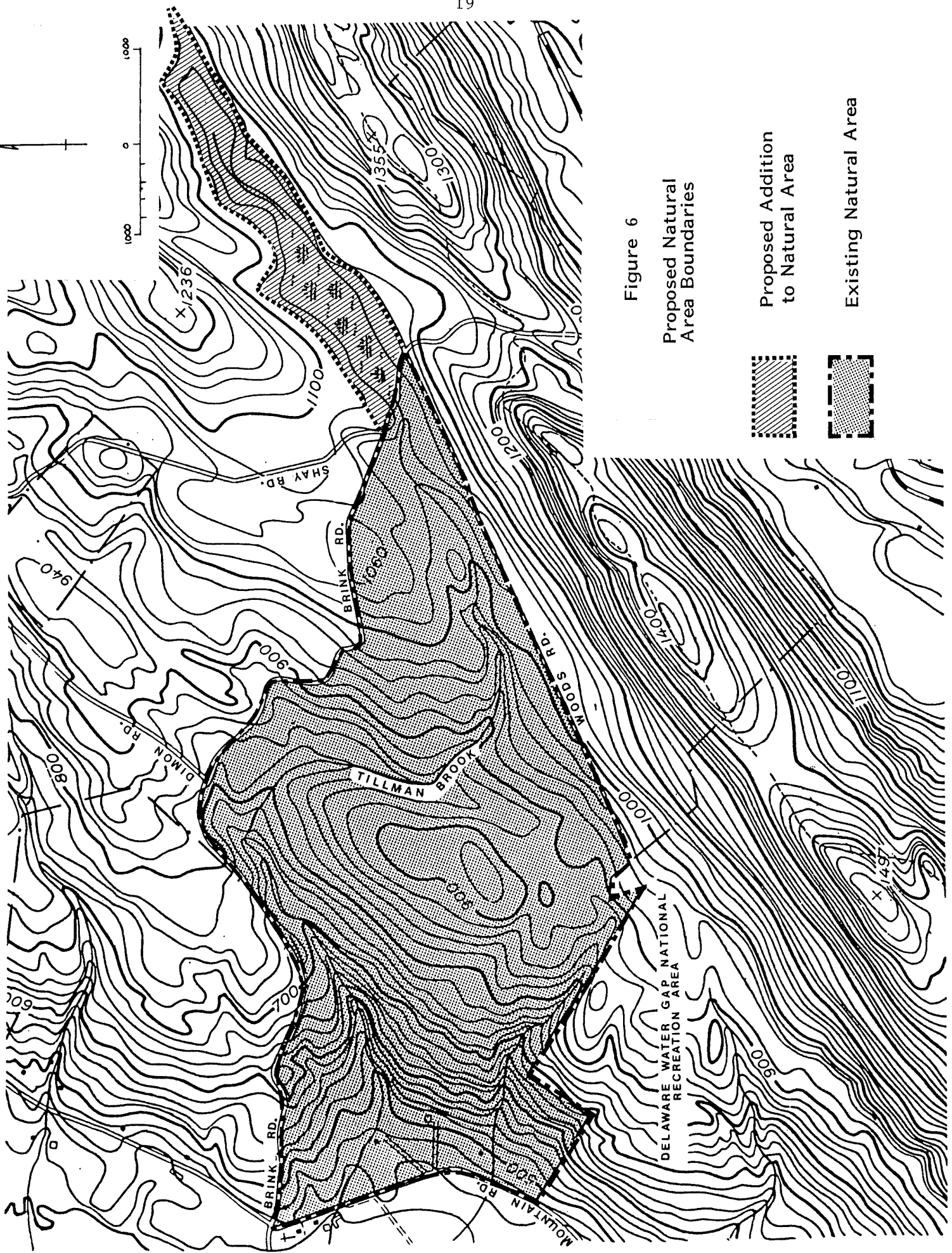
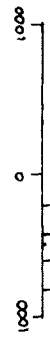


Figure 6  
Proposed Natural Area Boundaries

- Proposed Addition to Natural Area
- Existing Natural Area

DELAWARE WATER GAP NATIONAL RECREATION AREA

These conditions have existed for over fifteen years and have not contributed to any significant amount of environmental deterioration (Cherepy, no date). Illegal camping seems to occur mostly during the spring months. Campers may be attracted to the natural area because of its proximity to the Appalachian Trail to the east and federal lands to the south and west.

State Park Service has indicated that they would like to close Brink Road at the second parking area. This plan, therefore, incorporates that suggestion as part of the management strategy of the natural area. State Park Service will take the necessary steps to close Brink Road.

Unauthorized camping, causing relatively minor damage, does not contribute to the preservation of the natural area and is, therefore, prohibited. Other alternatives are available to the casual camper and this prohibition should not represent a hardship. This should be relatively easy to curtail by identification of the natural area boundary and an indication that camping is prohibited (see Structures).

Although the existing trail system is adequate for interpretive use of the natural area, close inspection of the ravine reveals that there is soil compaction, erosion and a lack of hemlock regeneration along the trails and scenic areas where the public congregates.

Soil compaction is directly related to use. With the opening of a trail to public use there is initial soil compaction; however, the soil will reach a maximum density after which there is no additional compaction as long as use levels are not increased (Goodman, personal communications). In Tillman Ravine the trails have been used for a number of years; therefore, the continued use of existing trails will not cause additional soil compaction provided public use is not significantly increased.

To prevent additional impacts due to soil compaction, no new trails will be permitted in the natural area under this plan. Proposals for new trails or realignment of those currently existing may be considered on a case-by-case basis. Should new or realigned trails be proposed by State Park Service in the future, the Director of the Division shall seek the recommendations of the Natural Areas Council prior to approval. Likewise, requests for trail closures, due to a significant increase in public use and resulting impacts, shall first be evaluated by the Council.

Adverse impacts on vegetation, and those related to soil compaction, may increase at current use levels as a result of straying from designated trails. Leaving the trail does not appear to be a random occurrence; however, it is concentrated along areas which are delineated poorly as trails. It is also prevalent where people congregate, such as the area overlooking the teacup along Tillman Brook.

In order to control the flow of people through the natural area, the Park Superintendent shall provide additional trail delineation in those areas where straying is apparent. The Parks Superintendent shall line the perimeter of areas where people tend to congregate along the trail, using staked logs lying end to end. The locations and final design of these



natural "barriers" shall be determined and implemented within six months of adoption of this plan. Only dead, on-site trees will be used for delineation of the trails; shale from outside sources may be brought into the area for necessary stabilization.

Trees which have fallen across trails and obstruct passage along those trails is another possible cause for straying. Such straying may cause new paths to be formed around the obstruction thus widening the trail. At the discretion of the Superintendent, dead trees or parts of trees which have fallen across trails and obstruct passage may be removed and used elsewhere in the natural area for trail delineation or other purposes.

### Structures

Structures in the natural areas are limited to two restroom facilities; two blacktopped parking areas (one has a 9 car capacity and the other has a 25 car capacity); fencing around parking areas, two information boards, and directional signs (Fig. 5). On the trail system, there are rustic wood bridges which are used to cross Tillman Brook and in some places logs which edge the trails. All these structures contribute to use of the natural areas for educational opportunities and therefore serve the purpose of the natural area. The capacities of the parking areas also serves to indirectly limit the maximum number of visitors to Tillman Ravine at any one time.

The parking areas and restroom facilities, while serving the purpose of the natural area, are conveniences rather than necessities at the existing locations. The impacts associated with these facilities has already been incurred during initial construction. Possible continuing adverse impacts related to runoff, infiltration and water quality are not clearly quantifiable, but appear to be negligible.

Signing of the natural area is important for promotions of the preservation concept, public education to solicit cooperation, and as a means of identifying prohibited practices. Simple boundary signs identifying Tillman Ravine Natural Area, its purpose for designation, and prohibited uses are particularly appropriate along Mountain, Brink, and Wood Roads. Signs along the northern boundary of the natural area addition will serve to identify the extent of the area where no physical demarcation exists in the field.

Within one year of adoption of this plan, the Park superintendent shall install natural area boundary signs which are to be developed in the near future, and will continue to maintain trail head signs. At a minimum the trail head signs shall include the name of the natural area, its purpose for preservation and general rules of conduct. Under general rules of conduct or on separate signs, it will be indicated that camping and motor vehicle use are prohibited in order to protect the feature of the natural area.

Boundary signs identifying Tillman Ravine as a natural area shall be posted along Mountain, Brink and Woods Roads at a maximum distance of 500 feet apart. Such signs shall also be posted along the northern border of the natural area extension beginning at the intersection of Shay and Brink Roads. The extent and number of signs at this latter area is subject to

the discretion of the Park Superintendent. The purpose for posting this area will be primarily for Park personnel to identify the natural area boundaries. All signs shall be replaced as the need arises.

### Hunting, Fishing and Trapping

Tillman Ravine Natural Area has been used to hunt white tail deer and small game such as wild turkey and ruffed grouse. Other small game species include gray squirrel, rabbit, woodcock and released pheasants. Fur bearing animals which may be trapped include raccoon, opossum, skunk, red and gray fox, eastern coyote, river otter and muskrat.

In New Jersey the only method of control of game species is through recreational hunting and trapping. Habitats can support only limited numbers of species beyond which stress will be placed on the entire population. There is no detectable evidence of this stress in the natural area, and it can be assumed that game species are within limits that can be supported by their habitat through recreational hunting use.

Recreational hunting and trapping will be allowed to continue in the natural area in accordance with fish and game regulations. Occasional fishing in Tillman Brook occurs with negligible impacts and, therefore, will be allowed to continue. The primary objective in managing a natural area, however, is to preserve the area and not to manipulate the habitat to increase the numbers of game species. Therefore although hunting, fishing and trapping will continue to be recreational uses permitted in the Tillman Ravine Natural Area, habitat manipulation to increase numbers of game species will not be permitted.

In the event that any one game species increases in numbers to the point where there is stress placed on the habitat and recreational hunting and trapping can no longer control that species population, the Fish and Game Council will be asked to institute special regulations which will allow that species to be brought under control. Special regulations may include extended seasons or increased bag limits.

### Disease and Insect Control

Disease and insect populations can play a critical role in the ecology of a forest. Historically, chestnut blight (Endothia parasitica) was responsible for the complete destruction of an important forest tree, the American Chestnut (Castanea dentata) and a change in forest composition along the Eastern United States. More recently the gypsy moth (Lymantria dispar(L.)) has been a prevalent threat to the oak forests of the Eastern United States and New Jersey.

The general policy concerning disease and insect infestations within natural areas is to allow the natural processes to occur unaltered. However, when a disease or an insect population threatens those characteristics of a specific natural area, which are the significant factors for the area's preservation, short term control measures may become necessary.

Control of any disease or insect infestation must be tailored to the specific situation. Control measures must be based on those characteristics of the area which are in jeopardy and the threatening

organism. Control must also be designed to reduce or eliminate the threat in as short of time as possible and not be a continuous process.

The specific characteristics which make Tillman Ravine an excellent example of a hemlock ravine are the age, size and quality of the hemlocks. Some of these trees have been measured to be 122 feet high, have a trunk diameter of 46 inches and being estimated at over 160 years old (Tillman Ravine Trail Guide). If these trees were lost, they could be replaced in time; however, it could take three or more generations for the new hemlock trees to reach current levels of maturity.

The only foreseeable threat to these mature hemlocks is from gypsy moth populations. Conifers are not acceptable food sources of first, second, or third instar gypsy moth larvae; however, fourth, fifth and sixth instar larvae will feed readily on the needles of hemlock, pine and spruce (Frank B. Lewis, personal communications). In situations of high gypsy moth populations where defoliation is 75% or more one defoliation is enough to kill mature hemlock trees. The mature hemlocks are extremely susceptible to this type of stress (David R. Houston, personal communications).

Where a hemlock forest is surrounded by mixed oaks, the early instar larvae will feed on preferred food trees. With the defoliation of this food source the later instar larvae will readily migrate to hemlocks. If the population of gypsy moth is high and the hemlocks substantially defoliated the trees will die (Schweitzer, personal communications).

The strategy to protect the mature hemlocks of the natural area will be three phased. Phase one will include monitoring the population of gypsy moth around and within the natural area through the State Forestry Service's Insect and Disease Program. The Insect and Disease Specialist will report to State Park Service any situation where the gypsy moth population will threaten the hemlocks of the natural area and provide recommendations for control. In the event that the hemlocks of the ravine are threatened by high gypsy moth populations the natural area and adjacent areas will be included in the Bacillus thuringensis (B.t.) spray program for that year.

The gypsy moth population will be monitored through defoliation estimates and any other means of determining population size by the park superintendent and the Insect and Disease Specialist during the control program. If it becomes evident that the application of B.t. has not reduced the larvae populations of gypsy moth enough to eliminate the threat to the hemlocks, the Division Director shall have the option, after consultation with the State Forestry Services, to apply additional spraying of B.t. Sevin will only be used as an agent of last resort.

Control measures must take place during the early stages of infestation of the hemlock forest (4th, early 5th instar) before the larvae can cause much damage. It is therefore important that the situation be assessed accurately and all necessary arrangements made within a one or two week period. Delays here may allow the pest insect to inflict damage to the hemlocks from which they may never recover (Schweitzer, personal communications).

In the event that diseases or insect infestations other than gypsy moth threaten the characteristics of the natural area, the State Park Service in coordination with State Forestry Services and the Office of Natural Lands Management will study the threatening organism, evaluate the specific threats to the area's features and recommend to the Director control measures to protect those features.

### Fire Control

Forest fires can play a critical role in the ecology of an area. In some forests such as the pine forests and plains forests of the Pinelands, fire is a primary factor in maintaining a particular habitat. In the hemlock-mixed hardwood forests, fire can be a destructive influence which could change the entire forest composition.

The cooler, moister macroclimate of a hemlock ravine forest can be considered to be less of a fire hazard than other types such as a ridge top hardwood forest. Nevertheless during the dry forest fire season hemlock forests will burn. If the old hemlocks of the ravine were to be lost to fire, it would take three or more generations for new hemlock trees to reach current levels of maturity.

It is the general policy of the Division of Parks and Forestry to contain and extinguish forest fires as soon as possible. This plan therefore incorporates this policy as part of the management strategy for Tillman Ravine Natural Area.

### Rare Plant Species

Seven rare plant species have been found in the Tillman Ravine Natural Area and four additional rare plant species have been found within a one mile radius of the natural area and may be expected to be found within the area (Snyder, personal communications). Three of these species are in jeopardy of becoming eliminated from the flora of New Jersey (Snyder, 1984).

Although it would be impractical to survey the entire 500\_ acres of the natural area, an effort should be made to locate populations of these plants in those portions of the natural area which are frequented by the public. This limited survey should be conducted in the vicinity of the parking areas, the trails along roadsides and in the headwater area of Tillman Brook. The Natural Heritage Program within the Department is currently investigating rare plants locations throughout the State and this program will satisfy the survey requirement. Plant species and their exact locations will be considered confidential information and will not be available to the general public. All plant location information will be provided to the Park Superintendent on a confidential basis. Each situation in which a rare plant population is found growing near trails or other public facilities, will be assessed by State Park Service and the Office of Natural Lands Management to determine impacts of public use. In all cases, rare plant populations will be monitored by the Superintendent to detect any changes in their population or impacts related to public use.

Research conducted within the natural area which is concerned with rare plant species will be coordinated through the Superintendent and be consistent with procedures identified in the Research Section of this management plan. No research will be permitted which will jeopardize the populations of these plants.

### Threatened and Endangered Wildlife Species

Tillman Ravine Natural Area has been identified as containing potential habitat for a number of threatened or endangered species of wildlife.

In general, the management strategy for natural areas is to allow natural processes to continue without any manipulation of the habitat. In most cases this is consistent with practices which are recommended for non-game species management. For example: management of woodland areas for cavity nesting birds and mammals such as Barred Owls has recently been incorporated into forest management plans (Jim Sciascia, personal communication). Management for cavity nesting animals, or "Snag Management", is basically concerned with allowing a certain number of dead, dying or injured trees to remain standing in a wooded area to provide niches for cavity nesting species. Since the general management policy in natural areas is not to remove live or dead timber and to allow dead trees to naturally decompose, natural area management is consistent with "Snag management".

In some very specific instances, habitat manipulation may be appropriate for species preservations. This would only be in situations where a threatened or endangered species is declining due to one or more factors. This management plan discourages habitat manipulation, and allows no provisions for specific projects; yet, proposals will be evaluated on or case by case bases in the future. Plans for proposed habitat manipulation may be submitted to the Natural Areas Council for review and recommendation to the Division. Such plans may be for populations of species which are declining on site or in the general region.

### Research

Nature study and research are primary functions of natural areas. N.J.A.C. 7:2-11.6 addresses the general procedures for applying for and carrying out research projects within natural areas.

This management plan has already identified specific areas in which research may be pursued such as: an inventory of rare plant species and their exact locations or studies of threatened or endangered wildlife species. Other areas in which research may be valuable for the administration of the natural area include studies on the effect of acid rain on the Tillman Brook watershed and associated vegetation.

All research will be coordinated through the Superintendent of Stokes State Forest and research papers concerning the Tillman Ravine Natural Area will be kept on file in the Stokes State Forest office with copies sent to the Office of Natural Lands Management.

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## Appendix A

PLANT SPECIES OF TILLMAN RAVINE

## Lower Ravine

<u>Family</u>	<u>Species</u> (Trees)	<u>Common Name</u>
Pinaceae	<i>Tsuga canadensis</i>	Eastern Hemlock
Fagaceae	<i>Fagus grandifolia</i>	Beech
Fagaceae	<i>Quercus prinus</i>	Chestnut Oak
Cornaceae	<i>Cornus florida</i>	Flowering Dogwood
Betulaceae	<i>Betula nigra</i>	Black Birch
Betulaceae	<i>Betula lutea</i>	Yellow Birch
Aceraceae	<i>Acer rubrum</i>	Red Maple
Magnoliaceae	<i>Liriodendron tulipifera</i>	Tulip tree
	(Shrubs)	
Ericaceae	<i>Rhododendron maximum</i>	Rhododendron
Ericaceae	<i>Kalmia latifolia</i>	Mountain Laurel
Lauraceae	<i>Benzoin aestivale</i>	Spicebush
Hamamelidaceae	<i>Hamamelis virginica</i>	Witch Hazel
	(Herbaceous plants)	
Filicaceae	<i>Osmunda regalis</i>	Royal Fern
Filicaceae	<i>Osmunda claytoniana</i>	Interrupted Fern
Filicaceae	<i>Osmunda cinnamomea</i>	Cinnamon Fern
Filicaceae	<i>Thelypteris noveboracensis</i>	New York Fern
Filicaceae	<i>Thelypteris hexagonaptera</i>	Broad Beech Fern
Filicaceae	<i>Onoclea sensibilis</i>	Sensitive Fern
Filicaceae	<i>Dennstaedtia punctilobula</i>	Hayscented Fern
Filicaceae	<i>Matteuccia struthiopteris</i>	Ostrich Fern

## Appendix A (Continued)

## Upper Ravine

<u>Family</u>	<u>Species</u> (Trees)	<u>Common Name</u>
Pinaceae	<i>Tsuga canadensis</i>	Eastern Hemlock
Pinaceae	<i>Pinus strobus</i>	Eastern White Pine
Oleaceae	<i>Fraxinus americana</i>	White Ash
Vitaceae	<i>Tilia americana</i>	Basswood
Fagaceae	<i>Fagus grandifolia</i>	Beech
Fagaceae	<i>Castanea dentata</i>	American Chestnut
Fagaceae	<i>Quercus velutina</i>	Black Oak
Fagaceae	<i>Quercus prinus</i>	Chestnut Oak
Fagaceae	<i>Quercus rubra</i>	Northern Red Oak
Fagaceae	<i>Quercus alba</i>	White Oak
Betulaceae	<i>Betula nigra</i>	Black Birch
Betulaceae	<i>Ostrya virginiana</i>	Eastern Hophornbeam
Cornaceae	<i>Cornus florida</i>	Flowering Dogwood
Cornaceae	<i>Nyssa sylvatica</i>	Blackgum
Amygdalaceae	<i>Prunus serotina</i>	Black Cherry
Ulmaceae	<i>Ulmus americana</i>	American Elm
Malaceae	<i>Crataegus</i> spp.	Hawthorn
Juglandaceae	<i>Carya tomentosa</i>	Mockernut Hickory
Juglandaceae	<i>Carya glabra</i>	Pignut Hickory
Juglandaceae	<i>Carya ovata</i>	Shagbark Hickory
Aceraceae	<i>Acer rubrum</i>	Red Maple
Aceraceae	<i>Acer saccharum</i>	Sugar Maple
Lauraceae	<i>Sassafras albidum</i>	Sassafras
Platanaceae	<i>Platanus occidentalis</i>	Sycamore
Magnoliceae	<i>Liriodendron tulipifera</i>	Tulip tree
Juglandaceae	<i>Juglans nigra</i>	Black Walnut
(Shrubs)		
Caprifoliaceae	<i>Viburnum acerifolium</i>	Maple-leaved Viburnum
Caprifoliaceae	<i>Viburnum prunifolium</i>	Black Haw
Caprifoliaceae	<i>Viburnum dentatum</i>	Arrowwood
Lauraceae	<i>Benzoin aestivale</i>	Spicebush
Hamamelidaceae	<i>Hamamelis virginica</i>	Witch Hazel
Cornaceae	<i>Cornus stolonifera</i>	Red Dogwood
Cornaceae	<i>Cornus amomum</i>	Gray Dogwood
Anacardiaceae	<i>Rhus typhina</i>	Staghorn Sumac
Ericaceae	<i>Gaylussacia frondosa</i>	Huckleberry
Ericaceae	<i>Rhododendron maximum</i>	Rhododendron
Ericaceae	<i>Kalmia latifolia</i>	Mountain Laurel



## Appendix A (Continued)

## Upper Ravine (Continued)

<u>Family</u>	<u>Species</u> (Herbaceous Plants)	<u>Common Name</u>
Anacardiaceae	Toxicodendron radicans	Poison Ivy
Vitaceae	Parthenocissus quinquefolia	Virginia Creeper
Vitaceae		Wild Grape
Caprifoliaceae	Lonicera japonica	Japanese Honeysuckle
Violaceae	Viola pensylvanica	Yellow Violet
Portulacaceae	Claytonia virginica	Spring Beauty
Ranunculaceae	Anemonella thalictroides	Rue Anemone
Ranunculaceae	Ranunculus acris	Meadow Buttercup
Ranunculaceae	Hepatica americana	Round-leaved Hepatica
Linaceae	Impatiens biflora	Jewelweed
Araceae	Arisaema triphyllum	Jack-in-the-pulpit
Araceae	Spathyema foetidus	Skunk Cabbage
Liliaceae	Maianthemum canadense	Wild Lily-of-the-Valley
Liliaceae	Polygonatum commutatum	Solomon's Seal
Liliaceae	Erythronium americanum	Trout Lily
Smilacaceae	Smilax rotundifolia	Wild Sarsaparilla
Berberidaceae	Podophyllum peltatum	Mayapple
Ericaceae	Kalmia angustifolia	Sheep Laurel
Ericaceae	Epigaea repens	Trailing Arbutus
Labiatae	Prunella vulgaris	Heal-all
Monotropaceae	Monotropa uniflora	Indian-pipe
Orchidaceae	Cypripedium acaule	Moccasin Flower
Rubiaceae	Mitchella repens	Partridge-Berry
Pyrolaceae	Chimaphila umbellata	Prince's Pine
Cichoriaceae	Hieracium venosum	Rattlesnake Weed
Caryophyllaceae	Silene armeria	Sweet William Catchfly
Primulaceae	Lysimachia quadrifolia	Whorled Loosestrife
Fabaceae	Baptisia tinctoria	Wild Indigo
Amaryllidaceae	Hypoxis hirsuta	Yellow Star Grass
Filicaceae	Polystichum acrostichoides	Christmas Fern
Filicaceae	Dryopteris marginalis	Marginal Woodfern
Filicaceae	Dryopteris spinulosa	Spinulose Woodfern
Filicaceae	Dryopteris goldiana	Goldie's Fern
Filicaceae	Asplenium platyneuron	Ebony Spleenwort
Filicaceae	Pteridium aquilinum	Braken Fern
Filicaceae	Adiantum pedatum	Maidenhair Fern
Filicaceae	Athyrium filix-femina	Lady Fern

## Appendix A (Continued)

## Pine Plantation

<u>Family</u>	<u>Species</u> (Trees)	<u>Common Name</u>
Pinaceae	<i>Pinus resinosa</i>	Red Pine
Pinaceae	<i>Pinus strobus</i>	White Pine
Pinaceae	<i>Tsuga canadensis</i>	Eastern Hemlock
Pinaceae	<i>Juniperus virginiana</i>	Red Cedar
Cornaceae	<i>Cornus florida</i>	Flowering Dogwood
Aceraceae	<i>Acer rubrum</i>	Red Maple
Fagaceae	<i>Fagus grandifolia</i>	Beech
Lauraceae	<i>Sassafras albidum</i>	Sassafras

## (Shrubs)

Hamamelidaceae	<i>Hamamelis virginica</i>	Witch-hazel
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## (Herbaceous plants)

Phytolaccaceae	<i>Phytolacca americana</i>	Pokeweed
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## Abandoned Field

## (Trees)

Amygdalaceae	<i>Prunus serotina</i>	Black Cherry
Salicaceae	<i>Populus tremuloides</i>	Quaking Aspen
Betulaceae	<i>Betula populifolia</i>	Gray Birch
Fagaceae	<i>Quercus coccinea</i>	Scarlet Oak
Aceraceae	<i>Acer rubrum</i>	Red Maple
Pinaceae	<i>Juniperus virginiana</i>	Red Cedar

## (Shrubs)

Ericaceae	<i>Myrica pensylvanica</i>	Bayberry
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## (Herbaceous plants)

Labiatae	<i>Monarda punctata</i>	Horsemint
Gramineae	<i>Andropogon virginicus</i>	Broomgrass
Gramineae	<i>Poa compressa</i>	Canada Bluegrass
Gramineae	<i>Phleum pratense</i>	Timothy
Gramineae	<i>Agrostis alba</i>	Herd's Grass
Gramineae	<i>Chaetochloa glauca</i>	Yellow Foxtail
Solanaceae	<i>Solanum carolinense</i>	Horsenettle
Scrophulariaceae	<i>Linaria vulgaris</i>	Butter and Eggs
Scrophulariaceae	<i>Verbascum lychnitis</i>	Common Mullein
Compositae	<i>Solidago graminifolia</i>	Goldenrod
Compositae	<i>Leptilon canadense</i>	Horseweed
Umbelliferae	<i>Daucus carota</i>	Wild Carrot
Fabaceae	<i>Trifolium pratense</i>	Red Clover

## Appendix A (Continued)

## Abandoned Field (Continued)

<u>Family</u>	<u>Species</u> (Trees)	<u>Common Name</u>
Fabaceae	Trifolium repens	White Clover
Hypericaceae	Hypericum perforatum	Common St. John's Wort
Cichoriaceae	Hieracium pratense	Field Hawkweed
Cichoriaceae	Hieracium aurantiacum	Tawny Hawkweed
Asteraceae	Rudbeckia hirta	Black-eyed Susan
Poaceae	Andropogon scoparius	Little Bluestem

## Appendix A (Continued)

## Oak-Birch

<u>Family</u>	<u>Species</u> (Trees)	<u>Common Name</u>
Fagaceae	<i>Quercus prinus</i>	Chestnut Oak
Fagaceae	<i>Quercus velutina</i>	Black Oak
Fagaceae	<i>Quercus alba</i>	White Oak
Fagaceae	<i>Quercus rubra</i>	Northern Red Oak
Fagaceae	<i>Fagus grandifolia</i>	Beech
Fagaceae	<i>Castanea dentata</i>	American Chestnut
Betulaceae	<i>Betula nigra</i>	Black Birch
Aceraceae	<i>Acer rubrum</i>	Red Maple
Aceraceae	<i>Acer saccharum</i>	Sugar Maple
Oleaceae	<i>Fraxinus americana</i>	White Ash
Platanaceae	<i>Platanus occidentalis</i>	Sycamore
Juglandaceae	<i>Carya ovata</i>	Shagbark Hickory
Juglandaceae	<i>Carya glabra</i>	Pignut Hickory
Magnoliaceae	<i>Liriodendron tulipifera</i>	Tulip tree
Lauraceae	<i>Sassafras albidum</i>	Sassafras
Cornaceae	<i>Cornus florida</i>	Flowering Dogwood
Pinaceae	<i>Tsuga canadensis</i>	Eastern Hemlock
(Shrubs)		
Caprifoliaceae	<i>Viburnum acerifolium</i>	Maple-leaved Viburnum
Caprifoliaceae	<i>Viburnum recognitum</i>	Northern Arrowwood
Hamamelidaceae	<i>Hamamelis virginia</i>	Witch-hazel
Ericaceae	<i>Kalmia latifolia</i>	Mountain Laurel
Ericaceae	<i>Rhododendron maximum</i>	Rhododendron
Lauraceae	<i>Penzoin aestivale</i>	Spicebush
Cornaceae	<i>Cornus amomum</i>	Silky Dogwood
Ericaceae	<i>Vaccinium vacillans</i>	Early Low Blueberry
Caprifoliaceae	<i>Viburnum prunifolium</i>	Blackhaw
(Herbaceous plants)		
Ericaceae	<i>Kalmia angustifolia</i>	Sheep Laurel
Ericaceae	<i>Epigaea repens</i>	Trailing Arbutus
Berberidaceae	<i>Podophyllum peltatum</i>	Mayapple
Araliaceae	<i>Panax trifolius</i>	Dwarf Ginseng
Araliaceae	<i>Aralia nudicaulis</i>	Wild Sarsaparilla
Papaveraceae	<i>Sanguinaria canadensis</i>	Bloodroot
Liliaceae	<i>Trillium grandiflorum</i>	White Trillium
Liliaceae	<i>Maianthemum canadense</i>	Wild Lily-of-the-Valley
Liliaceae	<i>Polygonatum pubescens</i>	Solomon's Seal
Liliaceae	<i>Smilacina racemosa</i>	False Solomon's Seal
Liliaceae	<i>Medeola virginiana</i>	Cucumber Root
Liliaceae	<i>Erythronium americanum</i>	Trout Lily
Primulaceae	<i>Trientalis borealis</i>	Maystar
Rubiaceae	<i>Mitchella repens</i>	Partridge Berry
Monotropaceae	<i>Monotropa uniflora</i>	Indian Pipes
Orchidaceae	<i>Goodyera pubescens</i>	Rattlesnake Plantain
Compositae	<i>Aster divaricatus</i>	White Woodland Aster
Orchidaceae	<i>Cypripedium acuale</i>	Lady Slipper

## Appendix A (Continued)

<u>Family</u>	<u>Species</u>	<u>Common Name</u>
Ranunculaceae	<i>Hepatica americana</i>	Liverleaf
Saxifragaceae	<i>Saxifraga virginensis</i>	Saxifrage
Liliaceae	<i>Streptopus roseus</i>	Rose Twisted-stalk
Liliaceae	<i>Allium tricoccum</i>	Wild Leek
Campanulaceae	<i>Campanula americana</i>	Tall Bellflower
Papaveraceae	<i>Dicentra cucullaria</i>	Dutchman's Breeches
Filicaceae	<i>Polystichum acrostichoides</i>	Christmas Fern
Filicaceae	<i>Dryopteris marginalis</i>	Marginal Woodfern
Filicaceae	<i>Dryopteris spinulosa</i>	Spinulose Woodfern
Filicaceae	<i>Dryopteris goldiana</i>	Goldie's Fern
Filicaceae	<i>Asplenium platyneuron</i>	Ebony Spleenwort
Filicaceae	<i>Adiantum pedatum</i>	Maidenhair Fern
Filicaceae	<i>Athyrium filix-femina</i>	Lady Fern
Filicaceae	<i>Pteridium aquilinum</i>	Braken Fern
Filicaceae	<i>Dennstaedtia punctilobula</i>	Hayscented Fern

## Appendix A (Continued)

## Upper Brink Road

<u>Family</u>	<u>Species</u> (Trees)	<u>Common Name</u>
Pinaceae	<i>Pinus strobus</i>	White Pine
Pinaceae	<i>Tsuga canadensis</i>	Eastern Hemlock
Fagaceae	<i>Quercus prinus</i>	Chestnut Oak
Fagaceae	<i>Quercus ruba</i>	Red Oak
Fagaceae	<i>Quercus velutina</i>	Black Oak
Fagaceae	<i>Quercus alba</i>	White Oak
Fagaceae	<i>Fagus grandifolia</i>	Beech
Betulaceae	<i>Betula nigra</i>	Black Birch
Betulaceae	<i>Betula lutea</i>	Yellow Birch
Platanaceae	<i>Platanus occidentalis</i>	Sycamore
Aceraceae	<i>Acer rubrum</i>	Red Maple
Aceraceae	<i>Acer saccharum</i>	Sugar Maple
Juglandaceae	<i>Carya cordiformis</i>	Bitternut Hickory
Juglandaceae	<i>Carya glabra</i>	Pignut Hickory
Magnoliaceae	<i>Liriodendron tulipifera</i>	Tulip tree
Cornaceae	<i>Cornus florida</i>	Flowering Dogwood
Lauraceae	<i>Sassafras albidum</i>	Sassafras
	<i>Celtis occidentalis</i>	Hackberry
	(Shrubs)	
Ericaceae	<i>Rhododendron maximum</i>	Rhododendron
Ericaceae	<i>Kalmia latifolia</i>	Mountain Laurel
Ericaceae	<i>Vaccinium vacillans</i>	Early Low Blueberry
Ericaceae	<i>Gaylussacia baccata</i>	Black Huckleberry
Caprifoliaceae	<i>Viburnum recognitum</i>	Northern Arrowwood
	(Herbaceous plants)	
Araceae	<i>Symplocarpus foetidus</i>	Skunk Cabbage
Araceae	<i>Arisaema triphyllum</i>	Jack-in-the-Pulpit
Boraginaceae	<i>Myosotis scorpioides</i>	Forget-me-not
Scrophulariaceae	<i>Mimulus rigens</i>	Monkeyflower
Lobeliaceae	<i>Lobelia syphilitica</i>	Great Lobelia
Lobeliaceae	<i>Lobelia cardinalis</i>	Cardinal Flower
Alismataceae	<i>Sagittaria latifolia</i>	Arrowhead
Scrophularia	<i>Chelone glabra</i>	Turtlehead
Linaceae	<i>Impatiens capensis</i>	Touch-me-not
Ranunculaceae	<i>Caltha palustris</i>	Cowslip
Araliaceae	<i>Panax trifolius</i>	Dwarf Ginseng
Liliaceae	<i>Maianthemum canadense</i>	Wild-Lily-of-the-Valley
Primulaceae	<i>Trientalis borealis</i>	Maystar

## Appendix A (Continued)

## Upper Brink Road (Continued)

<u>Family</u>	<u>Species</u> (Herbaceous plants)	<u>Common Name</u>
Rubiaceae	<i>Mitchella repens</i>	Partridge Berry
Monotropaceae	<i>Monotropa uniflora</i>	Indian Pipe
Liliaceae	<i>Medeola virginiana</i>	Cucumber Root
Liliaceae	<i>Erythronium americanum</i>	Trout Lily
Orchidaceae	<i>Cypripedium acuale</i>	Lady Slipper
Filicaceae	<i>Metteuccia struthiopteris</i>	Ostrich Fern
Filicaceae	<i>Adiantum pedatum</i>	Maidenhair Fern
Filicaceae	<i>Athyrium filix-femina</i>	Lady Fern
Filicaceae	<i>Polystichum acrostichoides</i>	Christmas Fern
Filicaceae	<i>Dryopteris marginalis</i>	Marginal Woodfern
Filicaceae	<i>Dryopteris spinulosa</i>	Spinulose Woodfern
Filicaceae	<i>Dryopteris goldiana</i>	Goldie's Fern
Filicaceae	<i>Osmunda regalis</i>	Royal Fern
Filicaceae	<i>Osmunda claytoniana</i>	Interrupted Fern
Filicaceae	<i>Osmunda cinnamoinea</i>	Cinnamon Fern
Filicaceae	<i>Thelypteris hexagonaptera</i>	Broad Beech Fern
Filicaceae	<i>Thelypteris noveboracensis</i>	New York Fern
Filicaceae	<i>Onoclela sensibilis</i>	Sensitive Fern
Filicaceae	<i>Dennstaedtia punctilobula</i>	Hayscented Fern
Filicaceae	<i>Thelypteris palustris</i>	Marsh Fern
Filicaceae	<i>Pteridium aquilinum</i>	Braken Fern

## Appendix A (Continued)

## Maple-Beech-Oak

<u>Family</u>	<u>Species</u> (Trees)	<u>Common Name</u>
Aceraceae	<i>Acer saccharum</i>	Sugar Maple
Fagaceae	<i>Fagus grandifolia</i>	Beech
Fagaceae	<i>Quercus rubra</i>	Northern Red Oak
Fagaceae	<i>Quercus prinus</i>	Chestnut Oak
Fagaceae	<i>Quercus alba</i>	White Oak
Fagaceae	<i>Quercus velutina</i>	Black Oak
Betulaceae	<i>Betula nigra</i>	Black Birch
Betulaceae	<i>Betula lutea</i>	Yellow Birch
Magnoliaceae	<i>Liriodendron tulipifera</i>	Tulip tree
Juglandaceae	<i>Carya cordiformis</i>	Bitternut Hickory
Juglandaceae	<i>Carya ovata</i>	Shagbark Hickory
Oleaceae	<i>Fraxinus americana</i>	White Ash
Vitaceae	<i>Tilia americana</i>	Basswood
Aceraceae	<i>Acer rubrum</i>	Red Maple
Fagaceae	<i>Castanea dentata</i>	American Chestnut
Pinaceae	<i>Tsuga canadensis</i>	Eastern Hemlock
Cornaceae	<i>Cornus florida</i>	Flowering Dogwood
Lauraceae	<i>Sassafras albidum</i>	Sassafras
Pinaceae	<i>Pinus strobus</i>	White Pine
Betulaceae	<i>Carpinus caroliniana</i>	Ironwood
Betulaceae	<i>Ostrya virginiana</i>	Eastern Hophornbeam
	(Shrubs)	
Caprifoliaceae	<i>Viburnum acerifolium</i>	Maple-leaved Viburnum
Caprifoliaceae	<i>Viburnum prunifolium</i>	Black Haw
Caprifoliaceae	<i>Viburnum recognitum</i>	Northern Arrowwood
Lauraceae	<i>Benzoin aestivale</i>	Spicebush
Hamamelidaceae	<i>Hamamelis virginica</i>	Witch-hazel
	(Herbaceous plants)	
Araceae	<i>Symplocarpus foetidus</i>	Skunk Cabbage
Araceae	<i>Arisaema triphyllum</i>	Jack-in-the-pulpit
Boraginaceae	<i>Myosotis scorpioides</i>	Forget-me-not
Scrophulariaceae	<i>Mimulus rigens</i>	Monkeyflower
Lobeliaceae	<i>Lobelia syphilitica</i>	Great Lobelia
Lobeliaceae	<i>Lobelia cardinalis</i>	Cardinal Flower
Alismataceae	<i>Sagittaria latifolia</i>	Arrowhead
Scrophulariaceae	<i>Chelone glabra</i>	Turtlehead
Linaceae	<i>Impatiens glabra</i>	Touch-me-not
Ranunculaceae	<i>Caltha palustris</i>	Cowslip



## Appendix A (Continued)

## Maple-Beech-Oak

<u>Family</u>	<u>Species</u> (Herbaceous plants)	<u>Common Name</u>
Araliaceae	<i>Panax trifolius</i>	Dwarf Ginseng
Liliaceae	<i>Maianthemum canadense</i>	Wild Lily-of-the-Valley
Liliaceae	<i>Medeola virginiana</i>	Cucumber Root
Liliaceae	<i>Erythronium americanum</i>	Trout Lily
Primulaceae	<i>Trientalis borealis</i>	Maystar
Rubiaceae	<i>Mitchella repens</i>	Partridge Berry
Monotropaceae	<i>Monotropa uniflora</i>	Indian Pipe
Orchidaceae	<i>Cypripedium acuale</i>	Lady Slipper
Filicaceae	<i>Metteuccia struthiopteris</i>	Ostrich Fern
Filicaceae	<i>Adiantum pedatum</i>	Maidenhair Fern
Filicaceae	<i>Athyrium filix-femina</i>	Lady Fern
Filicaceae	<i>Polystichum acrostichoides</i>	Christmas Fern
Filicaceae	<i>Dryopteris marginalis</i>	Marginal Woodfern
Filicaceae	<i>Dryopteris spinulosa</i>	Spinulose Woodfern
Filicaceae	<i>Dryopteris goldiana</i>	Goldie's Fern
Filicaceae	<i>Osmunda regalis</i>	Royal Fern
Filicaceae	<i>Osmunda claytoniana</i>	Interrupted Fern
Filicaceae	<i>Osmunda cinnamoinea</i>	Cinnamon Fern
Filicaceae	<i>Thelypteris hexagonaptera</i>	Broad Beech Fern
Filicaceae	<i>Thelypteris noveboracensis</i>	New York Fern
Filicaceae	<i>Onoclela sensibilis</i>	Sensitive Fern
Filicaceae	<i>Dennstaedtia puntilobula</i>	Hayscented Fern
Filiaceae	<i>Thelypteris palustris</i>	Marsh Fern
Filicaceae	<i>Pteridium aquilinum</i>	Braken Fern

## Appendix B

MAMMALS, REPTILES AND AMPHIBIANS  
LIKELY TO OCCUR AT TILLMAN RAVINE

Mammals

White-tailed deer (Odocoileus virginianus)  
 Black bear (Ursus americanus)  
 Cotton-tailed rabbit (Sylvilagus floridanus)  
 Grey squirrel (Sciurus carolinensis)  
 Red squirrel (Tamiasciurus hudsonicus)  
 Southern flying squirrel (Glaucomys volans)  
 Eastern chipmunk (Tamias striatus)  
 Red fox (Vulpes fulva)  
 Grey fox (Urocyon cinereoargenteus)  
 Eastern coyote (Canis latrans)  
 Bobcat (Lynx rufus)  
 Raccoon (Procyon lotor)  
 Opossum (Didelphis virginiana)  
 Striped skunk (Mephitis mephitis)  
 Muskrat (Ondatra zibethica)  
 Beaver (Castor canadensis)  
 Porcupine (Erethizon dorsatum)  
 River otter (Lutra canadensis)  
 Mink (Mustela vison)  
 Woodchuck (Marmota monax)  
 Long-tailed weasel (Mustela frenata)  
 Masked shrew (Sorex cinereus)  
 Smoky shrew (Sorex fumeus)  
 Least shrew (Cryptotis parva)  
 Shorttail shrew (Blarina brevicauda)  
 Star-nose mole (Condylura cristata)  
 Eastern mole (Scalopus aquaticus)  
 Little brown myotis (Myotis lucifugus)  
 Eastern pipistrel (Pipistrellus subflavus)  
 Big brown bat (Eptesicus fuscus)  
 Red bat (Lasiurus borealis)  
 Hoary bat (Lasiurus cinereus)  
 White-footed mouse (Peromyscus leucopus)  
 Eastern woodrat (Neotoma floridana)  
 Boreale redback vole (Clethrionomys gapperi)  
 Meadow vole (Microtus pennsylvanicus)  
 Pine vole (Pitymys pinetorum)  
 Norway rat (Rattus norvegicus)  
 House mouse (Mus musculus)  
 Meadow jumping mouse (Zapus hudsonicus)

## Appendix B (Continued)

Reptiles

Wood turtle (Clemmys guttata)  
 Eastern box turtle (Terrapene carolina)  
 Northern water snake (Nerodia sipedon)  
 Northern brown snake (Storeria dekayi dekayi)  
 Eastern garter snake (Thamnophis sirtalis sirtalis)  
 Eastern hognose snake (Heterodon platyrhinos)  
 Northern ringneck snake (Diadophis punctatus edwardsi)  
 Eastern worm snake (Carphophis amoenus amoenus)  
 Northern black racer (Coluber constrictor constrictor)  
 Eastern smooth green snake (Opheodrys vernalis vernalis)  
 Black rat snake (Elaphe obsoleta obsoleta)  
 Eastern milk snake (Lampropeltis triangulum triangulum)  
 Northern copperhead (Agkistrodon contortrix mokasen)  
 Timber rattlesnake (Crotalus horridus horridus)

Amphibians

Marbled salamander (Ambystoma opacum)  
 Jefferson salamander (Ambystoma jeffersonianum)  
 Spotted salamander (Ambystoma maculatum)  
 Red-spotted newt (Notophthalmus viridescens viridescens)  
 Northern dusky salamander (Desmognathus fuscus fuscus)  
 Mountain dusky salamander (Desmognathus ochrophaeus)  
 Red-backed salamander (Plethodon cinereus cinereus)  
 Slimy salamander (Plethodon glutinosus glutinosus)  
 Four-toed salamander (Hemidactylium scutatum)  
 Northern spring salamander (Gyrinophilus porphyriticus porphyriticus)  
 Northern two-lined salamander (Evrycea bislineata bislineata)  
 American toad (Bufo americanus)  
 Northern spring peeper (Hyla crucifer bartramiana)  
 Gray treefrog (Hyla versicolor)  
 Upland chorus frog (Pseudacris triseriata feriarum)  
 Green frog (Rana clamitans melanota)  
 Wood frog (Rana sylvatica)

## Appendix C

BIRDS OF TILLMAN RAVINE\*

Wood Duck (Aix sponsa)  
 Turkey Vulture (Cathartes aura)  
 Sharp-shinned Hawk (Accipiter striatus)  
 Cooper's Hawk (Accipiter cooperii)  
 Northern Goshawk (Accipiter gentilis)  
 Red-shouldered Hawk (Buteo lineatus)  
 Broad-winged Hawk (Buteo platypterus)  
 Red-tailed Hawk (Buteo jamaicensis)  
 American Kestrel (Falco sparverius)  
 Ruffed Grouse (Bonasa umbellus)  
 Wild Turkey (Meleagris gallopavo)  
 American Woodcock (Scolopax minor)  
 Mourning Dove (Zenaida macroura)  
 Black-billed Cuckoo (Coccyzus erythrophthalmus)  
 Yellow-billed Cuckoo (Coccyzus americanus)  
 Eastern Screech-Owl (Otus asio)  
 Great Horned Owl (Bubo virginianus)  
 Barred Owl (Strix varia)  
 Common Nighthawk (Chordeiles minor)  
 Whip-poor-will (Caprimulgus vociferus)  
 Ruby-throated Hummingbird (Archilochus colubris)  
 Belted Kingfisher (Ceryle alcyon)  
 Downy Woodpecker (Picoides pubescens)  
 Hairy Woodpecker (Picoides villosus)  
 Northern Flicker (Colaptes auratus)  
 Pileated Woodpecker (Dryocopus pileatus)  
 Eastern Wood-Pewee (Contopus virens)  
 Acadian Flycatcher (Empidonax virescens)  
 Least Flycatcher (Empidonax minimus)  
 Eastern Phoebe (Sayornis phoebe)  
 Great Crested Flycatcher (Myiarchus crinitus)  
 Eastern Kingbird (Tyrannus tyrannus)  
 Tree Swallow (Tachycineta bicolor)  
 Blue Jay (Cyanocitta cristata)  
 American Crow (Corys brachyrhynchos)  
 Black-capped Chickadee (Parus atricapillus)  
 Tufted Titmouse (Parus bicolor)  
 Red-breasted Nuthatch (Sitta canadensis)  
 White-breasted Nuthatch (Sitta carolinensis)  
 Brown Creeper (Certhia americana)  
 House Wren (Troglodytes aedon)  
 Blue-gray Gnatcatcher (Polioptila caerulea)  
 Eastern Bluebird (Sialia sialis)  
 Veery (Catharus fuscescens)  
 Hermit Thrush (Catharus guttatus)

\* This list includes known and likely breeding birds.

## Appendix C (Continued)

Wood Thrush (*Hylocichla mustelina*)  
 American Robin (*Turdus migratorius*)  
 Gray Catbird (*Dumetella carolinensis*)  
 Brown Thrasher (*Toxostoma rufum*)  
 Cedar Waxwing (*Bombycilla cedrorum*)  
 European Starling (*Sturnus vulgaris*)  
 Solitary Vireo (*Vireo solitarius*)  
 Red-eyed Vireo (*vireo olivaceus*)  
 Blue-winged Warbler (*Vermivora pinus*)  
 Golden-winged Warbler (*Vermivora chrysoptera*)  
 Nashville Warbler (*Vermivora ruficapilla*)  
 Yellow Warbler (*Dendroica petechia*)  
 Chestnut-sided Warbler (*Dendroica pensylvanica*)  
 Magnolia Warbler (*Dendroica magnolia*)  
 Black-throated Blue Warbler (*Dendroica caerulescens*)  
 Black-throated Green Warbler (*Dendroica virens*)  
 Blackburnian Warbler (*Dendroica fusca*)  
 Pine Warbler (*Dendroica pinus*)  
 Prairie Warbler (*Dendroica discolor*)  
 Black-and-white Warbler (*Mniotilta varia*)  
 American Redstart (*Setophaga ruticilla*)  
 Worm-eating Warbler (*Helmitheros vermivorus*)  
 Ovenbird (*Seiurus aurocapillus*)  
 Northern Waterthrush (*Seiurus noveboracensis*)  
 Louisiana Waterthrush (*Seiurus motacilla*)  
 Common Yellowthroat (*Geothlypis trichas*)  
 Hooded Warbler (*Wilsonia citrina*)  
 Canada Warbler (*Wilsonia canadensis*)  
 Scarlet Tanager (*Piranga olivacea*)  
 Northern Cardinal (*Cardinalis cardinalis*)  
 Rose-breasted Grosbeak (*Pheucticus ludovicianus*)  
 Indigo Bunting (*Passerina cyanea*)  
 Rufous-sided Towhee (*Pipilo erythrophthalmus*)  
 Chipping Sparrow (*Spizella passerina*)  
 Field Sparrow (*Spizella pusilla*)  
 Song Sparrow (*Melospiza melodia*)  
 White-throated Sparrow (*Zonotrichia albicollis*)  
 Dark-eyed Junco (*Junco hyemalis*)  
 Red-winged Blackbird (*Aegialius phoeniceus*)  
 Common Grackle (*Quiscalus quiscula*)  
 Brown-headed Cowbird (*Molothrus ater*)  
 Northern Oriole (*Icterus galbula*)  
 American Goldfinch (*Carduelis tristis*)