

Historical Analysis and Map of Vegetation Communities, Land Covers, and Habitats of Fork Branch Nature Preserve Kent County, Delaware

St. Jones River Watershed

Submitted to:

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CHAPTER 1: INTRODUCTION AND METHODS

Setting of Fork Branch Nature Preserve

Fork Branch Nature Preserve is located in central Kent County, Delaware (Figure 1.1). The Nature Preserve totals 265 acres in one tract. All of the preserve is located within the Fork Branch watershed which is part of the larger St. Jones River watershed.

History and Formation of Fork Branch Nature Preserve

Formation of Fork Branch Nature Preserve

Fork Branch Nature Preserve was donated by Dr. James McClements and his wife to the State of Delaware.

Soils and Geology of Fork Branch Nature Preserve¹

Underlying Geology

Most of the Fork Branch Nature Preserve is underlain by the Lynch Heights Formation, with a small section at the western end underlain by the Columbia Formation. The floodplain of Fork Branch is swamp deposits.

The Lynch Heights Formation is from the Upper Pleistocene Period is described as a “heterogeneous unit of light-gray to brown to light-yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand.” It is found on terrace that parallels Delaware Bay between 30 and 50 feet in elevation.

The Columbia Formation is older and from the middle Pleistocene Period. It is described as being “yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel.” It was formed in a glacial outwash environment.

Swamp deposits are the youngest and are from the Holocene Period. They are described as “structureless, black to brown, organic-rich, silty and clayey, fine to coarse quartz sand with thin interbeds of medium to coarse quartz sand.”

Soils

Two soils are prominent in the Nature Preserve and include Fallsington Loam in some of the upland areas and depressions and Longmarsh and Indiantown Soils in the floodplain of Fork Branch. Two minor soils, Corsica Mucky Loam and Hambrook Sandy Loam are present in depressions and uplands respectively. Elevations of the preserve range from about 18 feet east of DE Route 15 to about 50 feet at West Denneys Road at the north end of the preserve.

¹ Ramsey, Kelvin. 2007. Geologic Map of Kent County, Delaware. Geologic Map Series No. 14, Delaware Geological Survey.

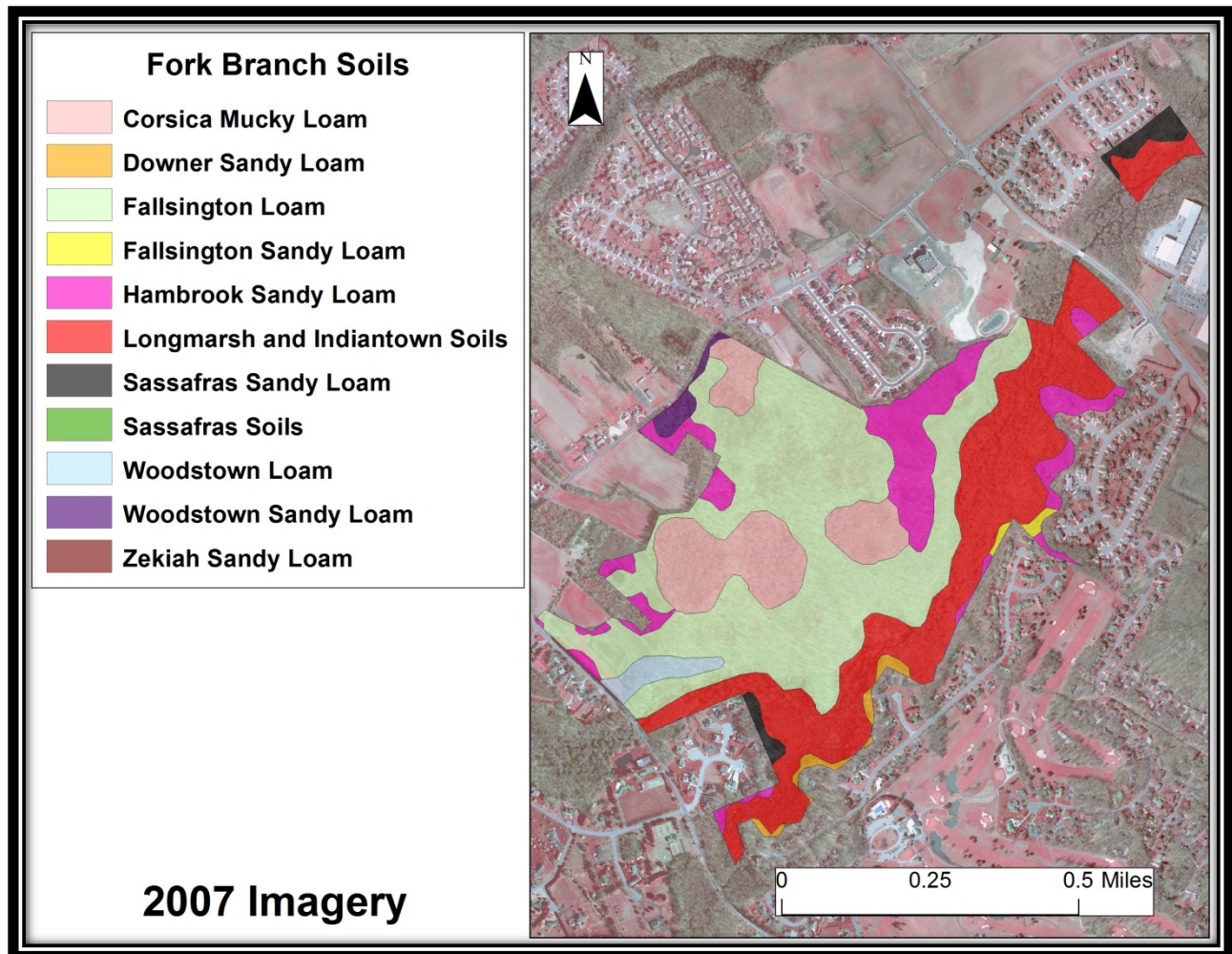


Figure 1.2. Soil Map of the Fork Branch Nature Preserve

Discussion of vegetation communities in general and why they are important in management

While Natural Communities provide the optimal habitats and structure that are needed for animals to exist, vegetation communities provide an approximation of natural communities. The differences in the vegetation communities are governed by non-biotic factors and biotic factors. Non-biotic factors include things such as geology (soil type, availability of moisture, and exposure), climate, and fire regime. Biotic factors include: number and amount of predators and prey, biodiversity of the community and presence and absence of contributors to ecosystem health such as ants, fungi and bacteria and size of forest blocks. Historically these factors have not changed much other than changes brought about by larger climate shifts. Since the time of modern European settlement of Eastern North America (i.e. from about 1600 A.D.), physical factors such as fire regime and moisture availability have changed and nearly all of the biotic factors have changed resulted in a markedly different landscape today than what the original settlers saw. Today, instead of having Natural Communities, we have

Vegetation Communities, which only approximate Natural Communities and are essentially artificial shells of what they could be.

Purpose of the Study

This study was conducted with the following goals in mind:

1. Classify and map vegetation communities, land covers, and assess habitat conditions for Species of Greatest Conservation Need (SGCN)[as defined in the Delaware Wildlife Action Plan (DEWAP)] for Fork Branch Nature Preserve based on 1937, 2002, and 2007 aerial imagery and field observations.
2. Use the maps above to determine changes in the vegetation communities over time.
3. Determine the forest blocks located within or partially within the nature preserve.
4. Produce Ecological Integrity Assessments (EIAs) for vegetation communities that are ranked S2 or higher.

Surveys were conducted during 2011 by Robert Coxe, an Environmental Scientist with the Delaware Natural Heritage and Endangered Species Program (DNHESP) within the Delaware Division of Fish and Wildlife, Department of Natural Resources and Environmental Control (DNREC).

Vegetation Community and Land Cover Surveys

Vegetation communities and land covers were determined by qualitative analysis using observations made in the field and aerial photo-interpretation using 1937, 2002, and 2007 imagery. Vegetation communities are named according to the *Guide to Delaware Vegetation Communities*² which follows the National Vegetation Classification System (NVCS). The NVCS classifies vegetation on a national scale for the United States and is linked to international vegetation classification. The NVCS helps provide a uniform name and description of vegetation communities found throughout the country and helps determine relative rarity. Descriptions of the vegetation communities are provided in Chapter 4 and of land covers in Chapter 5. A crosswalk to the Delaware Wildlife Action Plan (DEWAP) and the Northeast Habitat Classification (NHC) is provided at the top of each individual description.

Analysis of Historical Imagery

Historical imagery of Fork Branch Nature Preserve from 1937 and 2002 and current imagery from 2007 were examined. A vegetation community map was produced for each year in order to compare vegetation and land cover change over a 5, 65, and 70 year time frame. Changes in the respective vegetation communities and land covers are discussed in the descriptions while broader changes are discussed in the nature preserve discussion. There is more imagery available (1954, 1961, 1968, 1992, and 1997) but these sets were not used due to geo-registration problems in the image tiles.

Ecological Integrity Assessment (EIA)

An EIA was conducted for those communities in the preserve that are ranked S2 or higher in Delaware. EIAs are an analysis being developed by Natureserve to determine the relative quality of vegetation communities across North America. Using Natural Heritage methodology, communities are ranked according to rarity (Appendix I). The vegetation communities at Fork Branch Nature Preserve included in the EIA analysis are listed in Table 2.3 and depicted in Figure 2.1.

Forest Block Analysis

Current forest blocks within or partially within the nature preserve that are greater than 100 acres were mapped. Each current block is described for current total acres and current forest interior habitat, potential acres, potential forest interior habitat, vegetation communities currently present, and major drainage (Table 4). A block is defined as contiguous forest habitat that is contained within 30 feet of non-forested and is the method used by the Maryland's Strategic Forest Lands Assessment.³ Forest interior is forested area that is 100m from a forest edge. Potential blocks were extended out to areas of noncontiguous habitat (such as roads, power line right-of-ways, and developed areas) that were considered to be immovable. Most of the area that could be reverted to forest is currently old field

² Coxe, Robert. 2010. Guide to Delaware Vegetation Communities-Summer 2010 Edition. Unpublished report.

³ Maryland Department of Natural Resources. 2003. Strategic Forest Lands Assessment. Co-op Project between Maryland Department of Natural Resources, Watershed Services, and Maryland Forest Service. 40 p.

habitat or in agricultural use. These blocks were determined for future planning in regards to improving and increasing forest interior habitat.

Natural Capital Analysis

The natural capital of each vegetation community was determined using a table in Costanza, et al.⁴ The values from the table were calculated per acre of the vegetation community and then adjusted using an inflation calculator (DollarTimes.com) from 1994 values to 2012 values. Using these methods the following values were obtained:

Estuaries (water): \$9,247/acre/year

Temperate Forest (Upland forests): \$122/acre/year

Wetlands

- General (not as below): \$5,988/acre/year

- Tidal Marsh: \$4,046/acre/year

- Swamps/floodplains: \$7,930/acre/year

Lakes (Impoundments): \$3,442/acre/year

Cropland: \$37/acre/year

Grassland/fields: \$94/acre/year

Open Ocean: \$102/acre/year

Values were rounded off to the nearest whole dollar. Calculating the natural capital provides a consistent way to compare wildlife areas, nature preserves, state parks, and other lands as far as value. Even if you do not agree with the values, it still provides a relative measure of the areas.

⁴ Costanza, Robert, et al. 1997. The value of the world's ecosystem services and natural capital. Nature 387:253-260.

CHAPTER 2: RESULTS OF EIAs, FOREST BLOCKS, AND GENERAL OBSERVATIONS

Summary of Findings from this study

1. **Vegetation Communities:** Fourteen vegetation communities and three land covers were found at Fork Branch Nature Preserve. Mid-Atlantic Mesic Mixed Hardwood Forest (124 acres) is the largest vegetation community, followed by Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp with 70 acres. Water (5 acres) is the largest land cover, followed by agricultural field with 2 acres.
2. **Rare Plants:** One rare plant is known to exist in Fork Branch Nature Preserve (Table 2.1).

Scientific Name	Common Name	Rank	Last Observed
<i>Ranunculus ambigens</i>	Water-plantain Spearwort	S1.1	1991

Table 2.1 Rare Plants at Fork Branch Nature Preserve

3. **Rare Animals:** Three rare animals are known to exist in Fork Branch Nature Preserve (Table 2.2).

Scientific Name	Common Name	Rank	Last Observed
<i>Accipiter cooperii</i>	Cooper's Hawk	S1B	1991
<i>Ardea herodias</i>	Great Blue Heron	S2B	1991
<i>Buteo platypterus</i>	Broad-winged Hawk	S1B	1991

Table 2.2 Rare Animals at Fork Branch Nature Preserve

Ecological Integrity Assessment (EIA)

Three vegetation communities are ranked S2 or higher. These include Central Appalachian Cutgrass Marsh, Chesapeake Bay Non-riverine Wet Hardwood Forest, and Northeastern Pin Oak-Swamp White Oak Forest. These areas are mapped in Figure 2.1 and summarized in Table 2.3.

Fork Branch EIA Communities

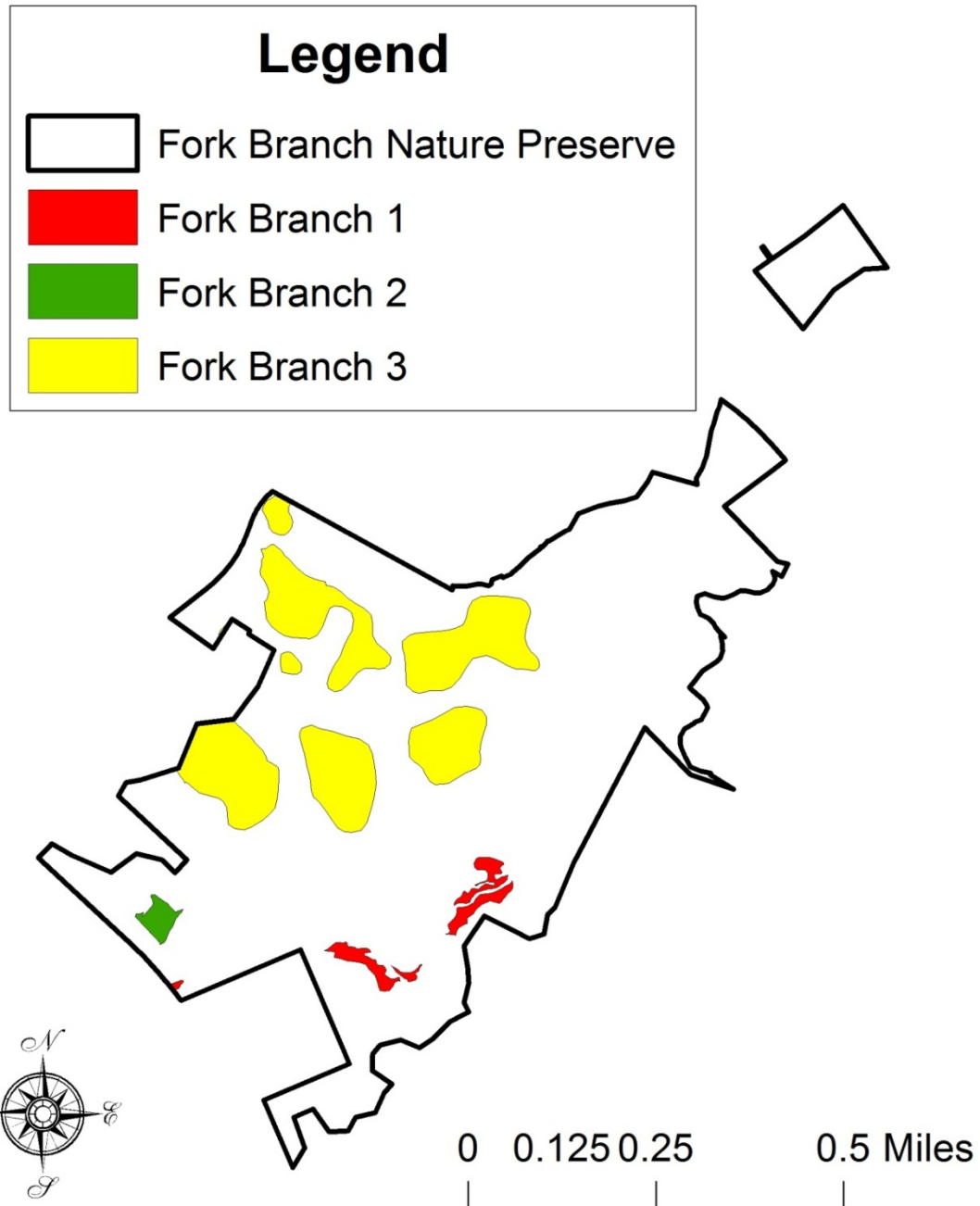
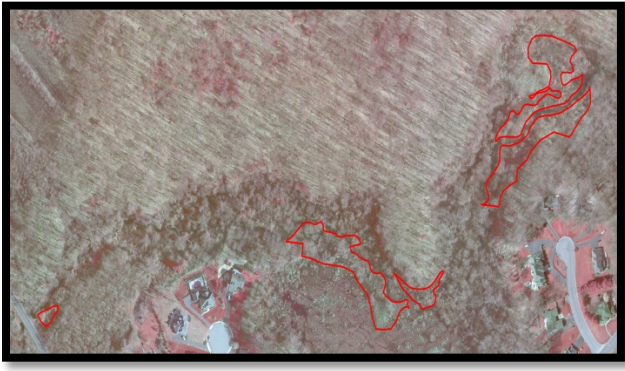


Figure 2.1. Location of EIA communities in the Fork Branch Nature Preserve

Table 2.3. EIA Vegetation Communities located in Fork Branch Nature Preserve

Community Map	Community Name/EIA Score	Description
	Fork Branch 1 Central Appalachian Cutgrass Marsh (3.2 acres) EIA = 3.65 (B rank)	This marsh is located in the floodplain of Fork Branch in an old beaver pond.
	Fork Branch 2 Chesapeake Bay Non-riverine Wet Hardwood Forest (1.2 acres) EIA = 3.09 (C rank)	This wet hardwood forest is located in a small upland depression that is former agricultural field.
	Fork Branch 3 Northeastern Pin Oak-Swamp White Oak Forest (37.5 acres) EIA = 4.37 (B rank)	This depression forest is scattered throughout the site.

Forest Block Analysis

Importance of Forest Blocks

Forest blocks are important for a number of animals such as bobcat and neo-tropical migratory birds which nest in forest interiors (those places that are 100 meters from the edge of a forest). Many neotropical migratory birds are considered to be breeders in forest interior areas. Due to development, road building, which causes fragmentation, agricultural fields and other non-forest land uses, habitats for these birds are increasingly being eliminated leading to reductions in populations. Predators are better able to get the birds in small woodlands and edge habitats. In Ontario it was found that 80% of the neo-tropical bird nests in small woodlands (<100 ha) were lost to predators⁵. Nests in interior forests are less susceptible to predation and are not taken over by cowbirds, which is another hazard on edge habitats. Examples of birds that may be affected by a lack of large forest tracts include Barred Owl, Black and White Warbler, Worm-Eating Warbler, Acadian Flycatcher, Ovenbird, Kentucky Warbler, Red-Shouldered Hawk and many others.

Management of state parks has traditionally favored recreational uses, which require cultivated lawns and edges running counter to the habitat needed for forest interior birds. Protecting forest interior bird species runs contrary to the idea that artificially created edges creates more diversity. While this technique creates more diversity of some aggressive species it diminishes the populations of other species.

In protecting forest blocks, those blocks which are circular contain the most interior area per unit area. The next best shape is a square and linear configurations produce the least forest interior due to shape.

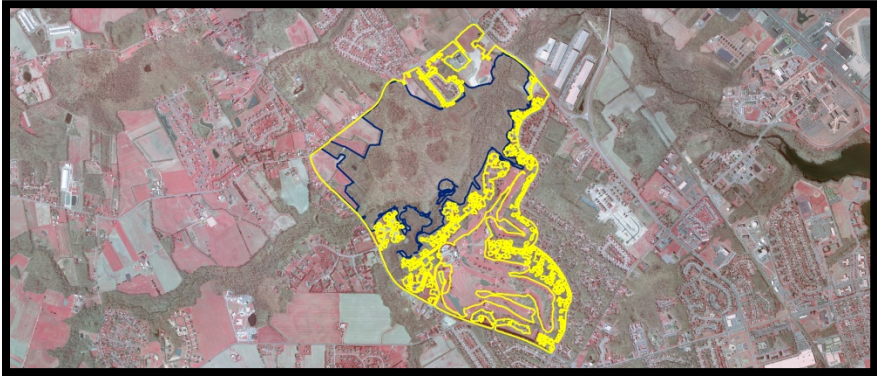
A study by Robbins et al. (1989) showed that most forest interior species require a forest of at least 150 ha (370 acres) in size. Very few forest tracts in Delaware are at least this size, one of the more notable being the Great Cypress Swamp.

Analysis of Forest Blocks at Fork Branch Nature Preserve

One forest block is present that are more than 100 acres in size and are located in whole or part in the Nature Preserve (Table 2.4). All forest blocks are bounded by a road, agricultural field, or other non-forested habitat. These areas are considered to be barriers to the passage of forest dwelling wildlife. A description is provided for the forest block.

⁵ Ontario Landowner Resource Centre. 2000. Conserving the Forest Interior: A threatened wildlife habitat. Ontario Ministry of Natural Resources.

Table 2.4. Forest Blocks located in whole or part in Fork Branch Nature Preserve

Forest Block Map	Block Name/Acreage	Description
	Fork Branch A Current Block = 268 acres (118 acres interior) Potential Block = 541 acres (211 acres interior)	Fork Branch A encompasses nearly all of the wooded area in the Fork Branch Nature Preserve. It is bounded by Kenton Road on the west, agricultural field and West Denneys Road on the north, DE Route 15 on the east and developed area on the south. Eight vegetation communities are located within this block and include Chesapeake Bay Non-riverine Wet Hardwood Forest, Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp, Loblolly Pine Plantation, Mid-Atlantic Mesic Mixed Hardwood Forest, Successional Sweetgum Forest, and Virginia Pine Successional Forest. The St. Jones River drains this block via Fork Branch. Currently this block contains 118 acres of interior habitat. Potentially this block could be 541 acres in size, and contain 211 acres of interior habitat.

CHAPTER 3: BROAD TRENDS AT FORK BRANCH NATURE PRESERVE

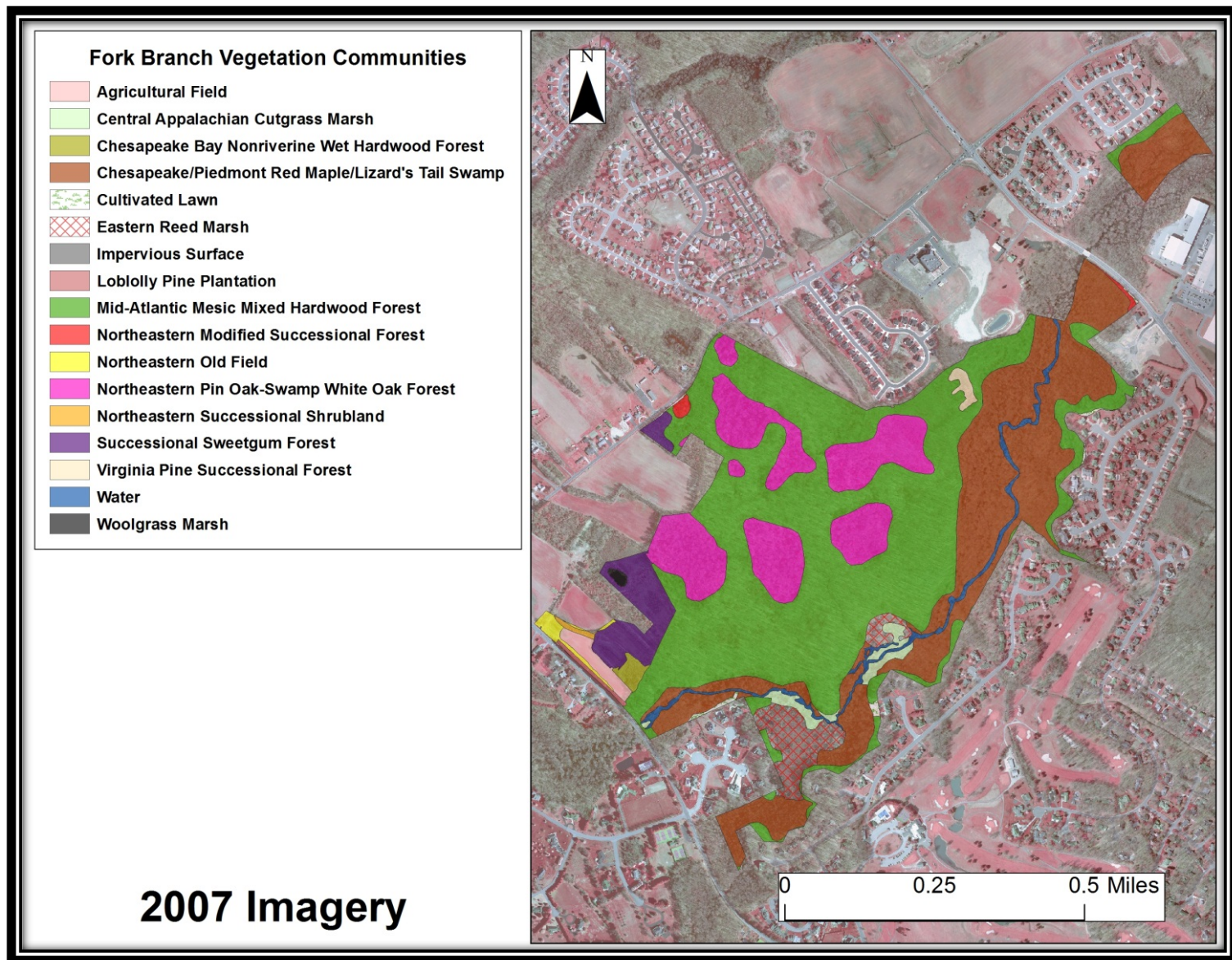


Figure 3.1. 2007 Vegetation Community map of Fork Branch Nature Preserve

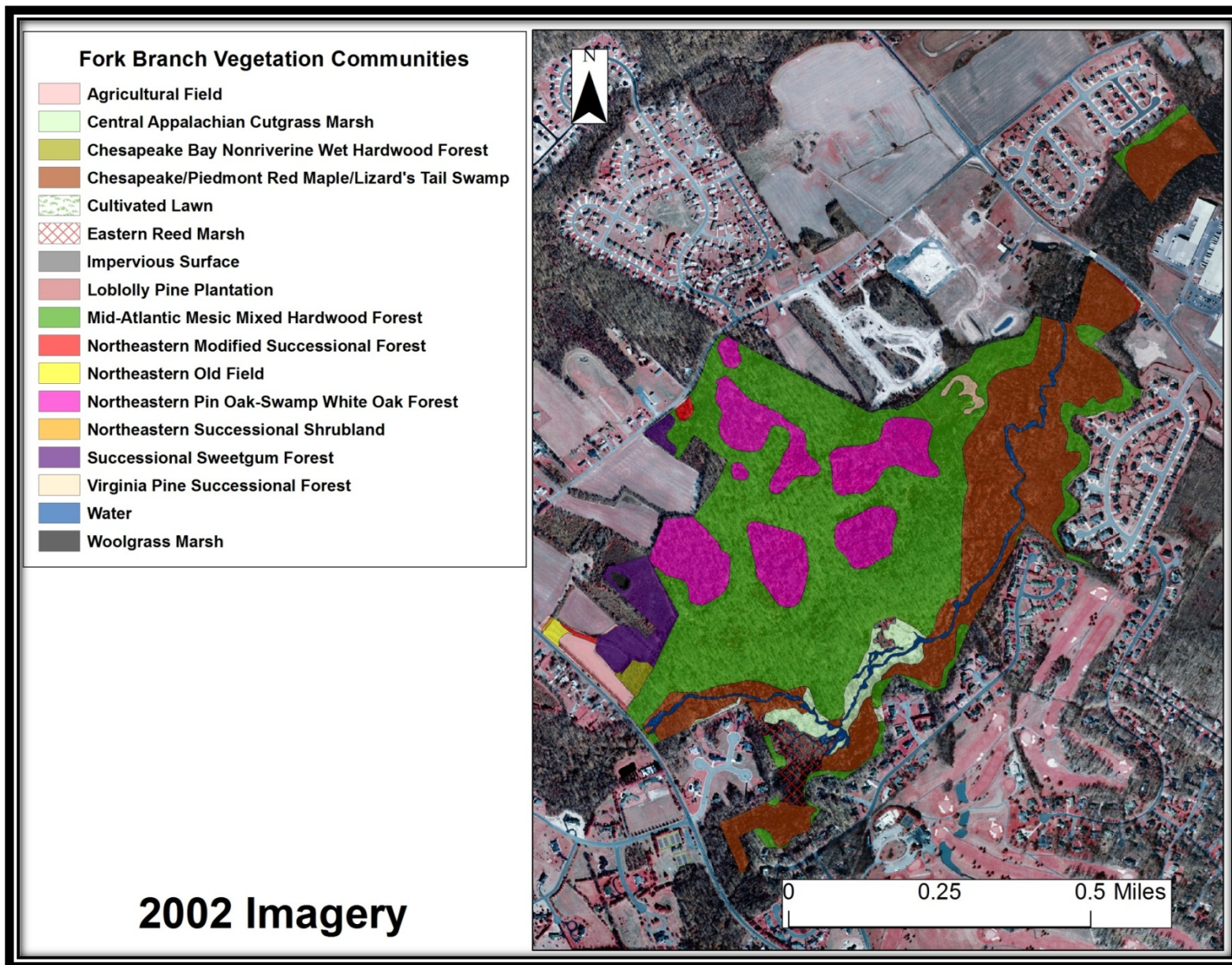


Figure 3.2. 2002 Vegetation Community map of Fork Branch Nature Preserve

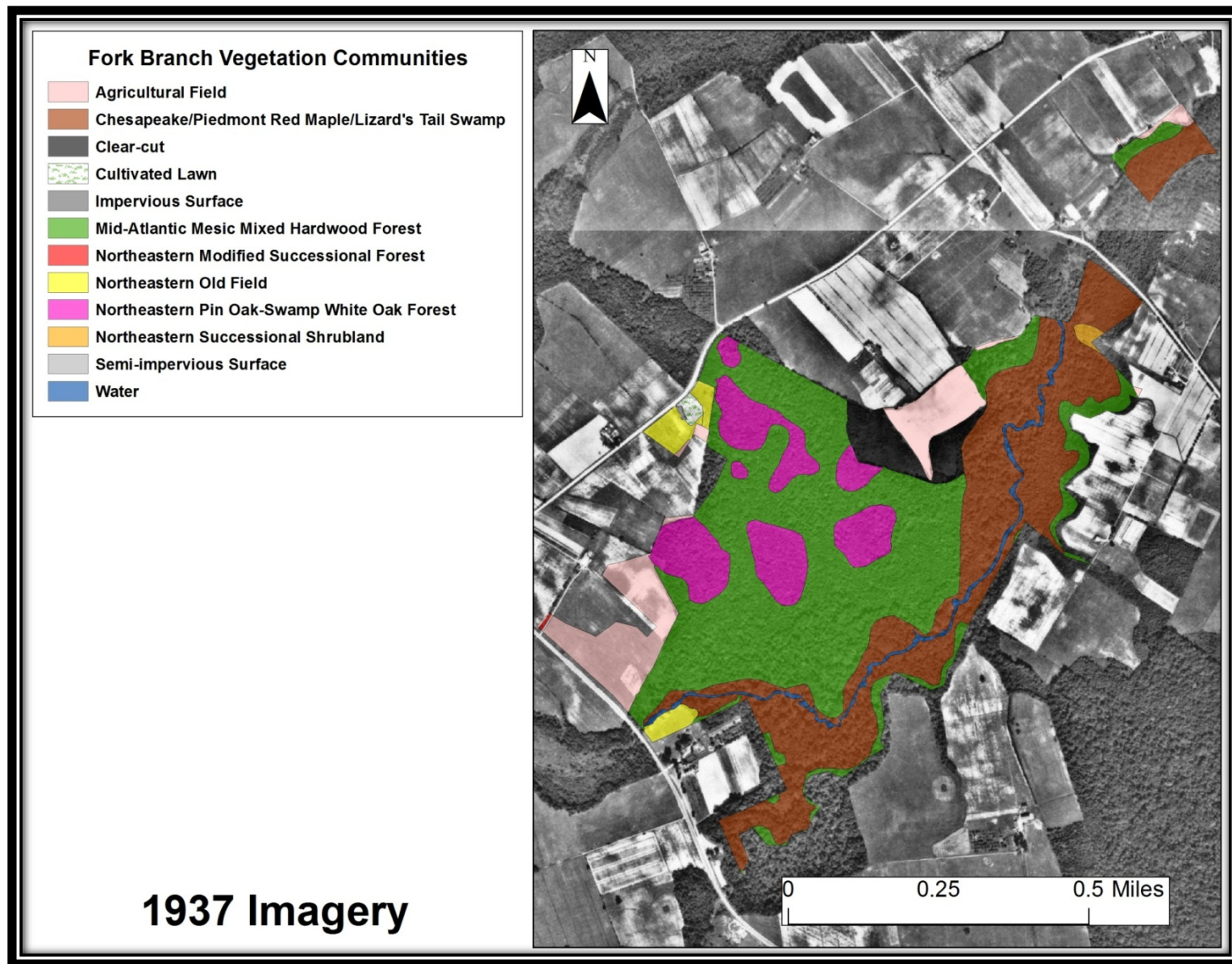


Figure 3.3. 1937 Vegetation Community map of Fork Branch Nature Preserve

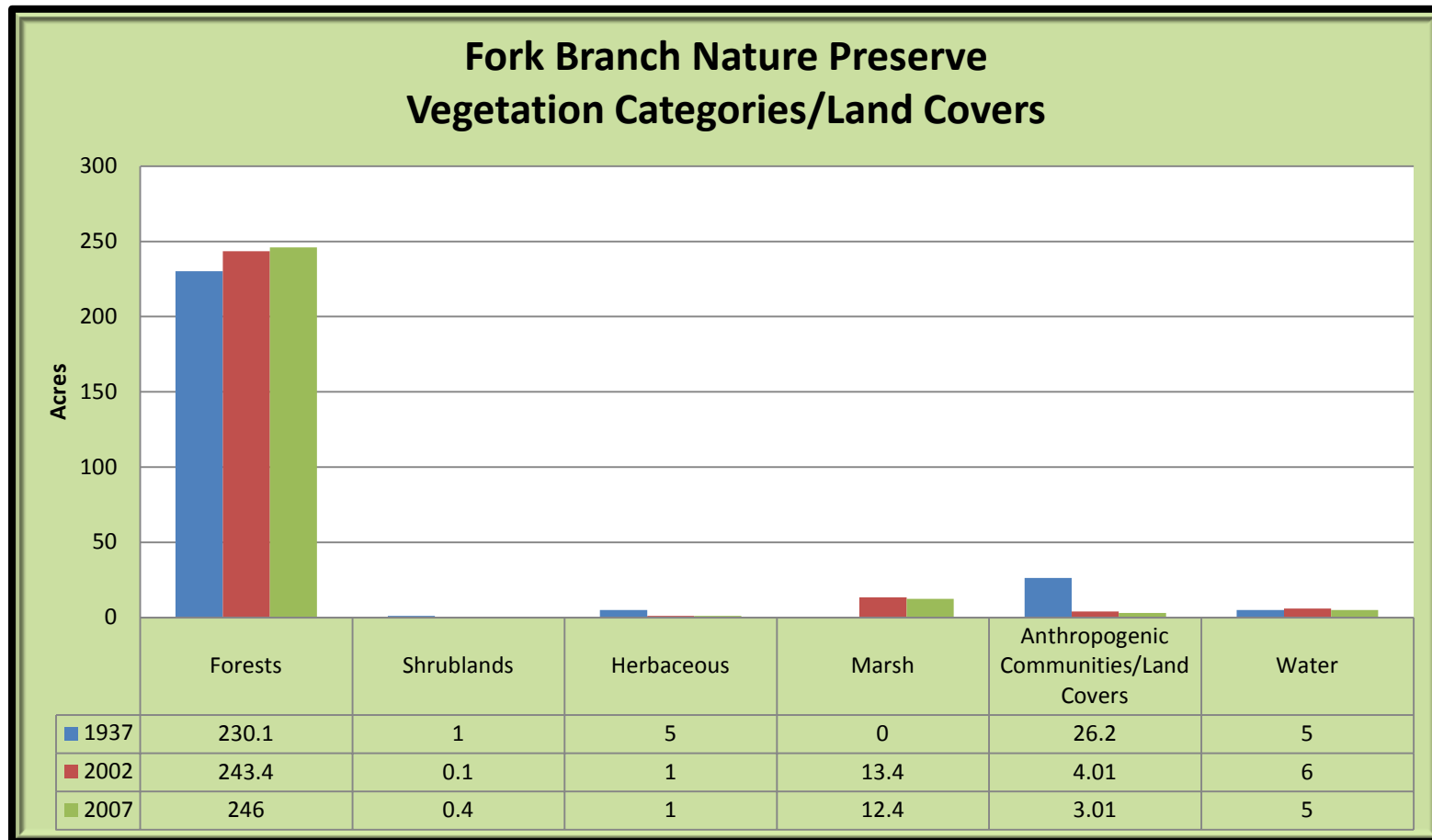


Figure 3.4. Fork Branch Nature Preserve Vegetation Categories/Land Covers (1937, 2002, and 2007)

Fork Branch Nature Preserve Broad Trends (Figure 3.4): Fork Branch Nature Preserve contains 246 acres of forest making a significant forested area in the Dover area. Marshland on Fork Branch covers a little more than 12 acres making it a distant second.

Natural Capital (Table 3.1)

Natural capital in Fork Branch Nature Preserve has gradually increased as former fields mature into forest.

Table 3.1. Natural Capital of Fork Branch Nature Preserve	
Year	Natural Capital (in 2012 dollars)
1937	\$1,440,067/year
2002	\$1,485,406/year
2007	\$1,507,764/year

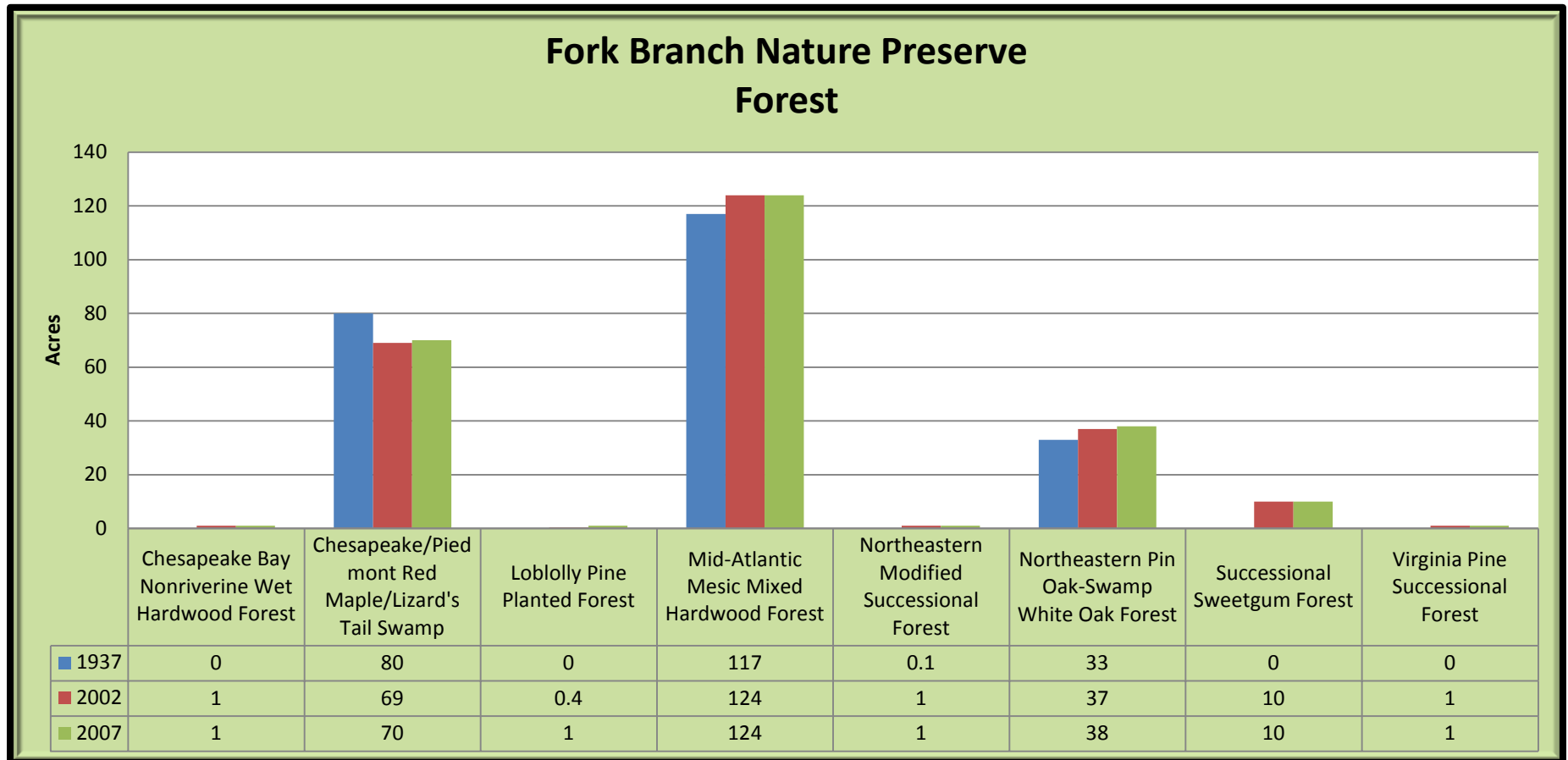


Figure 3.5. Forest at Fork Branch Nature Preserve (1937, 2002, and 2007)

Fork Branch Nature Preserve Forest (Figure 3.5): Mid-Atlantic Mesic Mixed Hardwood Forest is has been and is the largest forested community at Fork Branch Nature Preserve. Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp covers most of the floodplain of Fork Branch and has decreased in size since 1937 from conversion to Central Appalachian Cutgrass Marsh. Northeastern Pin Oak-Swamp White Oak Forest is present in the depressions on the site. Virginia Pine Successional Forest is located in a former sand excavation site.

Natural Capital (Table 3.2)

Natural capital of forest has decreased overall since 1937 but has increased slightly in the recent period.

Table 3.2. Natural Capital of Fork Branch Nature Preserve Forest	
Year	Natural Capital (in 2012 dollars)
1937	\$1,411,083/year
2002	\$1,328,692/year
2007	\$1,365,680/year

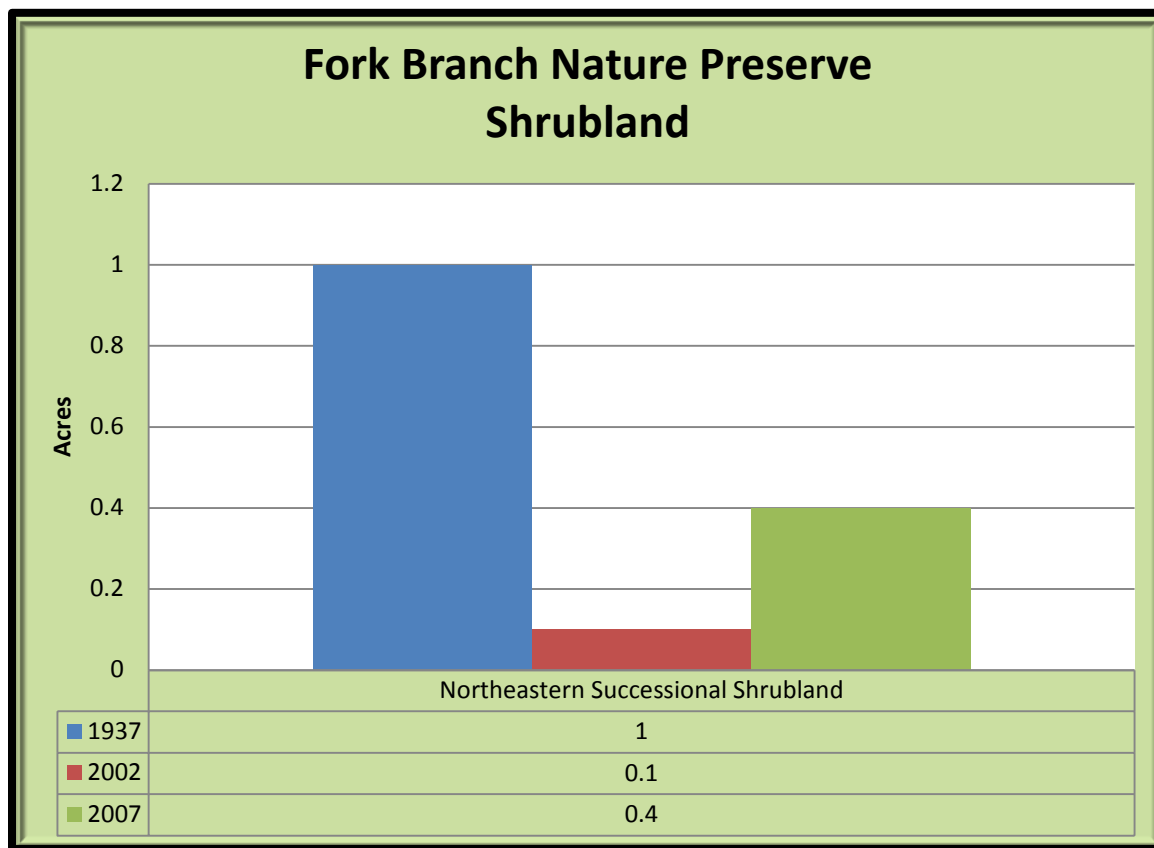


Figure 3.6. Shrubland at Fork Branch Nature Preserve (1937, 2002, and 2007)

Fork Branch Nature Preserve Shrubland (Figure 3.6): Northeastern Successional Shrubland is the only shrubland present at Fork Branch Nature Preserve.

Natural Capital (Table 3.3)

Shrubland capital has decreased as the shrublands mature into forest.

Table 3.3. Natural Capital of Fork Branch Nature Preserve Shrubland	
Year	Natural Capital (in 2012 dollars)
1937	\$146/year
2002	\$146/year
2007	\$58/year

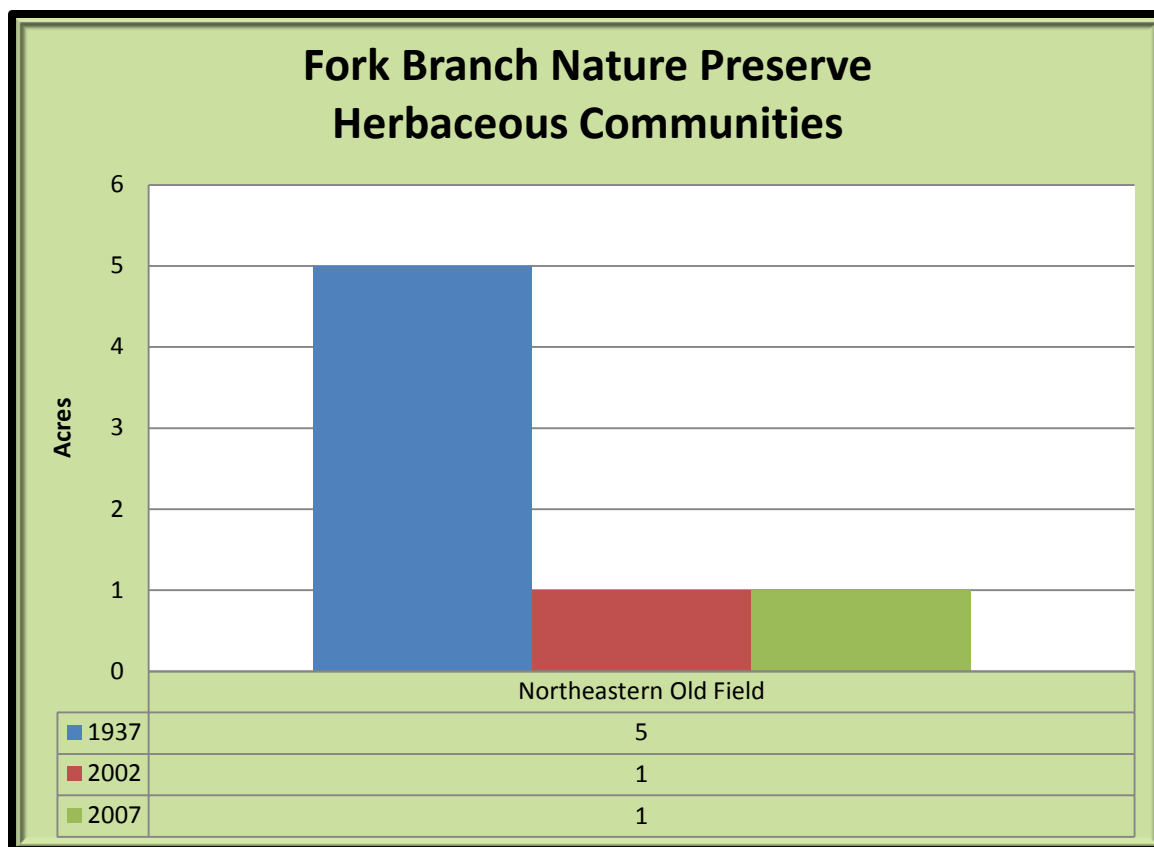


Figure 3.7. Herbaceous Communities at Fork Branch Nature Preserve (1937, 2002, and 2007)

Fork Branch Nature Preserve Herbaceous Communities (Figure 3.7): Northeastern Old Field is the only herbaceous community located at Fork Branch Nature Preserve.

Natural Capital (Table 3.4)

Herbaceous communities have decreased as these communities mature into shrubland and forest.

Table 3.4. Natural Capital of Fork Branch Nature Preserve Herbaceous Communities	
Year	Natural Capital (in 2012 dollars)
1937	\$729/year
2002	\$146/year
2007	\$146/year

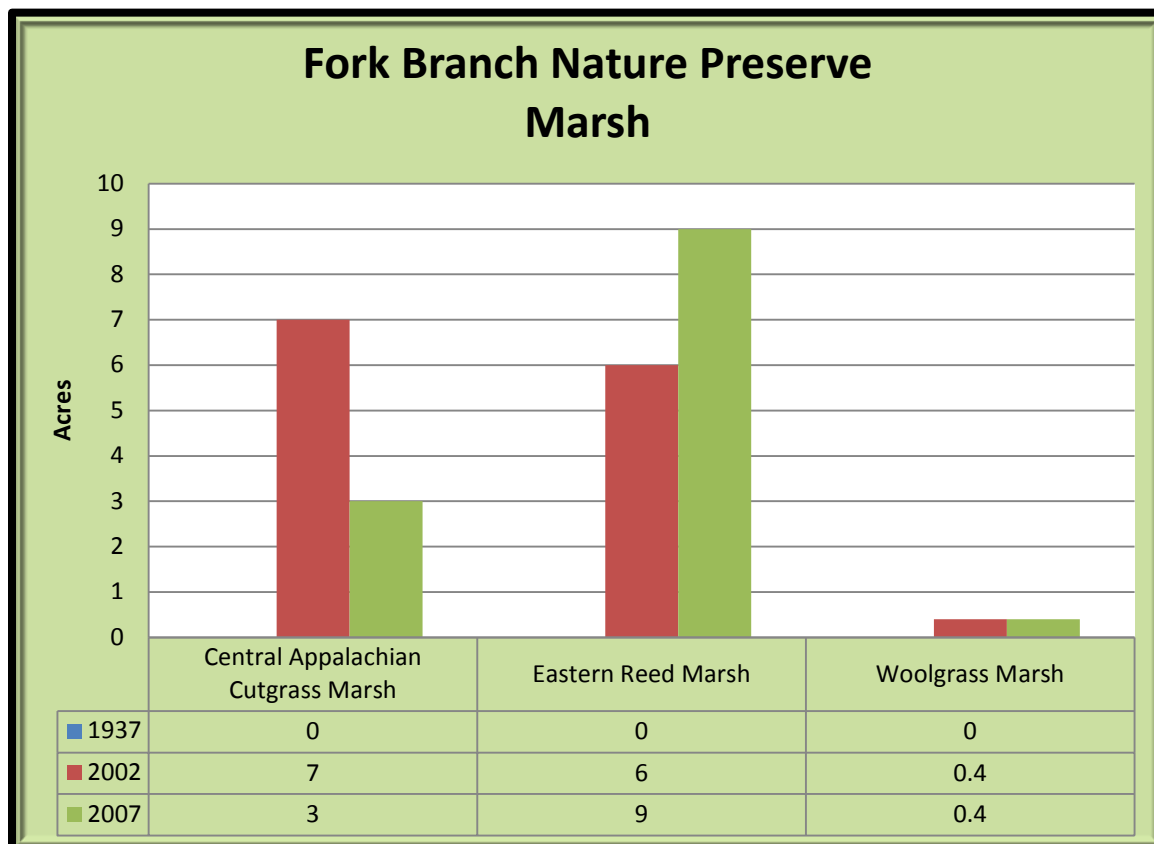


Figure 3.8. Marsh at Fork Branch Nature Preserve (1937, 2002, and 2007)

Fork Branch Nature Preserve Marsh (Figure 3.8): In 1937 there were no marshlands present at Fork Branch Nature Preserve. By 2002 Central Appalachian Cutgrass had populated part of the Fork Branch Floodplain in an area that was likely an old beaver impoundment along with Eastern Reed Marsh. In 2007 Eastern Reed Marsh had taken some of the area of Central Appalachian Cutgrass Marsh. Woolgrass Marsh populates a farm pond near an agricultural field.

Natural Capital (Table 3.5)

Marsh was not present in 1937 and has since populated part of the floodplain of Fork Branch. The amount of marsh has decreased slightly in the recent period.

Table 3.5. Natural Capital of Fork Branch Nature Preserve Marsh	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year (not present)
2002	\$124,371/year
2007	\$115,089/year

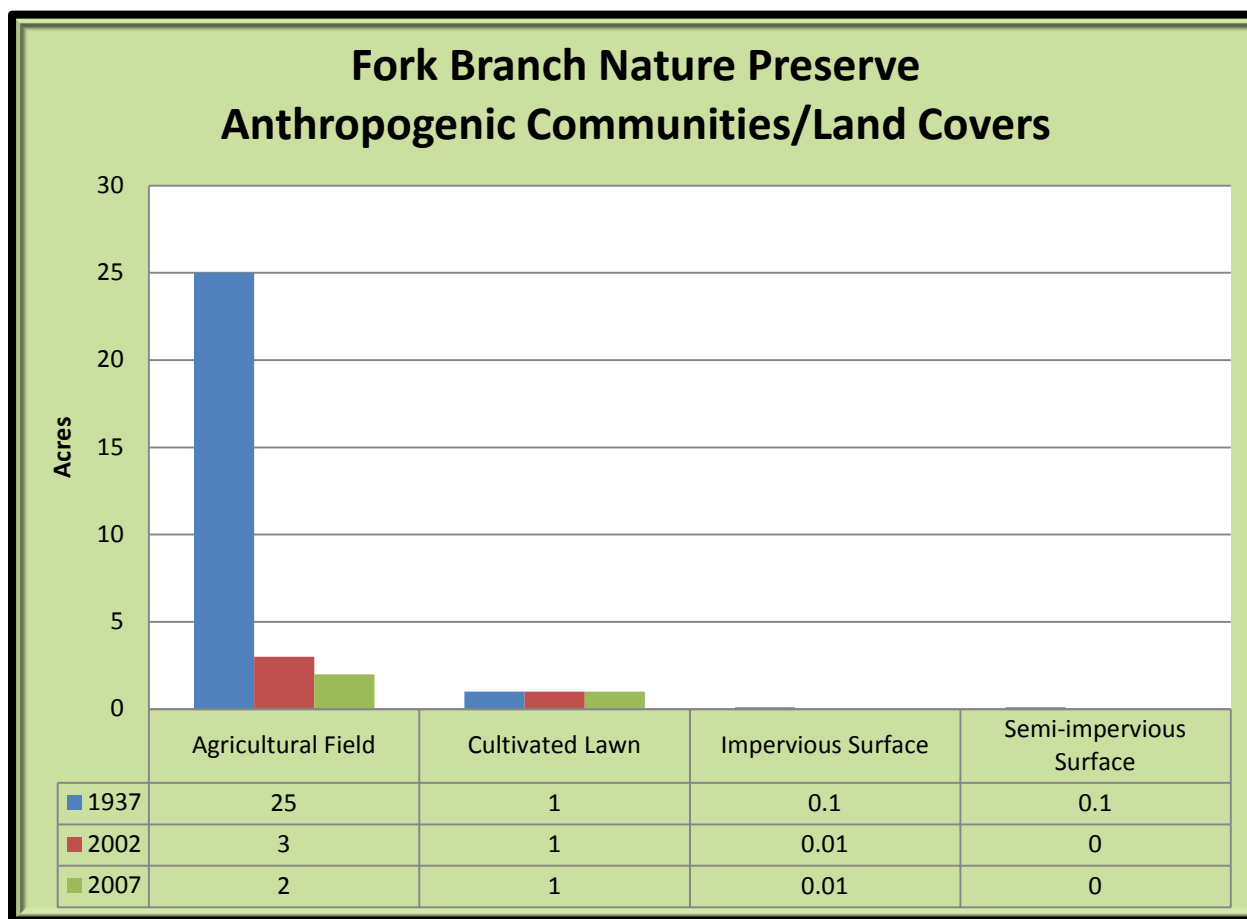


Figure 3.9. Anthropogenic Communities at Fork Branch Nature Preserve (1937, 2002, and 2007)

Fork Branch Nature Preserve Anthropogenic Communities/Land Covers (Figure 3.9):

Agricultural field was once larger in the preserve and has since succeeded to forested area or Northeastern Old Field. Cultivated Lawn has maintained the same amount since 1937.

Natural Capital (Table 3.6)

Capital of agricultural field (the only anthropogenic community/land cover with capital) has decreased as these fields are abandoned and convert to successional communities.

Table 3.6. Natural Capital of Fork Branch Nature Preserve Anthropogenic Communities/Land Covers	
Year	Natural Capital (in 2012 dollars)
1937	\$1,433/year
2002	\$172/year
2007	\$115/year

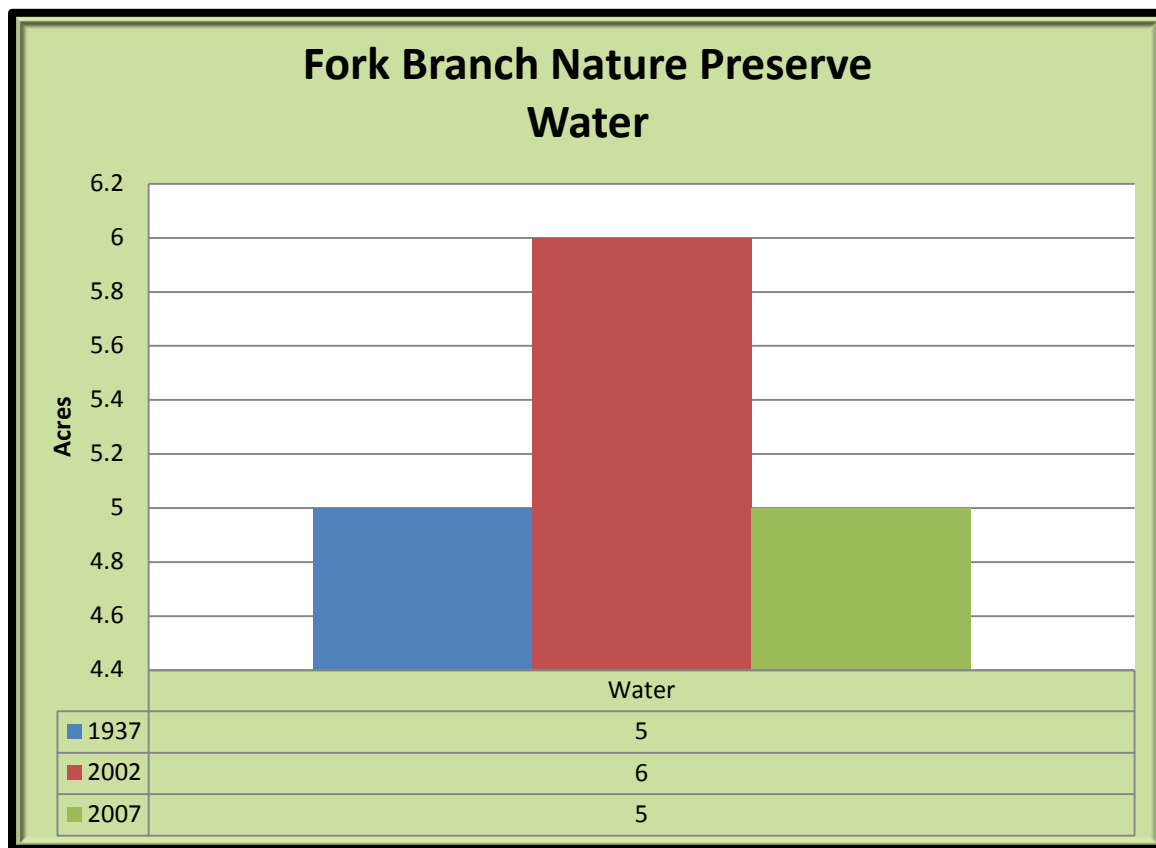


Figure 3.10. Water coverage at Fork Branch Nature Preserve (1937, 2002, and 2007)

Fork Branch Nature Preserve Water (Figure 3.10): The area covered in water has roughly remained the same depending on coverage by vegetation. The preserve area is not tidal and relies on the flow of Fork Branch and groundwater for hydrology. Sea level rise is not projected to affect Fork Branch Nature Preserve in the long term.

Natural Capital (Table 3.5)

The amount of water present has generally been stable with a slight one acre oscillation.

Table 3.5. Natural Capital of Fork Branch Nature Preserve Water	
Year	Natural Capital (in 2012 dollars)
1937	\$26,676/year
2002	\$32,011/year
2007	\$26,676/year

CHAPTER 4: DESCRIPTIONS AND ANALYSIS OF THE VEGETATION COMMUNITIES

Fourteen vegetation communities and three land covers were noted in the survey. Below are the descriptions of the vegetation communities. The National Vegetation Classification (NVC) Association number is given with the vegetation community and their approximate acreage in the project area. Names of communities correspond with the common names as given in the NVC and the Guide to Delaware Vegetation Communities.

The vegetation communities include:

1. Central Appalachian Cutgrass Marsh (CEGL006461)—3 acres
2. Chesapeake Bay Non-riverine Wet Hardwood Forest (CEGL004644)—1 acre
3. Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp (CEGL006606)—70 acres
4. Cultivated Lawn (CEGL008462)—1 acre
5. Eastern Reed Marsh (CEGL004141)—9 acres
6. Loblolly Pine Plantation (CEGL007179)—1 acre
7. Mid-Atlantic Mesic Mixed Hardwood Forest (CEGL006075)—124 acres
8. Northeastern Modified Successional Forest (CEGL006599)—1 acre
9. Northeastern Old Field (CEGL006107)—1 acre
10. Northeastern Pin Oak-Swamp White Oak Forest (CEGL006240)—38 acres
11. Northeastern Successional Shrubland (CEGL006451)—0.4 acres
12. Successional Sweetgum Forest (CEGL007216)—10 acres
13. Virginia Pine Successional Forest (CEGL002591)—1 acre
14. Woolgrass Marsh (CEGL006349)—0.4 acres

Central Appalachian Cutgrass Marsh [3 acres (Figures 4.1-4.2, Tables 4.1-4.2)] GNA S1

**DEWAP: Streamside Herbaceous Wetlands
NHC: Central Appalachian Stream and Riparian**

Description



Figure 4.1. Central Appalachian Cutgrass Marsh

Central Appalachian Cutgrass Marsh is generally found in the Piedmont of Delaware, but there are a few sites in the Coastal Plain within the St. Jones River watershed and this is one. Rice cutgrass (*Leersia oryzoides*) dominates the herbaceous layer with a few red maple (*Acer rubrum*) and buttonbush (*Cephalanthus occidentalis*) overtopping. Other associates in the herbaceous layer include arrow-arum (*Peltandra virginica*), wood reed (*Cinna arundinacea*), climbing hempweed (*Mikania scandens*), false nettle (*Boehmeria cylindrica*), and arrow-leaf

Analysis of Condition at Fork Branch Nature Preserve

This community has come about since 1937 in the preserve and appears to be declining due to invasion of common reed (*Phragmites australis*) in the recent period (2002-2007). This community has converted 3 acres of Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp and 0.1 acres of Northeastern Old Field since 1937 (Table 4.1).

Table 4.1. Central Appalachian Cutgrass Marsh has migrated into X or remained since 1937	
X	Acreage
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	3 acres
Northeastern Old Field	0.1 acres

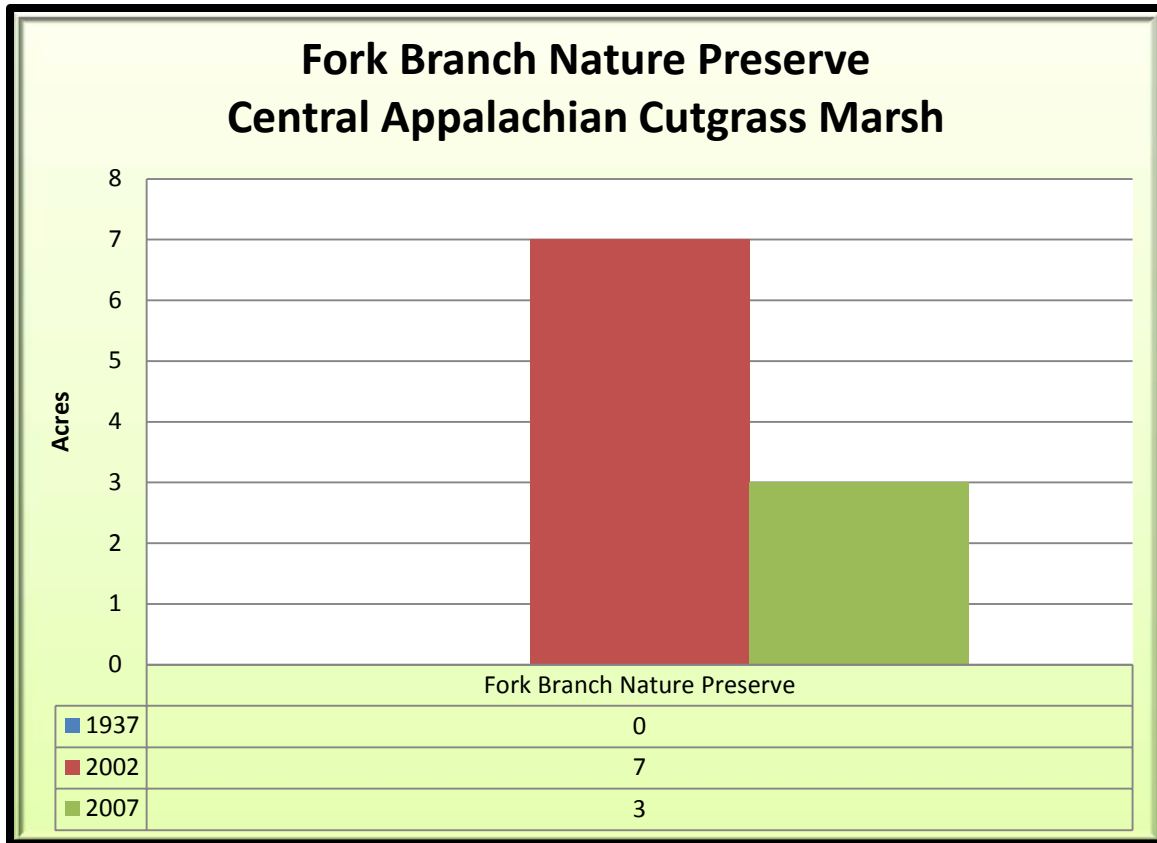


Figure 4.2. Central Appalachian Cutgrass Marsh at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.2)

This community was not present in 1937 and therefore there is no value. This community reached its highest capital in 2002 and has since declined due to invasion by Eastern Reed Marsh.

Table 4.2. Natural Capital of Central Appalachian Cutgrass Marsh	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year
2002	\$64,967/year
2007	\$27,843/year

Chesapeake Bay Non-riverine Wet Hardwood Forest [1 acre (Figure 4.3, Tables 4.3-4.4)]
G2? S2

DEWAP: Isolated Forested Wetlands

NHC: Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest

Description

A small area of Chesapeake Bay Non-riverine Wet Hardwood Forest occurs near Kenton Road. The canopy is composed of red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), willow oak (*Quercus phellos*), and river birch (*Betula nigra*). The understory includes smaller members of the canopy plus American holly (*Ilex opaca*) and American hornbeam (*Carpinus caroliniana*). The shrub and vine layer is composed scattered individuals of poison ivy (*Toxicodendron radicans*) and arrowwood (*Viburnum dentatum*). Wild onion (*Allium* sp.) was the only herbaceous species noted.

This forest appears to be in late successional to mature condition. Most trees are above 1.0 foot in diameter.

Analysis of Condition at Fork Branch Nature Preserve

This community has come about from old agricultural field since 1937. It currently occupies one acre in a low area and has stayed at the same amount in the recent period (2002-2007). It may possibly increase in size if the adjacent Successional Sweetgum Forest matures into this forest. All of the area that is currently this community arose from an agricultural field (Table 4.3).

Table 4.3. Chesapeake Bay Non-riverine Wet Hardwood Forest has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	1 acre

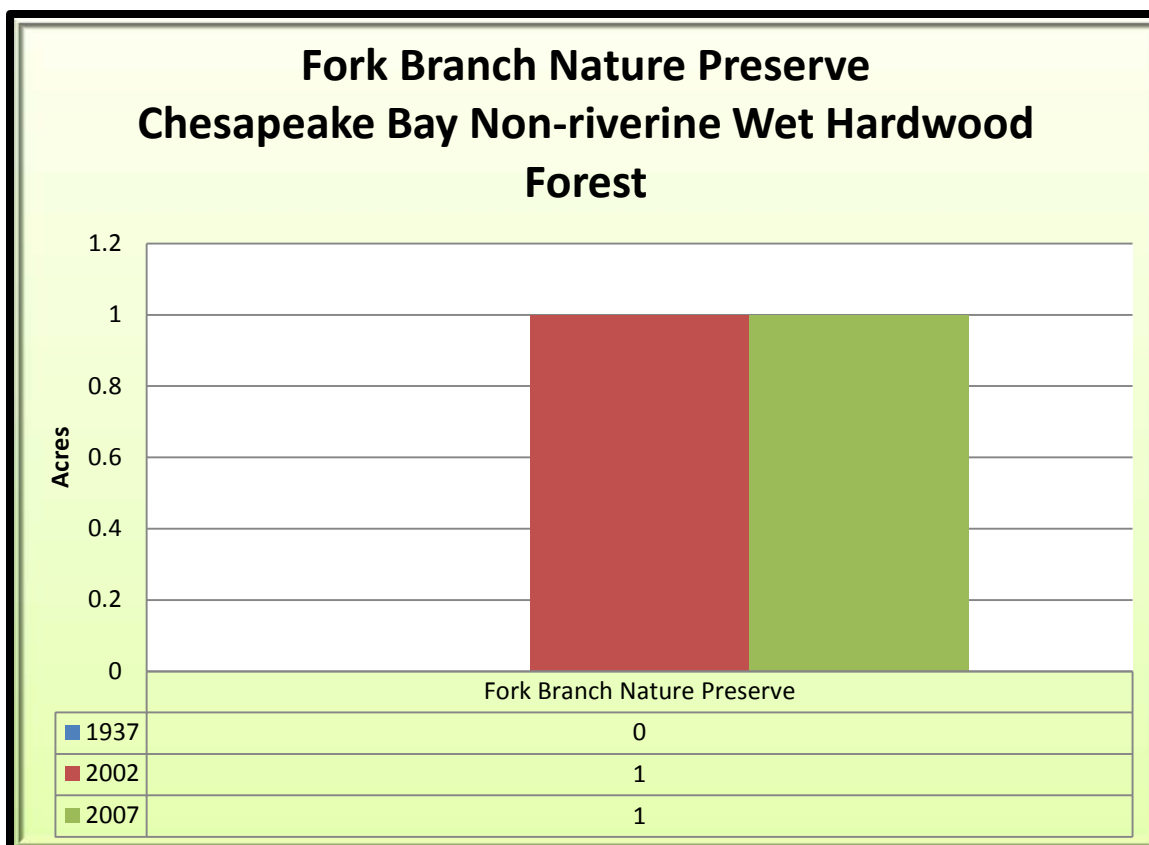


Figure 4.3. Chesapeake Bay Non-riverine Wet Hardwood Forest at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.4)

This community has gained \$189 in value since 1937.

Table 4.4. Natural Capital of Chesapeake Bay Non-riverine Wet Hardwood Forest	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year (not present)
2002	\$189/year
2007	\$189/year

Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp [70 acres (Figure 4.3, Tables 4.5-4.7)]
GNR S3

DEWAP: Forested Floodplains and Riparian Swamps
NHC: Northern Atlantic Coastal Plain Stream and River

Description

Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp is located in the floodplain of Fork Branch, both upstream and downstream of the Central Appalachian Cutgrass Marsh. The example upstream of the marsh is in poor condition and contains many openings. The example downstream is older aged and contains a more mature canopy. Red maple (*Acer rubrum*), green ash (*Fraxinus pensylvanica*), and swamp white oak (*Quercus bicolor*) compose a canopy that overtops sweetgum (*Liquidambar styraciflua*), spicebush (*Lindera benzoin*), American holly (*Ilex opaca*), and a few serviceberry (*Amelanchier arborea*). The shrub and vine layer is composed of common greenbrier (*Smilax rotundifolia*), summer grape (*Vitis aestivalis*), winterberry (*Ilex verticillata*), Japanese honeysuckle (*Lonicera japonica*), and poison ivy (*Toxicodendron radicans*).



Lizard's tail (*Saururus cernuus*) dominates the herbaceous layer and is associated by false nettle (*Boehmeria cylindrica*), wood reed (*Cinna arundinacea*), sensitive fern (*Onoclea sensibilis*), pokeweed (*Phytolacca americana*), common reed (*Phragmites australis*), and arrow-arum (*Peltandra virginica*).

This community is in mature in condition and has been in the preserve since 1937. Layering is good and diameters of trees range from 1.5 feet to 2 feet.

Figure 4.4. Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp

Analysis of Condition at Fork Branch Nature Preserve

This community has lost acreage since 1937 to marsh, but is stable in the recent term (2002-2007). Its prognosis is good for the long term.

In 2007, 67 acres of the original 80 acres from 1937 were still present in the preserve. The rest of the acreage has become 9 acres of Eastern Reed Marsh, 3 acres of Central Appalachian Cutgrass Marsh, 1 acre of Mid-Atlantic Mesic Mixed Hardwood Forest, and 0.4 acres of water (Table 4.5). Since 1937, this community has arisen from 1 acre of Northeastern Old Field and 0.3 acres of Agricultural field, and has converted one acre of Mid-Atlantic Mesic Mixed Hardwood Forest (Table 4.6).

Table 4.5. What was once Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp in 1937 has become X or remained in 2007	
X	Acreage
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	67 acres
Eastern Reed Marsh	9 acres
Central Appalachian Cutgrass Marsh	3 acres
Mid-Atlantic Mesic Mixed Hardwood Forest	1 acre
Water	0.4 acres
Other communities/land covers	0.4 acres

Table 4.6. Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp has migrated into X or remained since 1937	
X	Acreage
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	67 acres
Northeastern Old Field	1 acre
Mid-Atlantic Mesic Mixed Hardwood Forest	1 acre
Agricultural Field	0.3 acres

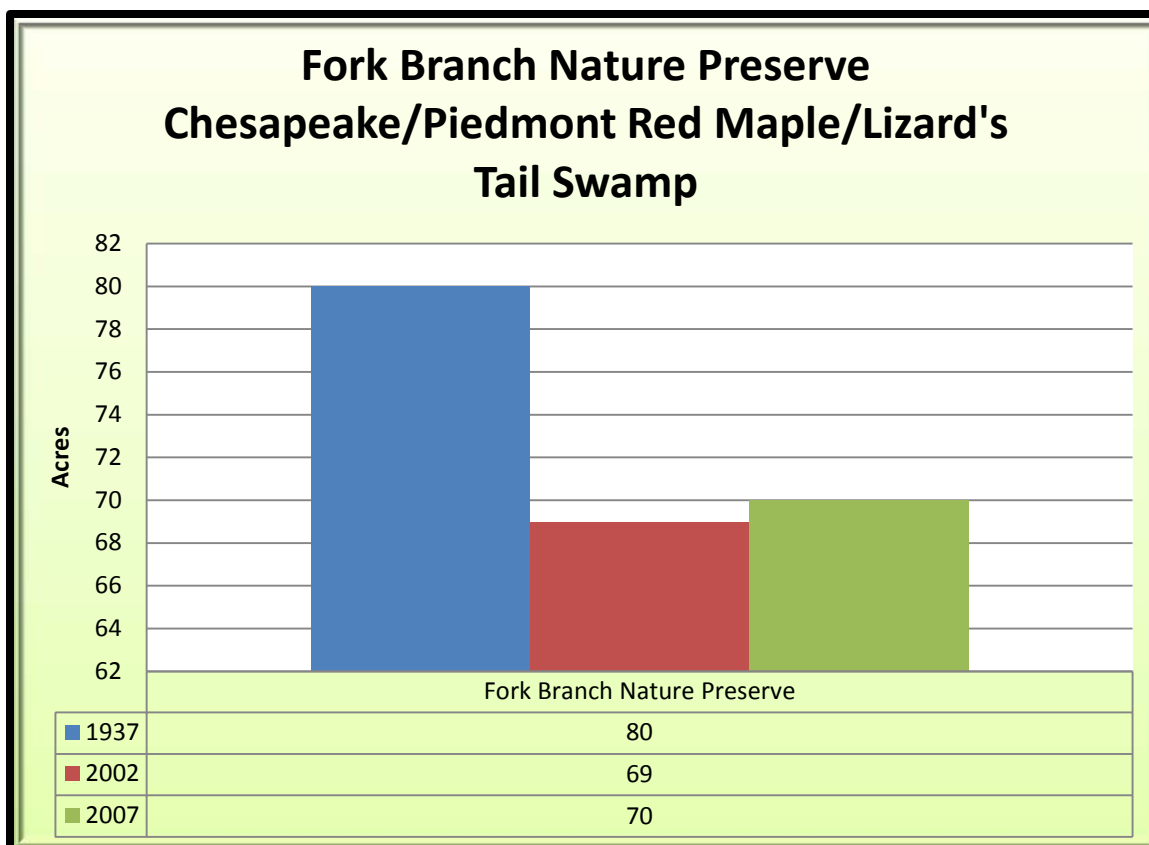


Figure 4.5. Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.7)

Capital of Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp has declined since 1937, but has increased somewhat in the recent period (2002-2007).

Table 4.7. Natural Capital of Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	
Year	Natural Capital (in 2012 dollars)
1937	\$983,320/year
2002	\$848,114/year
2007	\$860,405/year

Cultivated Lawn [1 acre (Figure 4.4, Tables 4.8-4.9)] GNA SNA

**DEWAP: No Equivalent Classification
NHC: Semi-natural/Altered Vegetation and Conifer Plantations**

Description

Cultivated lawn is composed of various ornamental plant species that are often associated with developed areas such as house and roads. Tall fescue (*Festuca arundinacea*) is most commonly planted in lawns and mowed more than once per year.

Analysis of Condition at Fork Branch Nature Preserve

Cultivated lawn has remained at the same amount since 1937 and at least within the preserve is not projected to increase or decrease. However, it has moved around the preserve. In 2007, 0.1 acres of the original 1 acre of cultivated lawn from 1937 was still present. The other acreage has become 0.5 acres of Mid-Atlantic Mesic Mixed Hardwood Forest and 0.3 acres of Northeastern Modified Successional Forest (Table 4.8).

Since 1937, 1 acre of Mid-Atlantic Mesic Mixed Hardwood Forest has been developed into cultivated lawn. In addition 0.1 acres each of agricultural field, Northeastern Old Field, and Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp have been developed into cultivated lawn (Table 4.9).

Table 4.8. What was once Cultivated Lawn in 1937 has become X or remained in 2007	
X	Acreage
Mid-Atlantic Mesic Mixed Hardwood Forest	0.5 acres
Northeastern Modified Successional Forest	0.3 acres
Cultivated Lawn	0.1 acres

Table 4.9. Cultivated Lawn has migrated into X or remained since 1937	
X	Acreage
Mid-Atlantic Mesic Mixed Hardwood Forest	1 acre
Agricultural Field	0.1 acres
Northeastern Old Field	0.1 acres
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	0.1 acres
Cultivated Lawn	0.1 acres

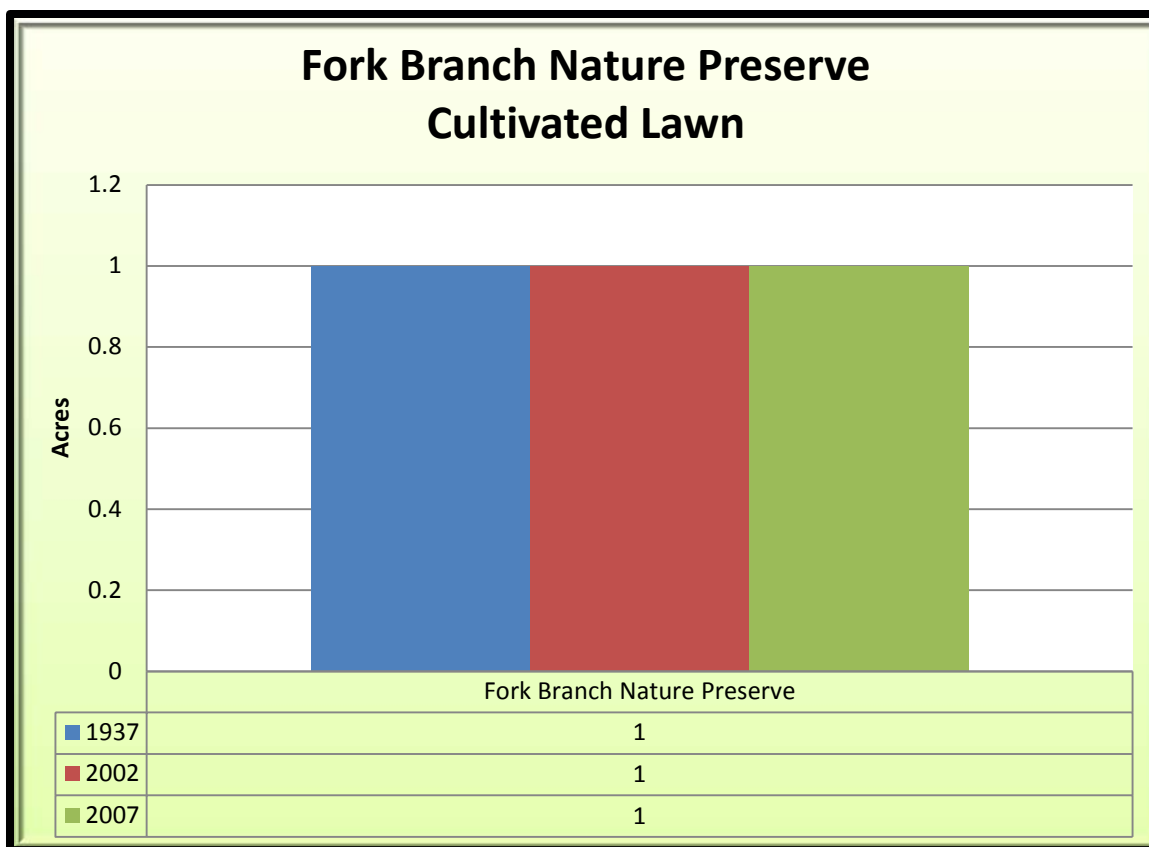


Figure 4.6. Cultivated Lawn at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital

Cultivated lawn does have any natural capital value.

**DEWAP: Streamside Herbaceous Wetlands
NHC: Semi-natural/Altered Vegetation and Conifer Plantations**

Description



Eastern Reed Marsh is dominated by common reed (*Phragmites australis*) nearly entirely in non-tidal wetlands.

Figure 4.7. Eastern Reed Marsh (in background)

Analysis of Condition at Fork Branch Nature Preserve

Eastern Reed Marsh has been increasing since it colonized the wetlands between 1937 and 2002. If not controlled it might continue to increase taking over the Central Appalachian Cutgrass Marsh. While not present in 1937, it has colonized 9 acres of Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp (Table 4.10).

Table 4.10. Eastern Reed Marsh has migrated into X or remained since 1937	
X	Acreage
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	9 acres

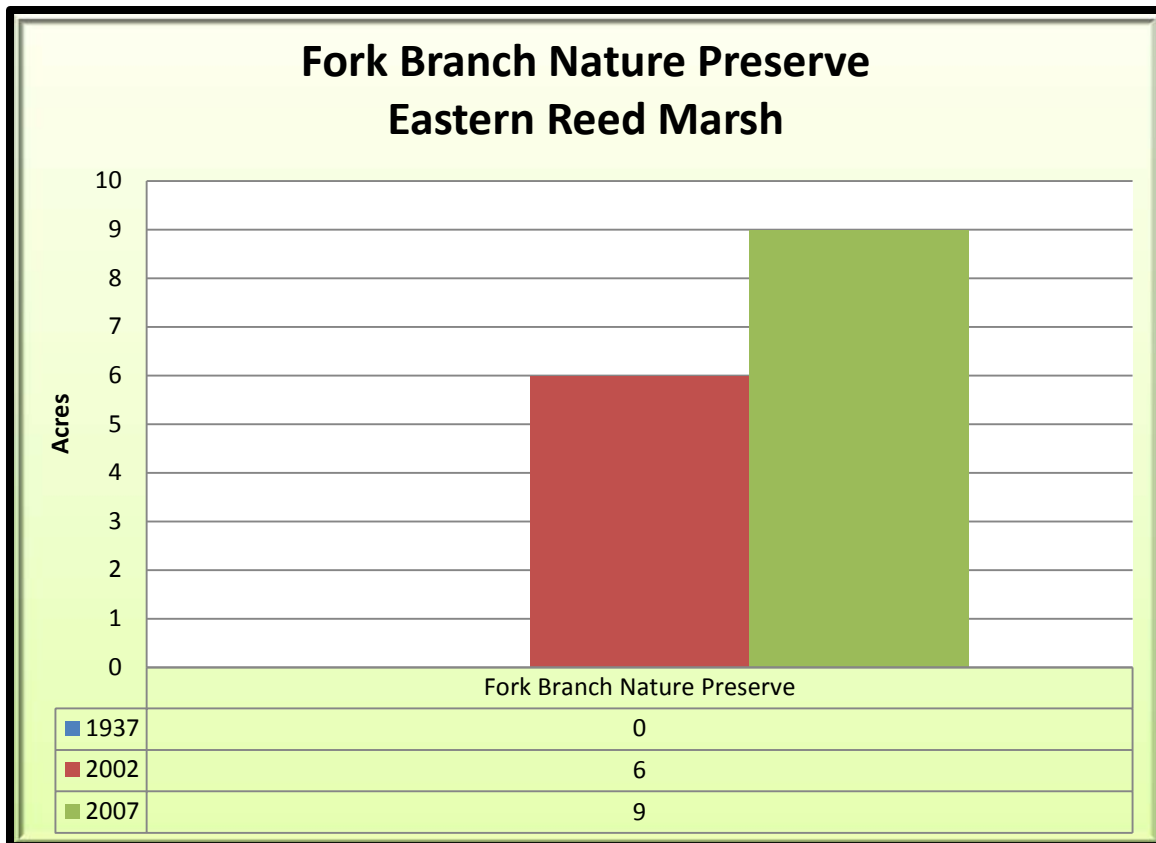


Figure 4.8. Eastern Reed Marsh at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.11)

This community was not present in 1937 and therefore there is no value. By 2002 gained some capital and has increased since.

Table 4.11. Natural Capital of Eastern Reed Marsh	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year (not present)
2002	\$55,688/year
2007	\$83,533/year

Loblolly Pine Plantation [1 acre (Figure 4.9, Tables 4.12-4.13)] GNA SNA

**DEWAP: Coastal Plain Upland Forests
NHC: Semi-natural/Altered Vegetation and Conifer Plantations**

Description

This community is often a stand of loblolly pine (*Pinus taeda*) that is planted for forestry purposes. In this case the pine is more in the theme of a Loblolly Pine Planted Forest which provides a windrow between an old agricultural field and Kenton Road.

Analysis of Condition at Fork Branch Nature Preserve

This community is small in extent in the preserve and the increase observed between 2002 and 2007 is because of the individual trees growing larger. All of the acreage since 1937 has arisen from an agricultural field (Table 4.12).

Table 4.12. Loblolly Pine Plantation has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	1 acre

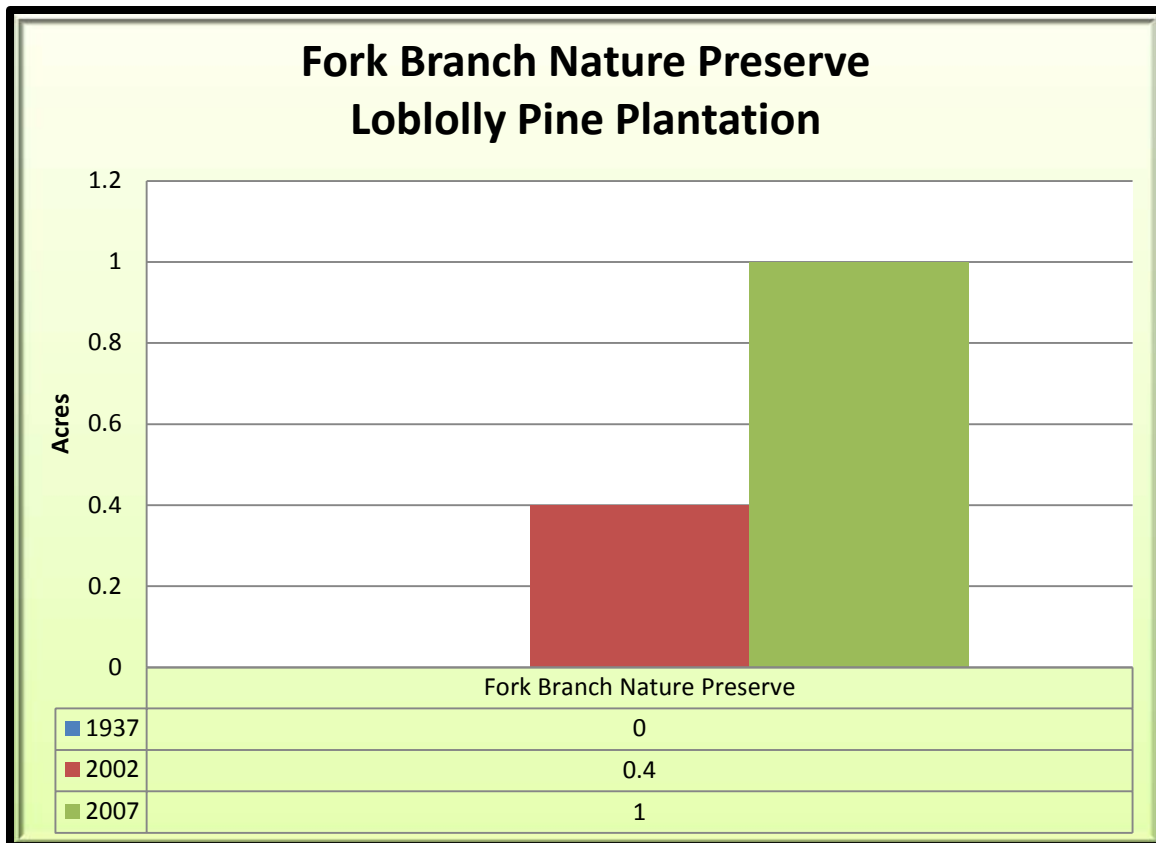


Figure 4.9. Loblolly Pine Plantation at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.13)

Capital of Loblolly Pine Plantation has been going up with an increase in its area.

Table 4.13. Natural Capital of Loblolly Pine Plantation	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year (not present)
2002	\$76/year
2007	\$189/year

Mid-Atlantic Mesic Mixed Hardwood Forest [124 acres (Figures 4.10-4.11, Tables 4.15-4.17)]

G5 S5

DEWAP: Coastal Plain Upland Forest

NHC: Northern Atlantic Coastal Plain Hardwood Forest

Description

Mid-Atlantic Mesic Mixed Hardwood Forest is the most common vegetation community in Fork Branch Nature Preserve and one of the more common communities from about Dover, De and northward. American beech (*Fagus grandifolia*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), mockernut hickory (*Carya alba*), and on bluffs southern red oak (*Quercus falcata*) compose the canopy. The understory includes smaller members of the canopy plus sassafras (*Sassafras albidum*), American holly (*Ilex opaca*), and a few sweet birch (*Betula lenta*). The shrub and vine layer is sparse and composed of common greenbrier (*Smilax rotundifolia*) and strawberry bush (*Euonymus americana*). Common herbs include pinesap (*Monotropa hypopithys*), beech drops (*Epifagus virginiana*), thicket sedge (*Carex abscondita*), putty root

orchid (*Aplectrum hyemale*), New York Fern (*Thelypteris novaboracensis*), and false solomon's seal (*Maianthemum racemosum*).



The examples of this community are in mature condition and are some of the best in the Coastal Plain of Delaware. Diameters of trees range from 1.5 feet up to 3 feet. Separation from canopy, understory and shrub layers is very good and with good definition.

Figure 4.10. Mid-Atlantic Mesic Mixed Hardwood Forest

Analysis of Condition at Fork Branch Nature Preserve

This community has been present in the preserve since 1937 and has increased since. It is projected to remain in the long term period. In 2007, 108 acres of the original 117 acres from 1937 still existed. The rest of the acreage has converted to 1 acre of Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp, 1 acre of Northeastern Pin Oak-Swamp White Oak Forest, and 1 acre of cultivated lawn (Table 4.15). Since 1937, Mid-Atlantic Mesic Mixed Hardwood Forest has arisen from 6 acres each of agricultural field and clear-cut, 2 acres of Northeastern Old Field, and 1 acre of Northeastern Successional Shrubland Table 4.16).

Table 4.14. What was once Mid-Atlantic Mesic Mixed Hardwood Forest in 1937 has become X or remained in 2007	
X	Acreage
Mid-Atlantic Mesic Mixed Hardwood Forest	108 acres
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	1 acre
Northeastern Pin Oak-Swamp White Oak Forest	1 acre
Cultivated Lawn	1 acre

Table 4.15. Mid-Atlantic Mesic Mixed Hardwood Forest has migrated into X or remained since 1937	
X	Acreage
Mid-Atlantic Mesic Mixed Hardwood Forest	108 acres
Agricultural Field	6 acres
Clear-cut	6 acres
Northeastern Old Field	2 acres
Northeastern Successional Shrubland	1 acre
Other communities/land covers	1 acre

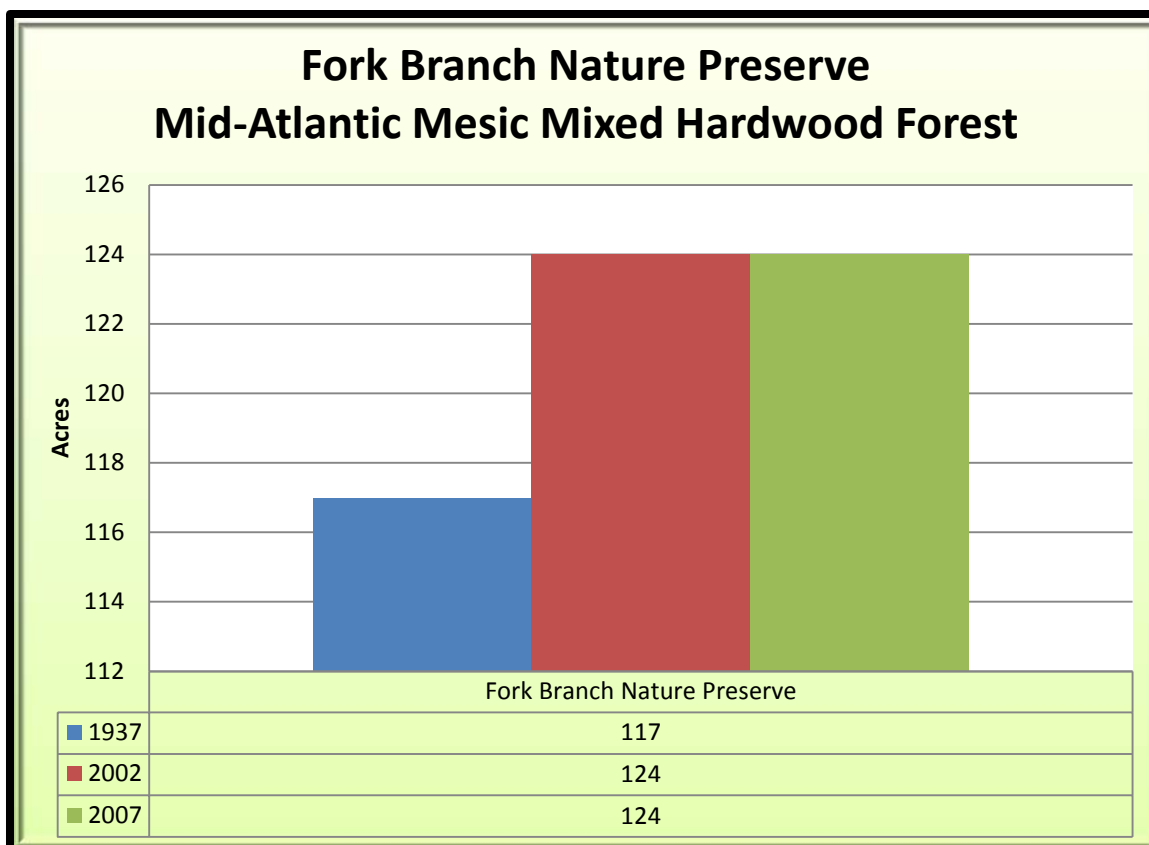


Figure 4.11. Mid-Atlantic Mesic Mixed Hardwood Forest at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.16)

Capital of Mid-Atlantic Mesic Mixed Hardwood Forest has gone up slightly since 1937 and has been stable in the recent period (2002-2007).

Table 4.16. Natural Capital of Mid-Atlantic Mesic Mixed Hardwood Forest	
Year	Natural Capital (in 2012 dollars)
1937	\$22,125/year
2002	\$23,448/year
2007	\$23,448/year

Northeastern Modified Successional Forest [1 acre (Figures 4.12-4.13, Tables 4.17-4.19)]

GNA SNA

DEWAP: Coastal Plain Upland Forest

NHC: Semi-natural/Altered Vegetation and Conifer Plantations

Description

This community is located at the site of an abandoned home site. The understory is thick with exotic invasive plant species and aggressive natives. Common canopy species include wild black cherry (*Prunus serotina*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and a few black locust (*Robinia pseudoacacia*). Understory species include eastern red cedar (*Juniperus virginiana*), white mulberry (*Morus alba*), Norway maple (*Acer plantanoides*), and Hercules club (*Aralia spinosa*). Trumpet creeper (*Campsis radicans*), Japanese honeysuckle (*Lonicera japonica*), arrowwood (*Viburnum dentatum*), blackberry (*Rubus* sp.), summer grape

(*Vitis aestivalis*), and multiflora rose (*Rosa multiflora*) compose the shrub and vine layer. Partridgeberry (*Mitchella repens*), jumpseed (*Polygonum virginianum*), Virginia creeper (*Parthenocissus quinquefolia*), ebony spleenwort (*Asplenium platyneuron*), and pokeweed (*Phytolacca americana*) are among some of the herbs noted.



The example of this community is young to medium age with small canopy trees and a thick understory.

Figure 4.12. Northeastern Modified Successional Forest

Analysis of Condition at Fork Branch Nature Preserve

This community is relict of former home site. It is unknown whether this community will persist, but with management and removal of the exotic invasive plant species, this community may succeed into a Mid-Atlantic Mesic Mixed Hardwood Forest.

Table 4.17. What was once Northeastern Modified Successional Forest in 1937 has become X or remained in 2007	
X	Acreage
Northeastern Old Field	1 acre

Table 4.18. Northeastern Modified Successional Forest has migrated into X or remained since 1937	
X	Acreage
Cultivated Lawn	0.3 acres
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	0.3 acres
Imperious Surface	0.1 acres
Northeastern Old Field	0.1 acres

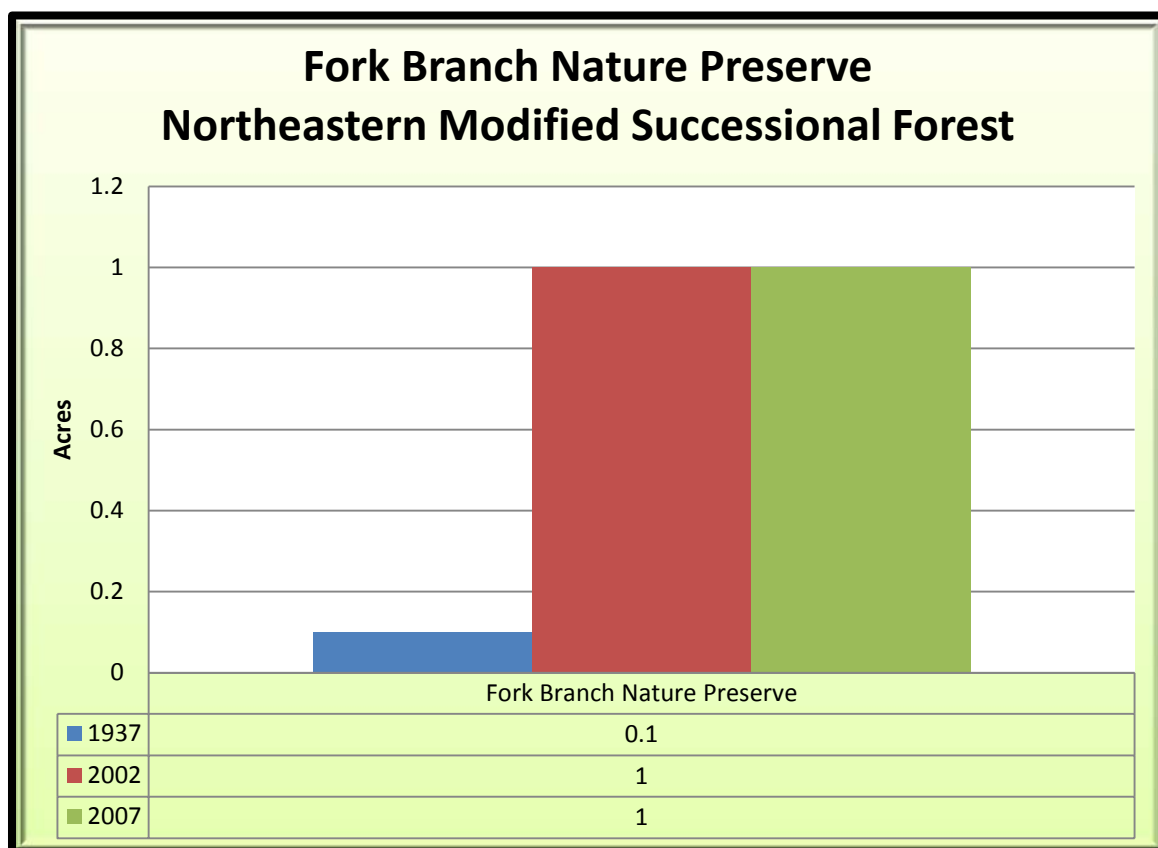


Figure 4.13. Northeastern Modified Successional Forest at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.19)

Northeastern Modified Successional Forest only accounted for \$19.00 of natural capital in 1937 and has since increased to \$189.00.

Table 4.19. Natural Capital of Northeastern Modified Successional Forest	
Year	Natural Capital (in 2012 dollars)
1937	\$19/year
2002	\$189/year
2007	\$189/year

DEWAP: Early Successional Upland Habitats
NHC: Semi-natural/Altered Vegetation and Conifer Plantations

Description

A small area of recently abandoned agricultural field is located at the southwestern end of the preserve. The field contains species typical of a first to second year field with Jimsonweed (*Datura stramonium*), horseweed (*Conyza canadensis*), nightshade (*Solanum nigrum*), morning glory (*Ipomoea* sp.), switchgrass (*Panicum virgatum*), foxtail grass (*Setaria viridis*), amaranth (*Amaranthus* sp.), and blackberry (*Rubus* sp.).

Figure 4.14. Northeastern Old Field

Analysis of Condition at Fork Branch Nature Preserve

Northeastern Old Field has decreased at Fork Branch Nature Preserve as fields have succeeded to forest. The amount of field area is generally dependent on the amount of agricultural field going out of production. None of the Northeastern Old Field from 1937 was still present in 2007. The former fields have become 2 acres of Mid-Atlantic Mesic Mixed Hardwood Forest, 1 acre of Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp, 1 acre of Successional Sweetgum Forest, 0.2 acres of water, and 0.1 acres of Central Appalachian Cutgrass Marsh (Table 4.20).

Since 1937, Northeastern Old Field has developed in 1 acre of agricultural field, 0.1 acres of Northeastern Modified Successional Forest, and 0.1 acres of Semi-impervious Surface (Table 4.21).

Table 4.20. What was once Northeastern Old Field in 1937 has become X or remained in 2007	
X	Acreage
Mid-Atlantic Mesic Mixed Hardwood Forest	2 acres
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	1 acre
Successional Sweetgum Forest	1 acre
Water	0.2 acres
Central Appalachian Cutgrass Marsh	0.1 acres
Other communities/land covers	0.1 acres

Table 4.21. Northeastern Old Field has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	1 acre
Northeastern Modified Successional Forest	0.1 acres
Semi-imperious Surface	0.1 acres

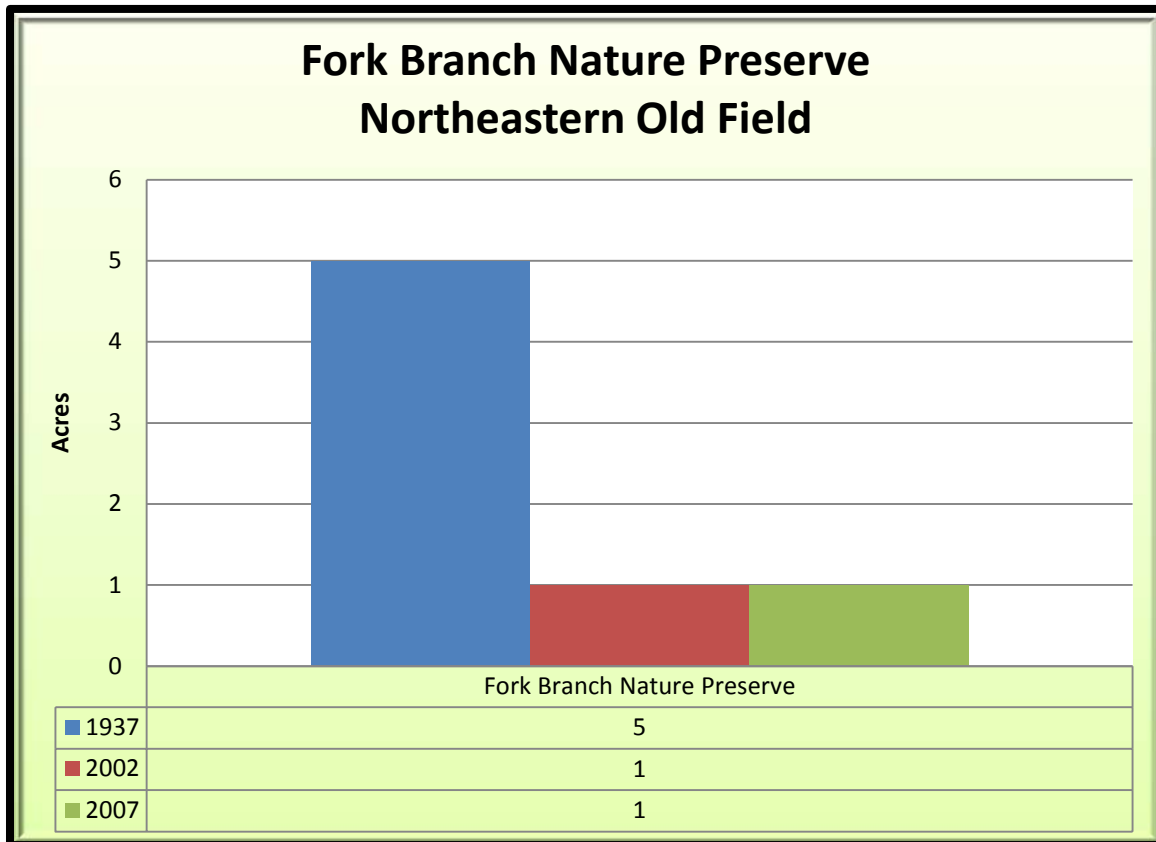


Figure 4.15. Northeastern Old Field at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.22)

Capital of Northeastern Old Field has decreased as this community matures into shrubland and forest.

Table 4.22. Natural Capital of Northeastern Old Field	
Year	Natural Capital (in 2012 dollars)
1937	\$729/year
2002	\$146/year
2007	\$146/year

Northeastern Pin Oak-Swamp White Oak Forest [38 acres (Figure 4.16-4.17, Table 4.23-4.25)]
GNR S1

DEWAP: Isolated Forested Wetlands

NHC: Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest

Description

This swamp forest is situated in Coastal Plain pond-like depressions but often contain at least saturated soils throughout the year. During the late winter to early spring they may have standing water similar to a Coastal Plain Pond. Canopy species in these depressions include swamp white oak (*Quercus bicolor*), swamp chestnut oak (*Quercus michauxii*), pin oak (*Quercus palustris*), black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and willow oak (*Quercus phellos*) which overtop an understory of sweetbay (*Magnolia virginiana*), American holly (*Ilex opaca*), and sassafras (*Sassafras albidum*). The shrub



and vine layer is often thick with sweet pepperbush (*Clethra alnifolia*), common greenbrier (*Smilax rotundifolia*), and highbush blueberry (*Vaccinium corymbosum*). Royal fern (*Osmunda regalis*) was the only herbaceous species noted in this community.

The examples of this community in the Fork Branch Nature Preserve are in mature condition and are some of the best and only occurrences in Kent County. Diameters of trees range from 1.5 feet to 2 feet. Layering is good in these communities.

Figure 4.16. Northeastern Pin Oak-Swamp White Oak Forest

Analysis of Condition at Fork Branch Nature Preserve

This community is located in Coastal Plain pond like depressions. As the forests and hydrology have restored and matured from agricultural uses the amount of this community has increased. This community is projected to remain around the same level for the foreseeable future. Nearly all of the Northeastern Pin Oak-Swamp White Oak Forest present in 1937 was still present in 2007 (Table 4.23). Since 1937, this forest has developed in 3 acres of clear-cut, 2 acres of agricultural field, and 1 acre of Mid-Atlantic Mesic Mixed Hardwood Forest (Table 4.24).

Table 4.23. What was once Northeastern Pin Oak-Swamp White Oak Forest in 1937 has become X or remained in 2007	
X	Acreage
Northeastern Pin Oak-Swamp White Oak Forest	31 acres

Table 4.24. Northeastern Old Field has migrated into X or remained since 1937	
X	Acreage
Northeastern Pin Oak-Swamp White Oak Forest	31 acres
Clear-cut	3 acres
Agricultural Field	2 acres
Mid-Atlantic Mesic Mixed Hardwood Forest	1 acre

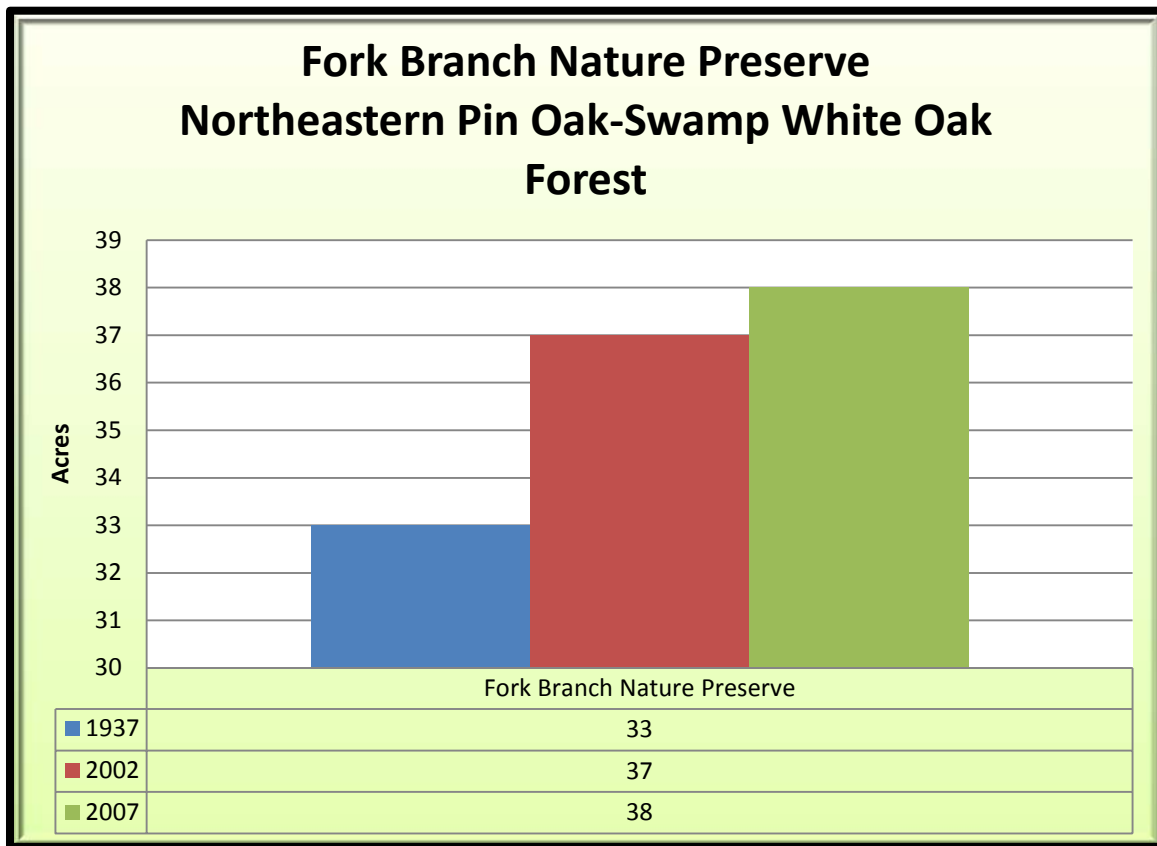


Figure 4.17. Northeastern Pin Oak-Swamp White Oak Forest at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.25)

Capital of Northern Pin Oak-Swamp White Oak Forest has been gradually increasing with gains in acreage.

Table 4.25. Natural Capital of Northeastern Pin Oak-Swamp White Oak Forest	
Year	Natural Capital (in 2012 dollars)
1937	\$405,620/year
2002	\$454,786/year
2007	\$467,077/year

Northeastern Successional Shrubland [0.4 acres (Figure 4.18, Tables 4.26-4.28)]
SNA

GNA

DEWAP: Shrub/Brush Early Successional Upland Habitats
NHC: Semi-natural/Altered Vegetation and Conifer Plantations

Description

This community was determined from aerial imagery interpretation so a species list was not obtained. Often these shrub communities are composed of blackberry (*Rubus* sp.), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), and common greenbrier (*Smilax rotundifolia*).

Analysis of Condition at Fork Branch Nature Preserve

Northeastern Successional Shrubland is an intermediate step in the maturation of Northeastern Old Field to forest. It has gradually declined in the nature preserve as shrublands have matured into forest. All of the Northeastern Successional Shrubland present in 1937 has become Mid-Atlantic Mesic Mixed Hardwood Forest in 2007 (Table 4.26). The acreage present in 2007 has arisen from 0.4 acres of agricultural field (Table 4.27).

Table 4.26. What was once Northeastern Successional Shrubland in 1937 has become X or remained in 2007	
X	Acreage
Mid-Atlantic Mesic Mixed Hardwood Forest	1 acre

Table 4.27. Northeastern Successional Shrubland has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	0.4 acres

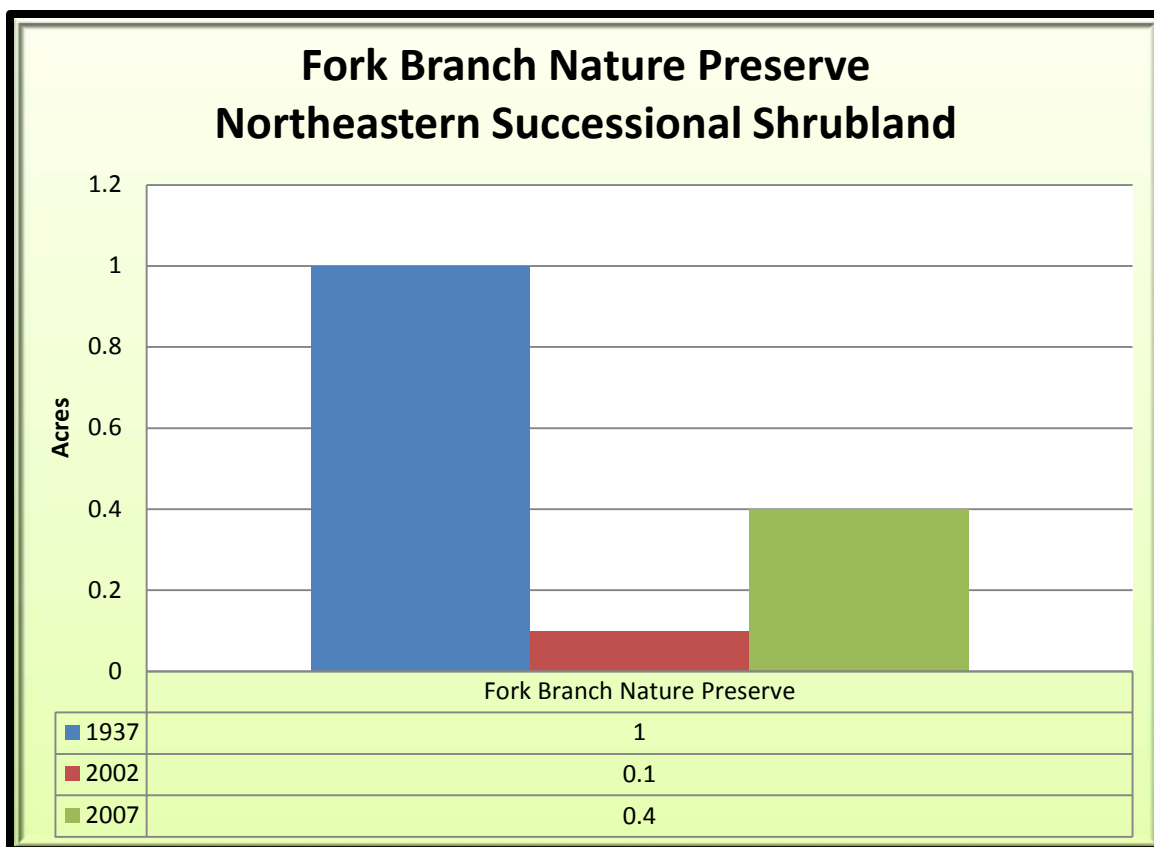


Figure 4.18. Northeastern Successional Shrubland at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.28)

Capital of Northeastern Successional Shrubland decreased to 2002 and has recently rebounded with the abandonment of an agricultural field in the preserve.

Table 4.28. Natural Capital of Northeastern Successional Shrubland	
Year	Natural Capital (in 2012 dollars)
1937	\$150/year
2002	\$15/year
2007	\$60/year

Successional Sweetgum Forest [10 acres (Figures 4.19-4.20, Tables 4.29-4.30)] GNA SNA

DEWAP: Shrub/Brush Early Successional Upland Habitats
NHC: Semi-natural/Altered Vegetation and Conifer Plantations

Description



This young forest is located in two locations. The largest is in the southwest with a smaller area to the north. Sweetgum (*Liquidambar styraciflua*) dominates the young canopy with an occasional tuliptree (*Liriodendron tulipifera*). Understory species include willow oak (*Quercus phellos*), southern red oak (*Quercus falcata*), American holly (*Ilex opaca*), and wild black cherry (*Prunus serotina*). The shrub layer is composed of highbush blueberry (*Vaccinium corymbosum*), Japanese honeysuckle (*Lonicera japonica*),

Figure 4.19. Successional Sweetgum Forest

Analysis of Condition at Fork Branch Nature Preserve

This community has grown from old agricultural field (9 acres) and a Northeastern Old Field (1 acre) since 1937 (Table 4.29). It now covers 10 acres and may in time mature into a Chesapeake Bay Non-riverine Wet Hardwood Forest.

Table 4.29. Successional Sweetgum Forest has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	9 acres
Northeastern Old Field	1 acre

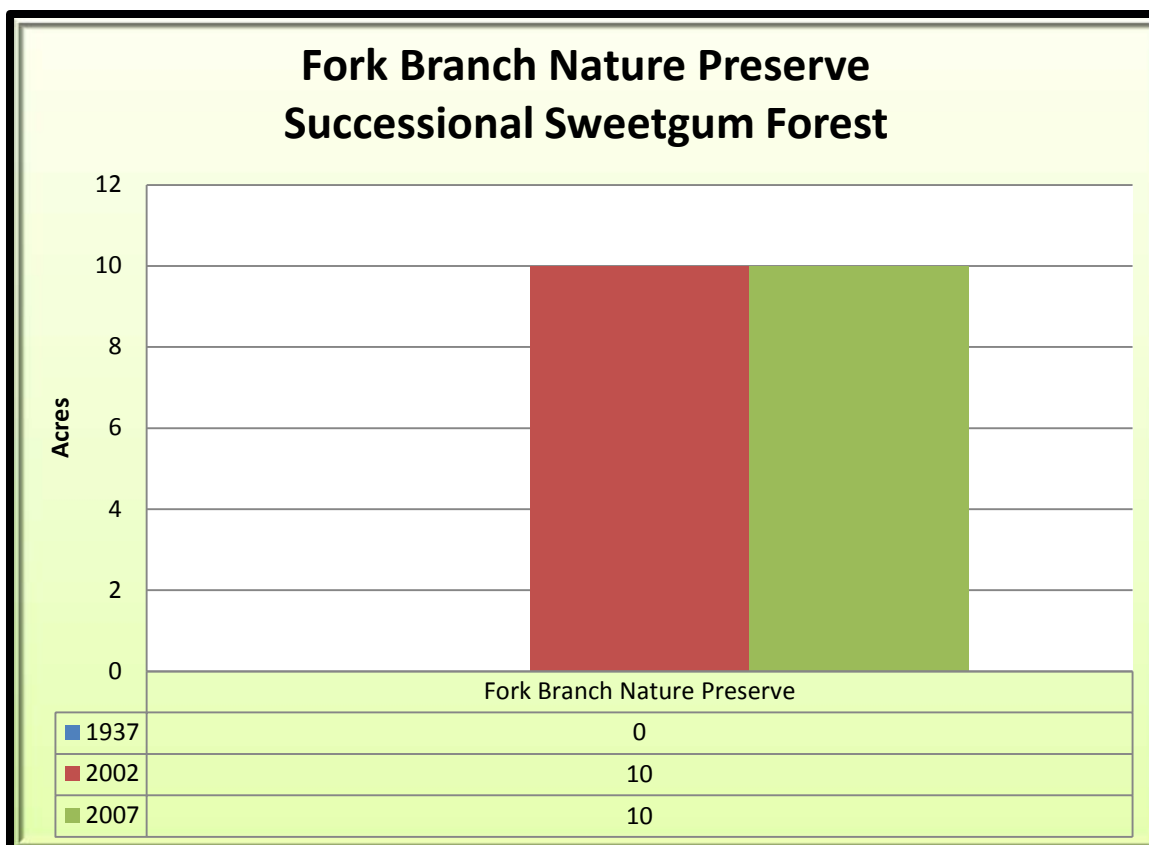


Figure 4.20. Successional Sweetgum Forest at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.30)

This community was not present in 1937 and has since gained capital for the preserve. The capital has been steady in the recent period.

Table 4.30. Natural Capital of Successional Sweetgum Forest	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year (not present)
2002	\$1,891/year
2007	\$1,891/year

Virginia Pine Successional Forest [1 acre (Figures 4.21-4.22, Tables 4.31-4.32)] GNA SNA

DEWAP: Coastal Plain Upland Forest
NHC: Semi-natural/Altered Vegetation and Conifer Plantations

Description



Figure 4.21. Virginia Pine Successional Forest

This dry forest is located in an old sandpit. Virginia pine (*Pinus virginiana*) dominates the canopy overtopping an understory of sweetgum (*Liquidambar styraciflua*) and willow oak (*Quercus phellos*). The shrub and vine layer includes highbush blueberry (*Vaccinium corymbosum*), common greenbrier (*Smilax rotundifolia*), and eastern reed cedar (*Juniperus virginiana*). Herbs include rattlesnake weed (*Hieracium* sp.), Curtis's three-awn grass (*Aristida dichotoma* var. *curtisii*), and broom-sedge (*Andropogon virginicus*).

Analysis of Condition at Fork Branch Nature Preserve

This community has matured in an old sand excavation area at the north end of the preserve. This community may persist for the short term and then mature into an oak dominated forest. Virginia Pine Successional Forest has developed from 1 acre of agricultural field since 1937 (Table 4.31).

Table 4.31. Virginia Pine Successional Forest has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	1 acre

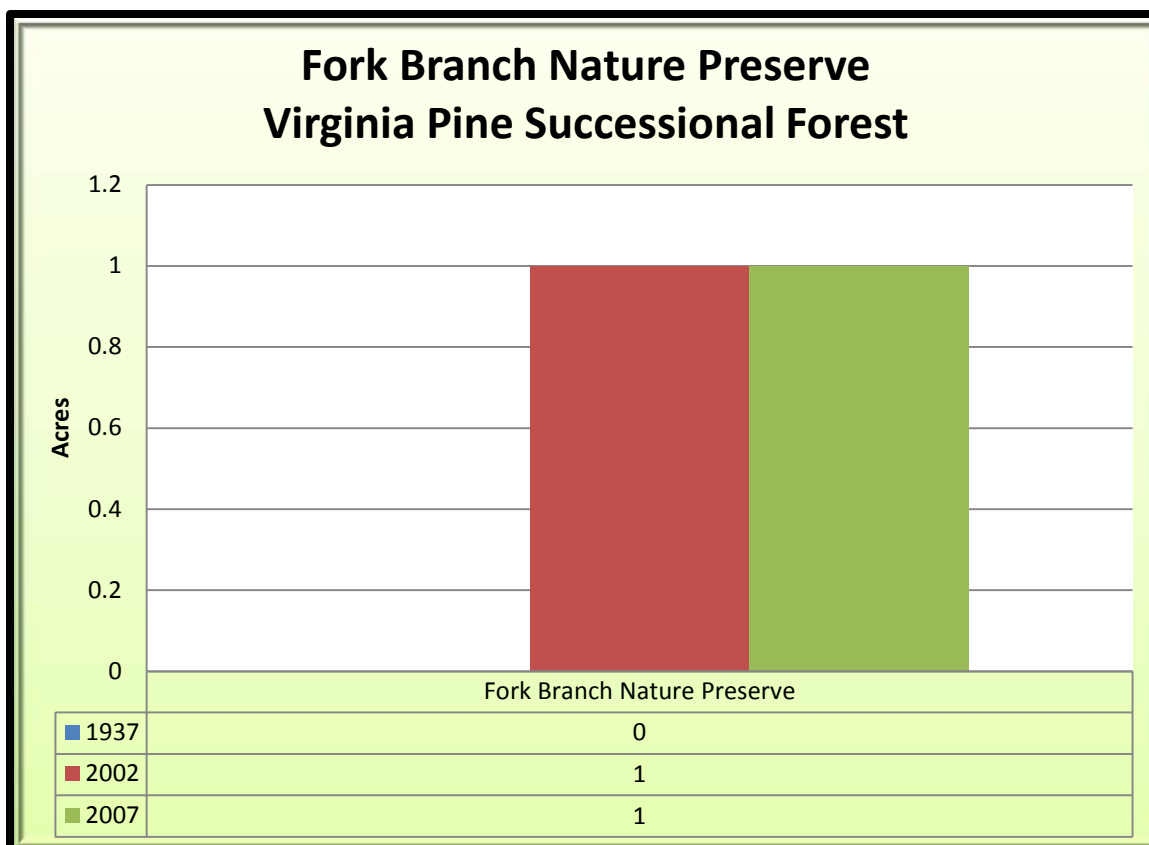


Figure 4.22. Virginia Pine Successional Forest at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.32)

This community was not present in 1937 and has since gained capital for the preserve. The capital has been steady in the recent period.

Table 4.32. Natural Capital of Virginia Pine Successional Forest	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year (not present)
2002	\$189/year
2007	\$189/year

Woolgrass Marsh [0.4 acres (Figures 4.23-4.24, Tables 4.33-4.34)]

GNA SNA

**DEWAP: Isolated Wetlands
NHC: Laurentian-Acadian Freshwater Marsh**

Description



This marshland is dominated entirely by woolgrass (*Scirpus cyperinus*). It is located in a farm pond on the western end of the property.

Figure 4.23. Woolgrass Marsh

Analysis of Condition at Fork Branch Nature Preserve

Woolgrass Marsh has grown into a farm pond at the western end of the preserve since 1937. As long as the hydrology of the pond is maintained it is projected that this community will remain. The farm pond itself and the Woolgrass Marsh was agricultural field in 1937 (Table 4.33).

Table 4.33. Woolgrass Marsh has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	0.3 acres

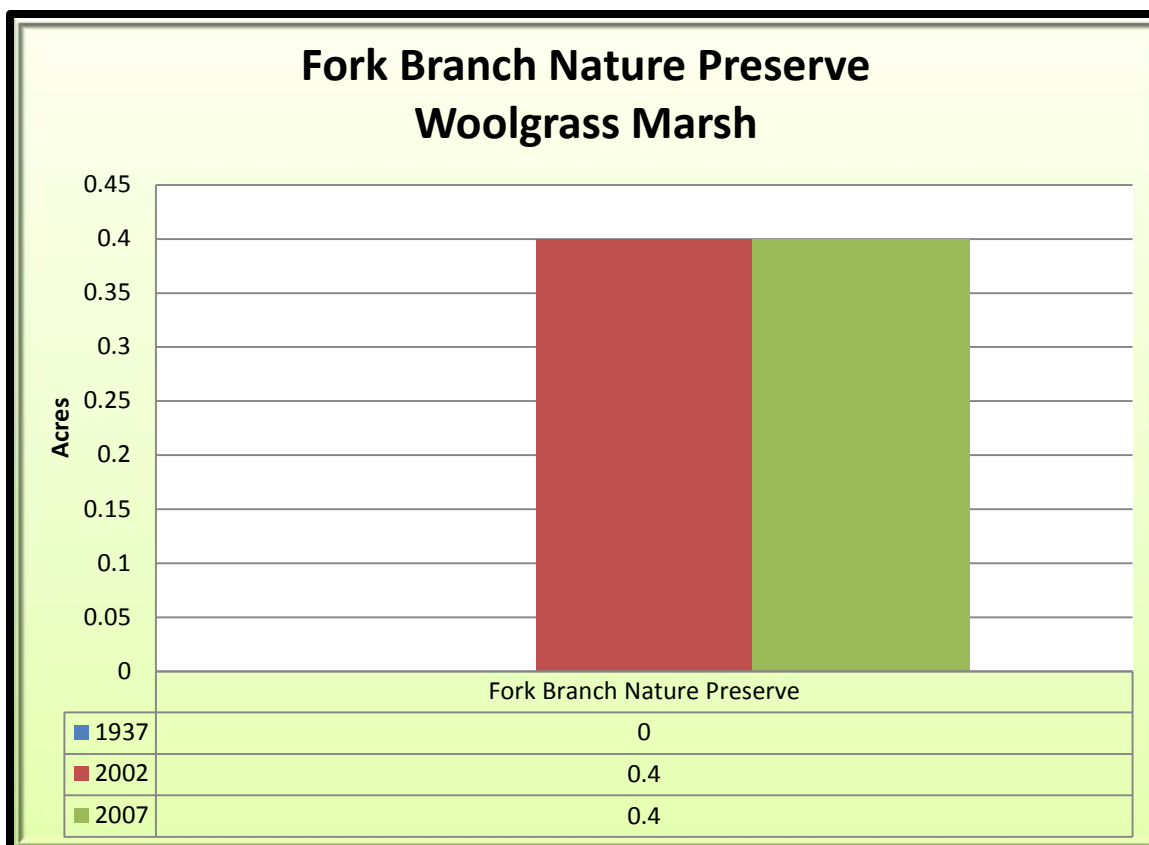


Figure 4.24. Woolgrass Marsh at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 4.34)

This community was not present in 1937 and has since gained capital for the preserve. The capital has been steady in the recent period.

Table 4.34. Natural Capital of Woolgrass Marsh	
Year	Natural Capital (in 2012 dollars)
1937	\$0/year (not present)
2002	\$3,713/year
2007	\$3,713/year

CHAPTER 5: DESCRIPTIONS AND ANALYSIS OF THE LAND COVERS

Land covers are those areas such as agricultural fields or places that do not contain vegetation communities but still cover ground surface. In terms of sea-level rise, water is most important but its effects can also be seen in the impoundments.

The land covers include:

1. Agricultural Field—2 acres
2. Impervious Surface—0.01 acres
3. Water—5 acres

Agricultural Field [2 acres, (Figure 5.1, Tables 5.1-5.3)]

DEWAP: No Equivalent Classification

NHC: No Equivalent Classification

Description

Agricultural field was once one of the prominent non-forest cover types in the preserve but as the fields have been abandoned, they have matured into forestland.

Analysis of Condition at Fork Branch Nature Preserve

This is a man-made community and as such is dependent on human activities to maintain it. It is unknown what the future management plans are this area.

Table 5.1. What was once Agricultural Field in 1937 has become X or remained in 2007	
X	Acreage
Successional Sweetgum Forest	9 acres
Mid-Atlantic Mesic Mixed Hardwood Forest	6 acres
Northeastern Pin Oak-Swamp White Oak Forest	2 acres
Agricultural Field	2 acres
Chesapeake Bay Non-riverine Wet Hardwood Forest	1 acre
Other communities/land covers	4 acres

Table 5.2. Agricultural Field has migrated into X or remained since 1937	
X	Acreage
Agricultural Field	2 acres

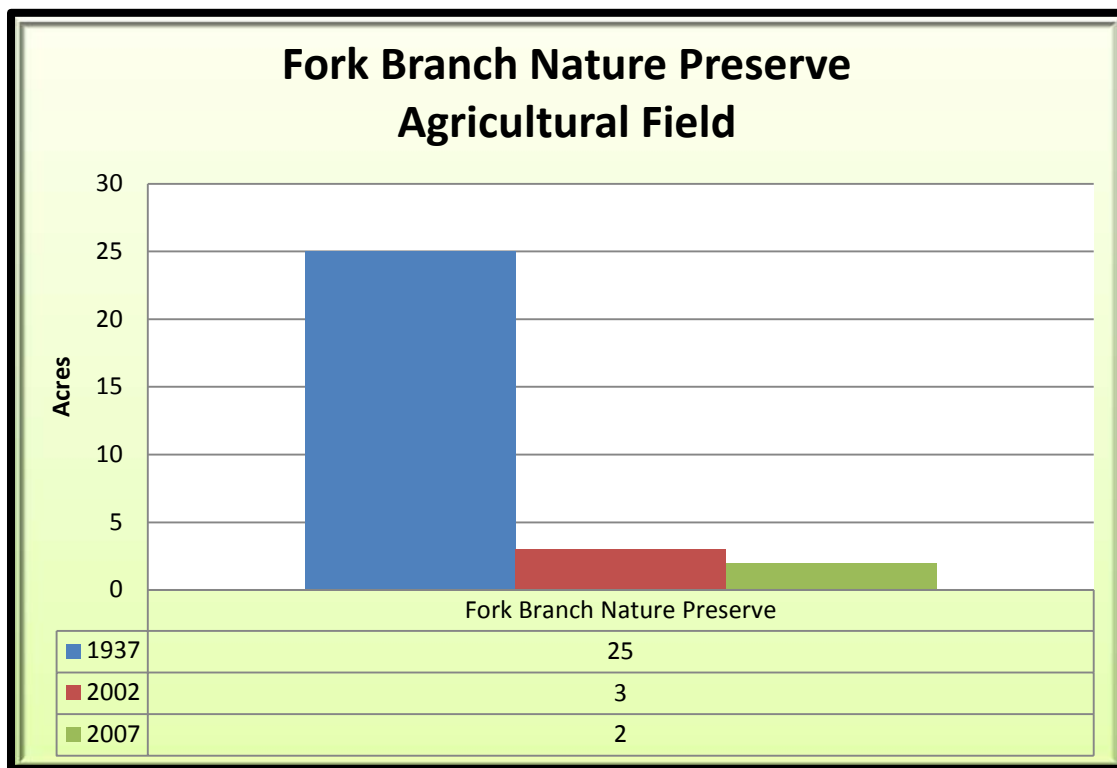


Figure 5.1. Agriculture Field at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 5.3)

The natural capital of agricultural fields has been gradually decreasing as these areas are retired. In general, the abandonment of these fields leads to an increase in capital for the preserve.

Table 5.3. Natural Capital of Agricultural Field	
Year	Natural Capital (in 2012 dollars)
1937	\$1,434/year
2002	\$267/year
2007	\$178/year

Impervious Surface [0.01 acres, (Figure 5.2, Table 5.4)]

DEWAP: No Equivalent Classification

NHC: No Equivalent Classification

Description

Impervious surface includes all of those areas that are impervious to water such as roads and buildings.

Analysis of Condition at Fork Branch Nature Preserve

Impervious surface has decreased since 1937 with the abandonment of a house/farm in the west end of the preserve. The acreage that was impervious surface has become Northeastern Modified Successional Forest (0.1 acres) and cultivated lawn (0.01 acres) (Table 5.4).

Table 5.4. What was once Impervious Surface in 1937 has become X or remained in 2007	
X	Acreage
Northeastern Modified Successional Forest	0.1 acres
Cultivated Lawn	0.01 acres

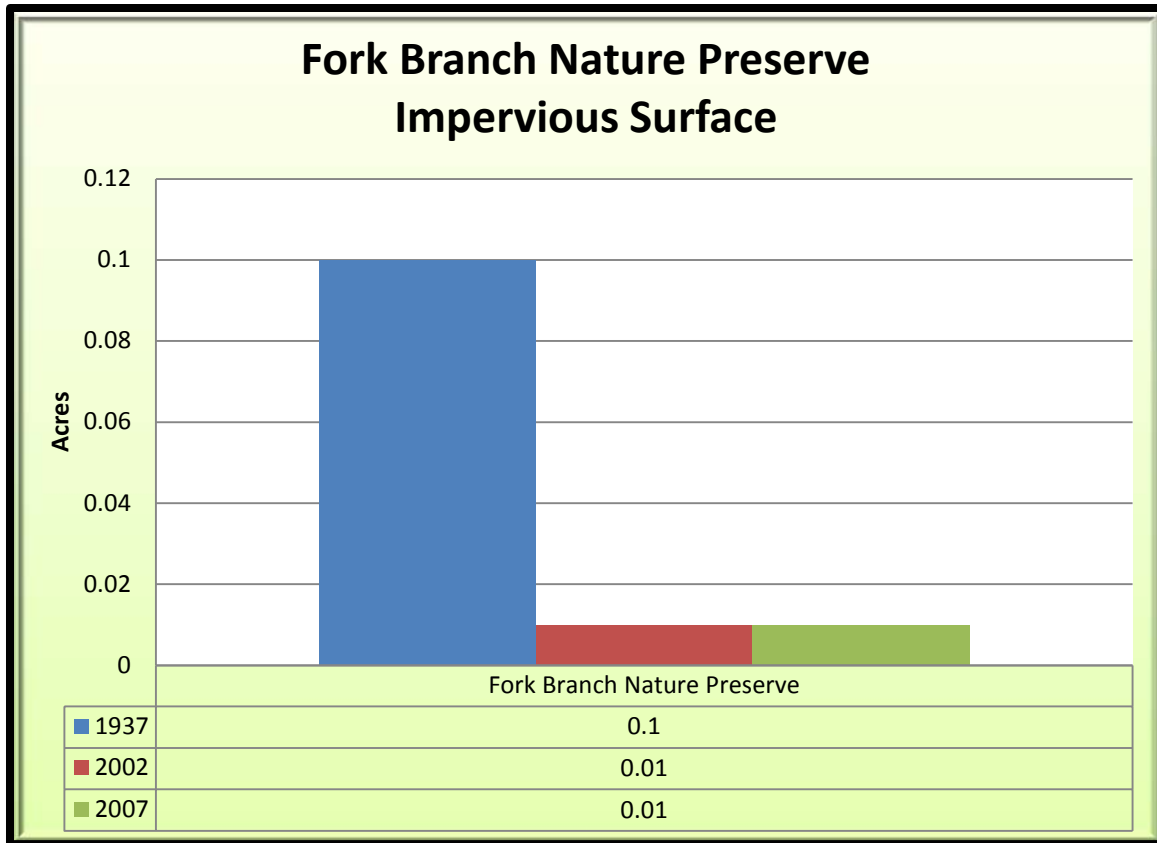


Figure 5.2. Impervious Surface at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital

Impervious Surface does not have any natural capital value.

Water [5 acres, (Figure 5.3, Tables 5.5-5.7)]

DEWAP: No Equivalent Classification

NHC: No Equivalent Classification

Description

Agricultural field was once one of the prominent non-forest cover types in the preserve but as the fields have been abandoned, they have matured into forestland.

Analysis of Condition at Fork Branch Nature Preserve

This is a man-made community and as such is dependent on human activities to maintain it. It is unknown what the future management plans are this area. All of the water present in 1937 was still present in 2007. About 0.04 acres of Eastern Reed Marsh had taken over some of the water surface by 2007 (Table 5.5). Since 1937, Water has covered 0.4 acres of Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp and 0.2 acres of Northeastern Old Field (Table 5.6).

Table 5.5. What was once Water in 1937 has become X or remained in 2007	
X	Acreage
Water	4 acres
Eastern Reed Marsh	0.04 acres

Table 5.6. Water has migrated into X or remained since 1937	
X	Acreage
Water	4 acres
Chesapeake/Piedmont Red Maple/Lizard's Tail Swamp	0.4 acres
Northeastern Old Field	0.2 acres

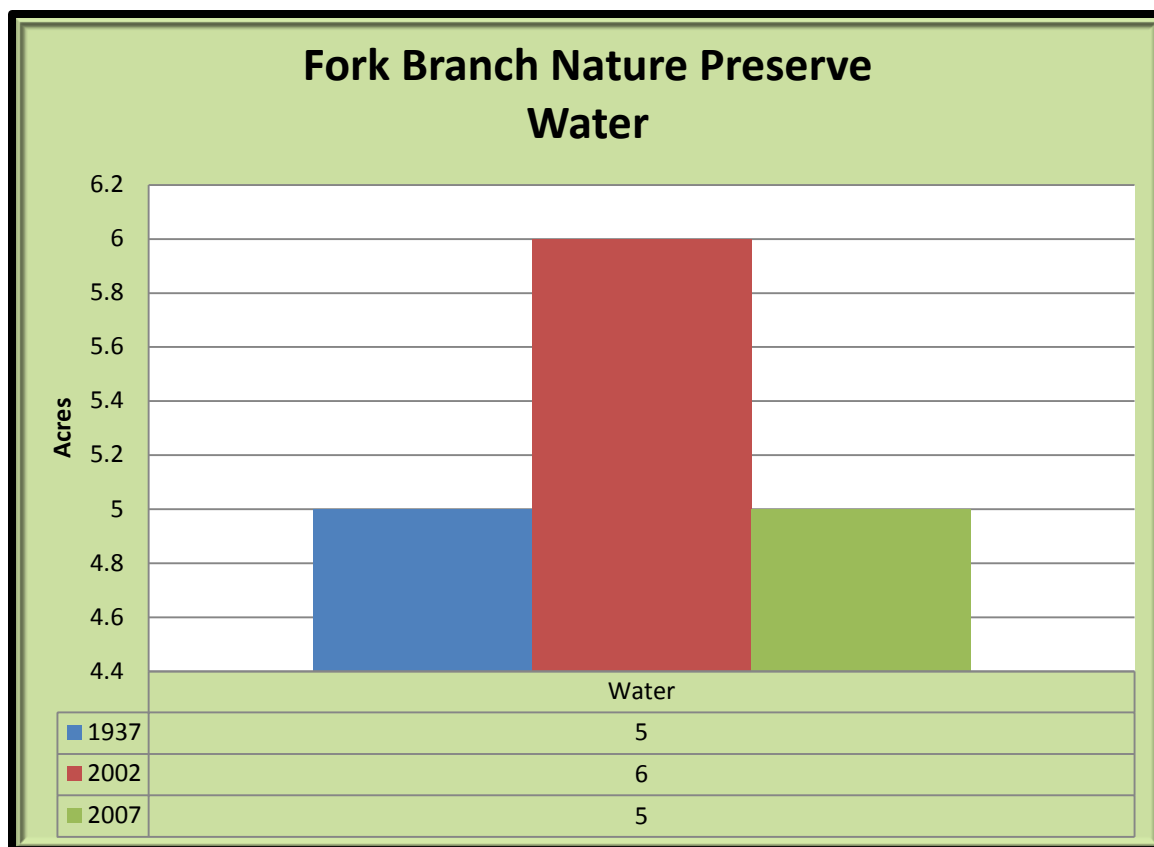


Figure 5.3. Water at Fork Branch Nature Preserve (1937, 2002, and 2007)

Natural Capital (Table 5.7)

Water of water has stayed roughly the same through the study with an increase in 2002 but then breaking even by 2007.

Table 5.7. Natural Capital of Water	
Year	Natural Capital (in 2012 dollars)
1937	\$26,676/year
2002	\$32,011/year
2007	\$26,676/year

APPENDIX I: STATE RARE VEGETATION RANKING CRITERIA

Ranks are based on a system developed by The Nature Conservancy and Natureserve to measure the relative rarity of vegetation communities within a given state. State rarity ranks are used to prioritize conservation and protection efforts so that the rarest of vegetation communities receive immediate attention. The primary criteria for ranking vegetation communities are the total number of documented occurrences with consideration given to the total number of occurrences and total amount of acreage in the state. Ranks for vegetation communities are updated annually and are based on current knowledge and mapping being done for the Guide to Delaware Vegetation Communities.

State Rank

- S1** Extremely rare (i.e., typically 5 or fewer occurrences statewide), or may be susceptible to extirpation because of other threats to its existence.
- S1.1** Only a single occurrence or population of the species is known to occur. (this rank is only applied to plants.)
- S2** Very rare, (i.e., typically 6 to 20 occurrences statewide), or may be susceptible to extirpation because other threats to its existence.
- S3** Rare to uncommon, not yet susceptible to extirpation but may be if additional populations are destroyed. Approximately 21 to 100 occurrences statewide.
- S4** Common, apparently secure in the state under present conditions.
- S5** Very common, secure in the state under present conditions.
- SH** Historically known, but not verified for an extended period (usually 15+ years); there are expectations that the species may be rediscovered.
- SX** Extirpated or presumed extirpated from the state. All historical locations and/or potential habitat have been surveyed.
- SU** Status uncertain within the state. Usually an uncommon species which is believed to be of conservation concern, but there is inadequate data to determine the degree of rarity.
- SNR** Unranked
- SNA** Not Applicable
- SW** Weedy vegetation or vegetation dominated by invasive alien species (this rank is only applied to natural communities).
- SM** Vegetation resulting from management or modification of natural vegetation. It is readily restorable by management or time and/or the restoration of original ecological processes (this rank is only applied to natural communities).

APPENDIX II: SGCN IN KEY WILDLIFE HABITATS

SGCN Species expected in Coastal Plain Forested Floodplains and Riparian Swamps			
Species	Common Name	Class	Tier
<i>Satyrium kingi</i>	King's hairstreak	Insect	1
<i>Clemmys guttata</i>	Spotted turtle	Reptile	1
<i>Terrapene carolina</i>	Eastern box turtle	Reptile	1
<i>Nerodia erythrogaster</i>	Plainbelly water snake	Reptile	1
<i>Nycticorax nycticorax</i>	Black crowned night-heron	Bird	1
<i>Nyctanassa violacea</i>	yellow-crowned night-heron	Bird	1
<i>Buteo platypterus</i>	Broad-winged hawk	Bird	1
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	Bird	1
<i>Hylocichla mustelina</i>	Wood thrush	Bird	1
<i>Parula americana</i>	Northern parula	Bird	1
<i>Setophaga ruticella</i>	American redstart	Bird	1
<i>Limnothlypis swainsonii</i>	Swainson's warbler	Bird	1
<i>Amblyscirtes aesculapius</i>	Lace-winged roadside-skipper	Insect	2
<i>Libytheana carinenta</i>	American snout	Insect	2
<i>Anacamptodes pergracilis</i>	Cypress looper	Insect	2
<i>Chloropteryx tepperaria</i>	Angle winged emerald moth	Insect	2
<i>Manduca jasminarum</i>	Ash sphinx	Insect	2
<i>Dolba hyloeus</i>	Black alder or pawpaw sphinx	Insect	2
<i>Haploa colona</i>	A tiger moth	Insect	2
<i>Orgyia detrita</i>	A tussock moth	Insect	2
<i>Catocala unijuga</i>	Once-married underwing	Insect	2
<i>Catocala praeclara</i>	Praeclara underwing	Insect	2
<i>Parapamea buffaloensis</i>	A borer moth	Insect	2
<i>Papaipema stenocelis</i>	Chain fern borer moth	Insect	2
<i>Gomphaeschna antilope</i>	Taper-tailed darner	Insect	2
<i>Gomphaeschna furcillata</i>	Harlequin darner	Insect	2
<i>Sympetrum ambiguum</i>	Blue-faced meadowhawk	Insect	2
<i>Enallagma weewa</i>	Blackwater bluet	Insect	2
<i>Hemidactylum scutatum</i>	Four-toed salamander	Amphibian	2
<i>Pseudotriton montanus montanus</i>	Mud salamander	Amphibian	2
<i>Hyla chrysoscelis</i>	Cope's gray treefrog	Amphibian	2
<i>Rana virgatipes</i>	Carpenter frog	Amphibian	2
<i>Opheodrys aestivus</i>	Rough green snake	Reptile	2
<i>Thamnophis sauritus</i>	Eastern ribbon snake	Reptile	2
<i>Agkistrodon contortix</i>	copperhead	Reptile	2
<i>Ardea herodias</i>	Great blue heron	Bird	2
<i>Casmerodius albus</i>	Great egret	Bird	2
<i>Egretta thula</i>	Snowy egret	Bird	2
<i>Egretta caerulea</i>	Little blue heron	Bird	2
<i>Egretta tricolor</i>	Tricolored heron	Bird	2
<i>Bubulcus ibis</i>	Cattle egret	Bird	2
<i>Plegadis falcinellus</i>	Glossy ibis	Bird	2
<i>Buteo lineatus</i>	Red-shouldered hawk	Bird	2

<i>Strix varia</i>	Barred owl	Bird	2
<i>Vireo flavifrons</i>	Yellow-throated vireo	Bird	2
<i>Protonotaria citrea</i>	Prothonotary warbler	Bird	2
<i>Helmitheros vermivorus</i>	Worm-eating warbler	Bird	2
<i>Oporornis formosus</i>	Kentucky warbler	Bird	2
<i>Piranga olivacea</i>	Scarlet tanager	Bird	2
<i>Icterus galbula</i>	Baltimore oriole	Bird	2
<i>Lasionycteris noctivagans</i>	Silver-haired bat	Mammal	2
<i>Nycticeius humeralis</i>	Evening bat	Mammal	2

SGCN Species expected in Coastal Plain Upland Forest			
<i>Hylocichla mustelina</i>	wood thrush	Bird	1
<i>Wilsonia citrina</i>	hooded warbler	Bird	1
<i>Sciurus niger cinereus</i>	Delmarva fox squirrel	Mammal	1
<i>Discus catskillensis</i>	angular disc	Gastropod	2
<i>Cicindela patruela</i>	Northern barrens tiger beetle	Insect	2
<i>Cicindela unipunctata</i>	one-spotted tiger beetle	Insect	2
<i>Photuris frontalis</i>	a firefly	Insect	2
<i>Erynnis martialis</i>	mottled duskywing	Insect	2
<i>Erynnis baptisiae</i>	wild indigo duskywing	Insect	2
<i>Battus philenor</i>	pipevine swallowtail	Insect	2
<i>Polygonia progone</i>	gray comma	Insect	2
<i>Caripeta aretaria</i>	a geometer moth	Insect	2
<i>Tolyte notialis</i>	a lasiocampid moth	Insect	2
<i>Hemileuca maia maia</i>	the buckmoth	Insect	2
<i>Cisthene kentuckiensis</i>	Kentucky lichen moth	Insect	2
<i>Cisthene tenuifascia</i>	a lichen moth	Insect	2
<i>Grammia phyllira</i>	phyllira tiger moth	Insect	2
<i>Zale metata</i>	a noctuid moth	Insect	2
<i>Catocala flebilis</i>	mournful underwing	Insect	2
<i>Catocala residua</i>	residua underwing	Insect	2
<i>Catocala cerogama</i>	Yellow banded underwing	Insect	2
<i>Acronicta exilis</i>	Exiled dagger moth	Insect	2
<i>Acronicta lithospila</i>	Streaked dagger moth	Insect	2
<i>Papaipema araliae</i>	Aralia shoot borer moth	Insect	2
<i>Papaipema baptisiae</i>	Wild indigo borer moth	Insect	2
<i>Lepipolys perscripta</i>	A noctuid moth	Insect	2
<i>Scincella lateralis</i>	Ground skink	Reptile	2
<i>Heterodon platirhinos</i>	Eastern hognose snake	Reptile	2
<i>Lampropeltis getula</i>	Common kingsnake	Reptile	2
<i>Storeria occipitomaculata</i>	Redbelly snake	Reptile	2
<i>Virginia valeriae</i>	Smooth earth snake	Reptile	2
<i>Agkistrodon contortix</i>	Copperhead	Reptile	2
<i>Coragyps atratus</i>	Black vulture	Bird	2
<i>Strix varia</i>	Barred owl	Bird	2
<i>Caprimulgus vociferus</i>	whip-poor-will	Bird	2
<i>Colaptes auratus</i>	Northern flicker	Bird	2
<i>Myiarchus crinitus</i>	Great crested flycatcher	Bird	2

<i>Sitta pusilla</i>	Brown-headed nuthatch	Bird	2
<i>Vireo flavifrons</i>	Yellow-throated vireo	Bird	2
<i>Dendroica dominica</i>	Yellow-throated warbler	Bird	2
<i>Mniotilta varia</i>	Black-and-white warbler	Bird	2
<i>Seiurus motacilla</i>	Louisiana waterthrush	Bird	2
<i>Oporornis formosus</i>	Kentucky warbler	Bird	2
<i>Piranga olivacea</i>	Scarlet tanager	Bird	2
<i>Pipilo erythrophthalmus</i>	Eastern towhee	Bird	2
<i>Icterus galbula</i>	Baltimore oriole	Bird	2
<i>Lasionycteris noctivagans</i>	Silver-haired bat	Mammal	2
<i>Lasiurus borealis</i>	Eastern red bat	Mammal	2
<i>Lasiurus cinereus</i>	Hoary bat	Mammal	2
<i>Canis latrans</i>	coyote	Mammal	2

SGCN Species expected in Early Successional Upland Habitats			
Species	Common Name	Class	Tier
<i>Nicrophorus americanus</i>	American burying beetle	Insect	1
<i>Callophrys irus</i>	frosted elfin	Insect	1
<i>Papaipema maritima</i>	maritime sunflower borer moth	Insect	1
<i>Terrapene carolina</i>	Eastern box turtle	Reptile	1
<i>Lampropeltis triangulum</i>	milk snake	Reptile	1
<i>Branta canadensis</i>	Canada goose (migratory)	Bird	1
<i>Circus cyaneus</i>	Northern harrier	Bird	1
<i>Bartramia longicauda</i>	upland sandpiper	Bird	1
<i>Scolopax minor</i>	American woodcock	Bird	1
<i>Asio flammeus</i>	short-eared Owl	Bird	1
<i>Chordeiles minor</i>	common nighthawk	Bird	1
<i>Lanius ludovicianus</i>	loggerhead shrike	Bird	1
<i>Dendroica discolor</i>	prairie warbler	Bird	1
<i>Ammodramus henslowii</i>	Henslow's sparrow	Bird	1
<i>Cinctula scutellaris</i>	festive tiger beetle	Insect	2
<i>Atrytonopsis hianna</i>	dusted skipper	Insect	2
<i>Satyrus liparops</i>	striped hairstreak	Insect	2
<i>Satyrus liparops strigosus</i>	stiped hairstreak	Insect	2
<i>Callophrys gryneus</i>	juniper hairstreak	Insect	2
<i>Speyeria aphrodite</i>	aphrodite fritillary	Insect	2
<i>Speyeria idalia</i>	regal fritillary	Insect	2
<i>Boloria bellona</i>	meadow fritillary	Insect	2
<i>Paratreia plebeja</i>	trumpet vine sphinx	Insect	2
<i>Calyptra canadensis</i>	Canadian owlet	Insect	2
<i>Acronicta rubricoma</i>	a dagger moth	Insect	2
<i>Papaipema rigida</i>	rigid sunflower borer moth	Insect	2
<i>Cirrhophanus triangulifer</i>	a noctuid moth	Insect	2
<i>Schima septentrionalis</i>	a noctuid moth	Insect	2
<i>Plegadis falcinellus</i>	glossy ibis	Bird	2
<i>Cygnus columbianus</i>	tundra swan	Bird	2
<i>Coragyps atratus</i>	black vulture	Bird	2

<i>Colinus virginianus</i>	Northern bobwhite	Bird	2
<i>Pluvialis squatarola</i>	black-bellied plover	Bird	2
<i>Coccyzus erythrophthalmus</i>	black-billed cuckoo	Bird	2
<i>Chaetura pelagica</i>	chimney swift	Bird	2
<i>Colaptes auratus</i>	Northern flicker	Bird	2
<i>Empidonax minimus</i>	least flycatcher	Bird	2
<i>Tyrannus tyrannus</i>	Eastern kingbird	Bird	2
<i>Toxostoma rufum</i>	Brown thrasher	Bird	2
<i>Dendroica pensylvanica</i>	Chestnut-sided warbler	Bird	2
<i>Icteria virens</i>	Yellow-breasted chat	Bird	2
<i>Pipilo erythrophthalmus</i>	Eastern towhee	Bird	2
<i>Spizella pusilla</i>	field sparrow	Bird	2
<i>Pooecetes gramineus</i>	vesper sparrow	Bird	2
<i>Passerculus sandwichensis</i>	savannah sparrow	Bird	2
<i>Ammodramus savannarum</i>	grasshopper sparrow	Bird	2
<i>Dolichonyx oryzivorus</i>	bobolink	Bird	2
<i>Cryptotis parva</i>	least shrew	Bird	2