Vegetation Community and Land Use Change Analysis of Old Furnace Wildlife Area Sussex County, Delaware

Deep Creek and Nanticoke River Watersheds

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CHAPTER 1: INTRODUCTION AND METHODS

Setting of Old Furnace Wildlife Area

Old Furnace Wildlife Area is located in southwestern Sussex County, Delaware (Figure 1.1). The wildlife area totals 2,237 acres in five sections. The tracts are all located within the greater Nanticoke River watershed in the Deep Creek and Nanticoke River sub-drainages.

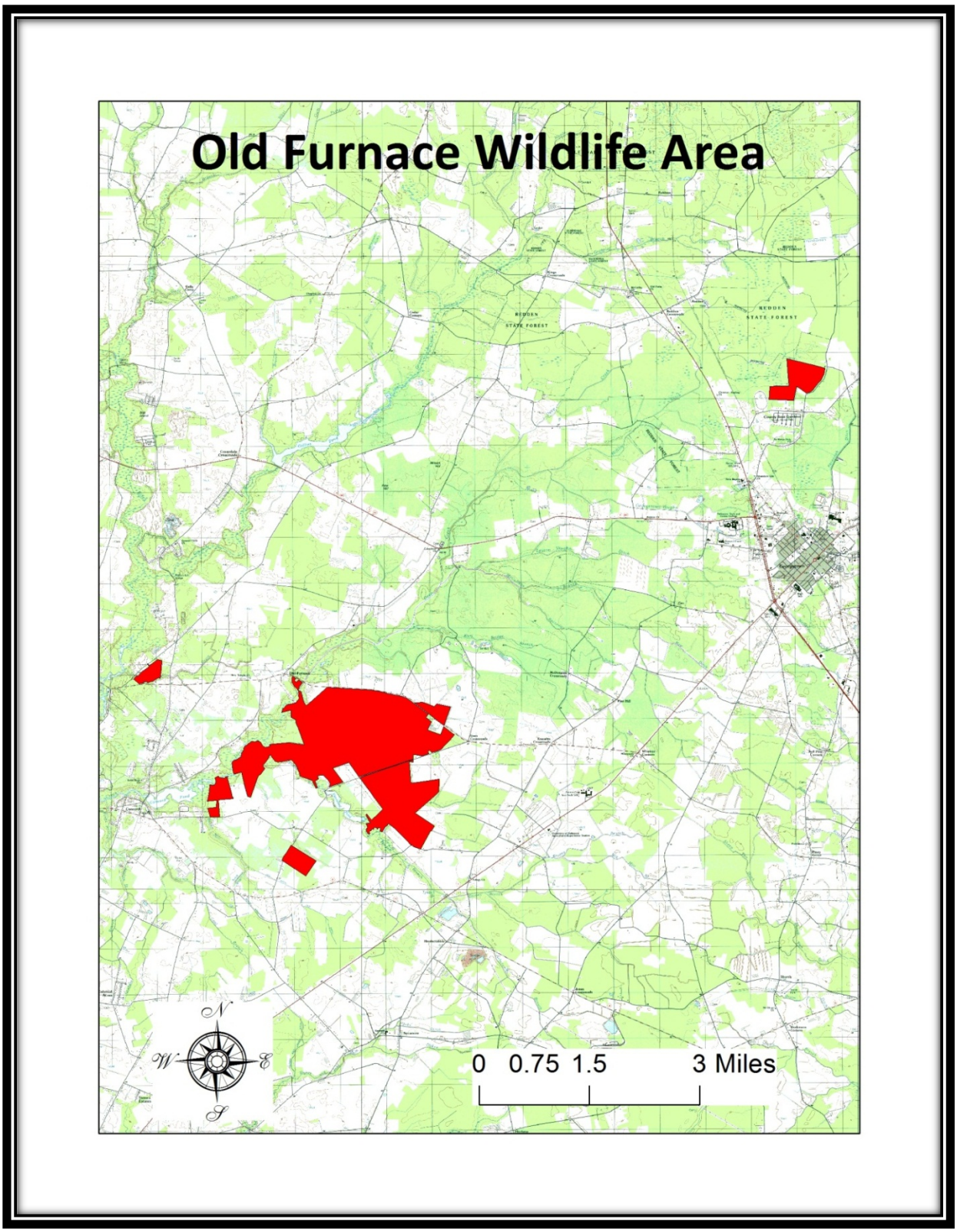

Figure 1.1. Location of Old Furnace Wildlife Area

Soils and Geology of Old Furnace Wildlife Area

Underlying Geology

Old Furnace Wildlife Area is underlain by the Beaverdam Formation. The Beaverdam Formation is described as "Pale white to buff to greenish-gray medium sand with scattered beds of coarse sand, gravelly sand and light gray to greenish gray silty clay."[1]

Soils

One soil, Rosedale Loamy Sand (1,339 acres) is prominent in Old Furnace Wildlife Area. Four other soils are minor and include Fort Mott Loamy Sand (295 acres), Mullica-Berryland Complex (114 acres), Longmarsh and Indiantown Soils (110 acres), and Evesboro Loamy Sand (76 acres). Elevations of Old Furnace Wildlife Area range from about 20 feet at Concord Pond to about 40 feet at the east end of the Main Section.

[1] Ramsey, Kelvin W. and William S. Schenck. 1990. Geologic Map of Southern Delaware. Delaware Geological Survey, Open File Report No.32.

Concord Pond Section Soils

Fort Mott Loamy Sand (36 acres) is the primary soil in the Concord Pond Section. Other minor soils include Ingleside Sandy Loam (13 acres) and Evesboro Loamy Sand (11 acres).

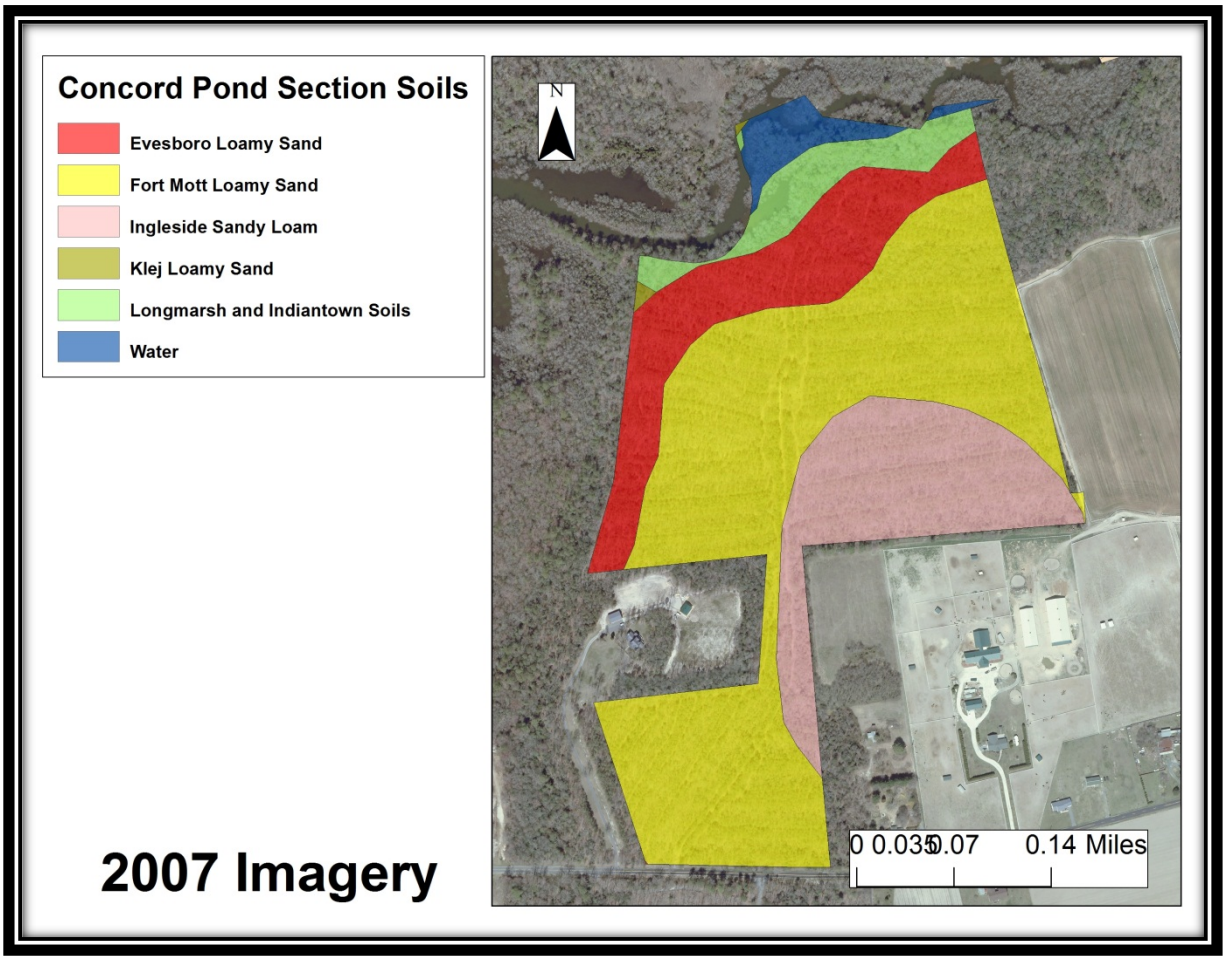

Figure 1.2. Concord Pond Section Soil Map

Main Section Soils

Rosedale Loamy Sand (1334 acres) is the primary soil in the Main Section. Other minor soils include Fort Mott Loamy Sand (232 acres) and Longmarsh and Indiantown Soils (106 acres) in the lowlands.

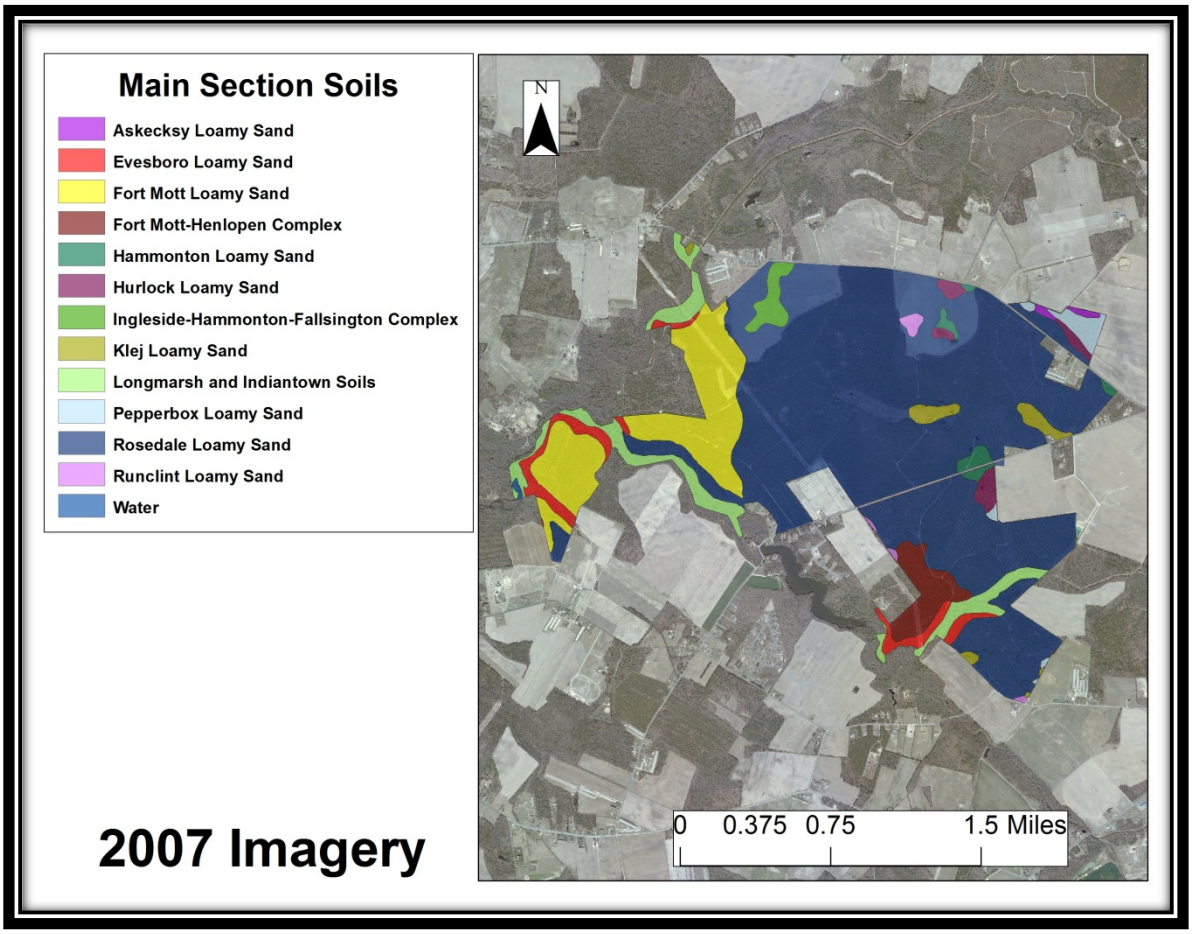

Figure 1.3. Main Section Soil Map

Middleford Section Soils

Fort Mott Sandy Loam (25 acres) is the primary soil in the Main Section. Other minor soils include Askecksy Loamy Sand (9 acres) and Evesboro Loamy Sand (8 acres).

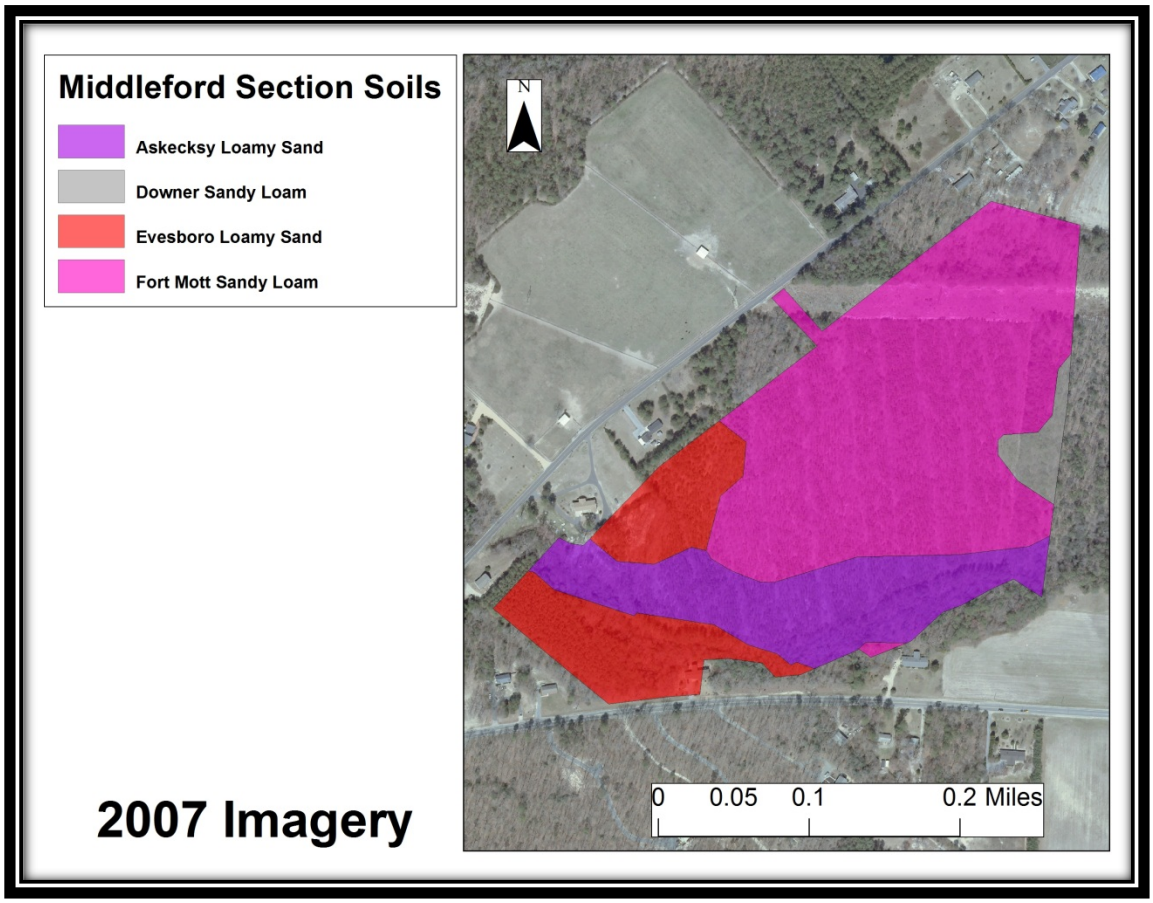

Figure 1.4. Middleford Section Soil Map

Northeast Section Soils

Mullica-Berryland Complex (114 acres) is the primary soil in the Northeast Section. Klej Loamy Sand (29 acres) is a minor soil.

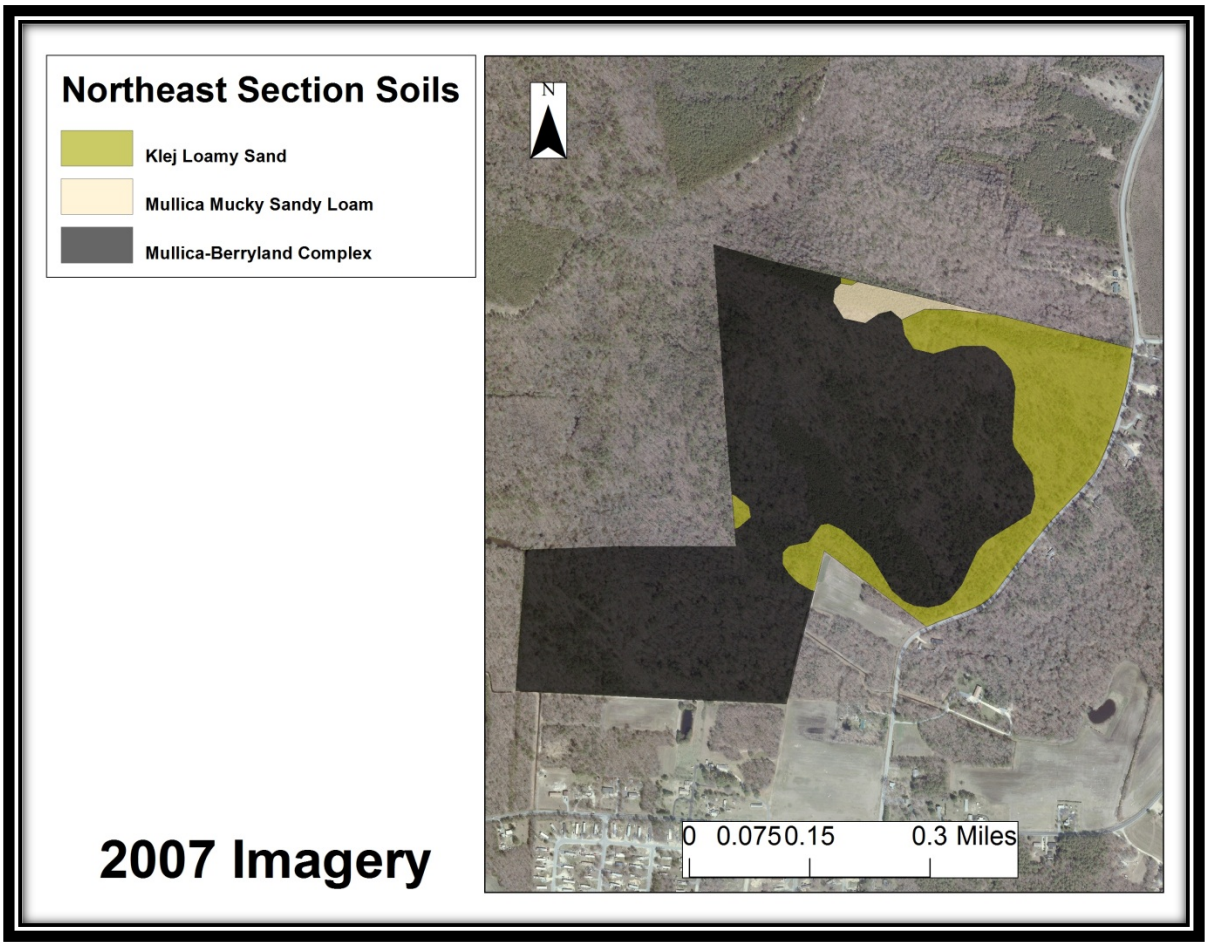

Figure 1.5. Northeast Section Soil Map

South Section Soils

The primary soils in the South Section include Fallsington Sandy Loam (35 acres) and Ingleside Sandy Loam (20 acres). Other minor soils include Rosedale Loamy Sand (5 acres).

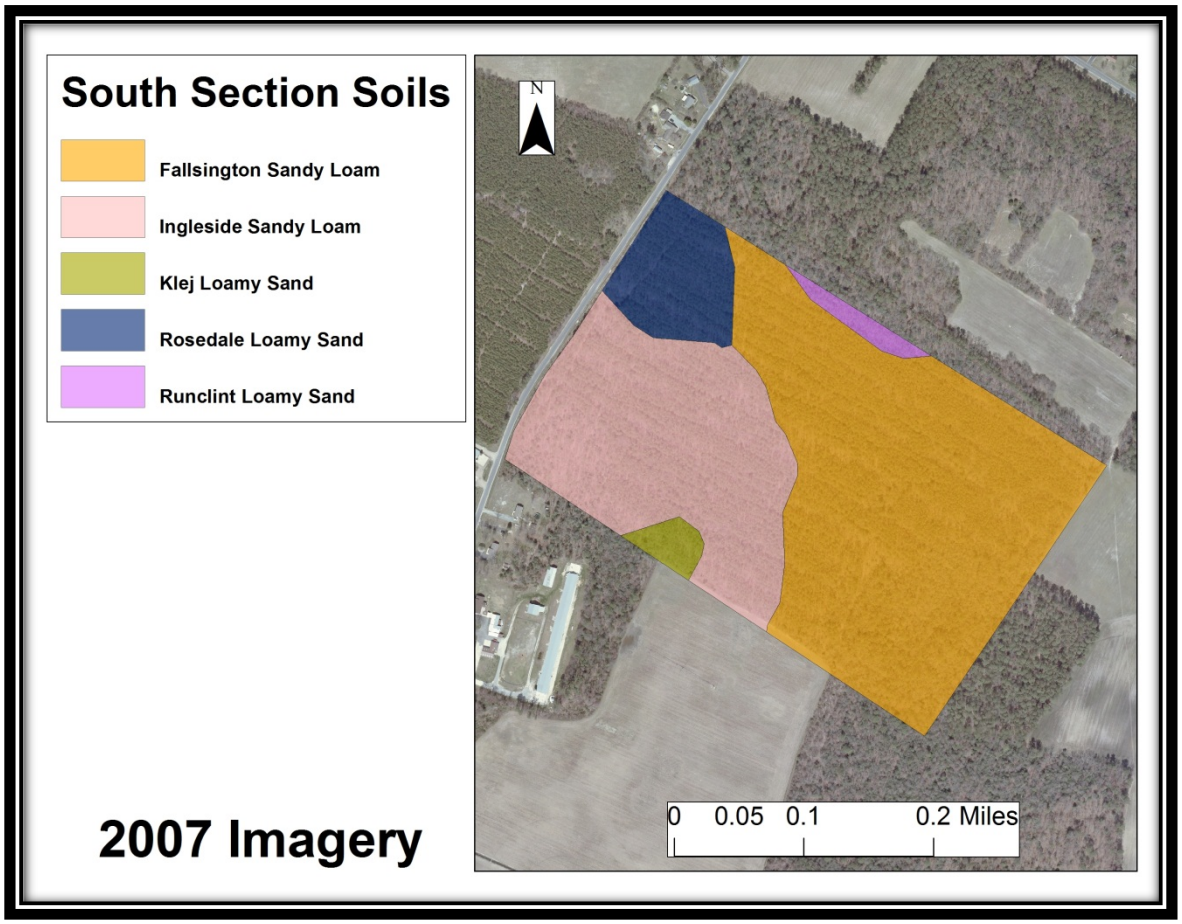

Figure 1.6. South Section Soil Map

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 Old Furnace Wildlife Area based on 1954, 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 wildlife area.
4. Produce Ecological Integrity Assessments (EIAs) for vegetation communities that are ranked S2 or higher.

Surveys were conducted during 2011 and 2012 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 1954, 2002, and 2007 aerial 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 5 and of land covers in Chapter 6. A crosswalk to the Delaware Wildlife Action Plan (DEWAP) and the Northeast Habitat Classification (NHC) provided at the top of each individual description.

Analysis of Historical Imagery

Historical imagery of Old Furnace Wildlife Area from 1954, 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, 48, and 53 year time frame. Changes in the respective vegetation communities and land covers are discussed in the descriptions while broader changes are discussed in the wildlife area discussion. There is more imagery available (1937, 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 wildlife area 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 Old Furnace Wildlife Area 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 2.4 and Figure 2.2). A block is defined as contiguous forest habitat that is contained with 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

[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.

currently old field 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 or land cover 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 and state parks 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 BLOCK ANALYSIS AND GENERAL OBSERVATIONS

Summary of Findings from this study

1. **Vegetation Communities:** Eleven vegetation communities and seven land covers were found at Old Furnace Wildlife Area. Early to Mid-Successional Loblolly Pine Forest (1,010 acres) is the largest vegetation community, followed by the related Loblolly Pine Plantation with 626 acres. Agricultural field (211 acres) is the largest land cover, followed by Powerline R-O-W with 23 acres.

2. **Rare Plants:** Three rare plants are known to exist in Old Furnace Wildlife Area (Table 1.1).

Scientific Name	Common Name	Rank	Last Observed
Amphicarpum purshii	Blue Maidencane	S2	???
Aureolaria pedicularia var. *pedicularia*	Fernleaf Yellow False-foxglove	S1	2003
Dichanthelium ravenelii	Ravenel's Witchgrass	S2	1993

Table 2.1. Rare Plants at Old Furnace Wildlife Area

3. **Rare Animals:** Two rare animals are known to exist in Old Furnace Wildlife Area (Table 2.2).

Scientific Name	Common Name	Rank	Last Observed
Buteo lineatus	Red Shouldered Hawk	S2B, S3N	1994
Strix varia	Barred Owl	S2	2001

Table 2.2. Rare Animals at Old Furnace Wildlife Area

Ecological Integrity Assessment (EIA)

One vegetation community, Pond Pine Woodland, is ranked S2 or higher at Old Furnace Wildlife Area. These areas are described in Table 2.3 and mapped in Figure 2.1.

Table 2.3. EIA Vegetation Communities located in Fork Nature Preserve

Community Map	Community Name/EIA Score	Description
	**Old Furnace 1** **Pond Pine Woodland (26.5 acres)** **EIA = 4.16 (B rank)**	This woodland is located in the middle of the Northeast Section.

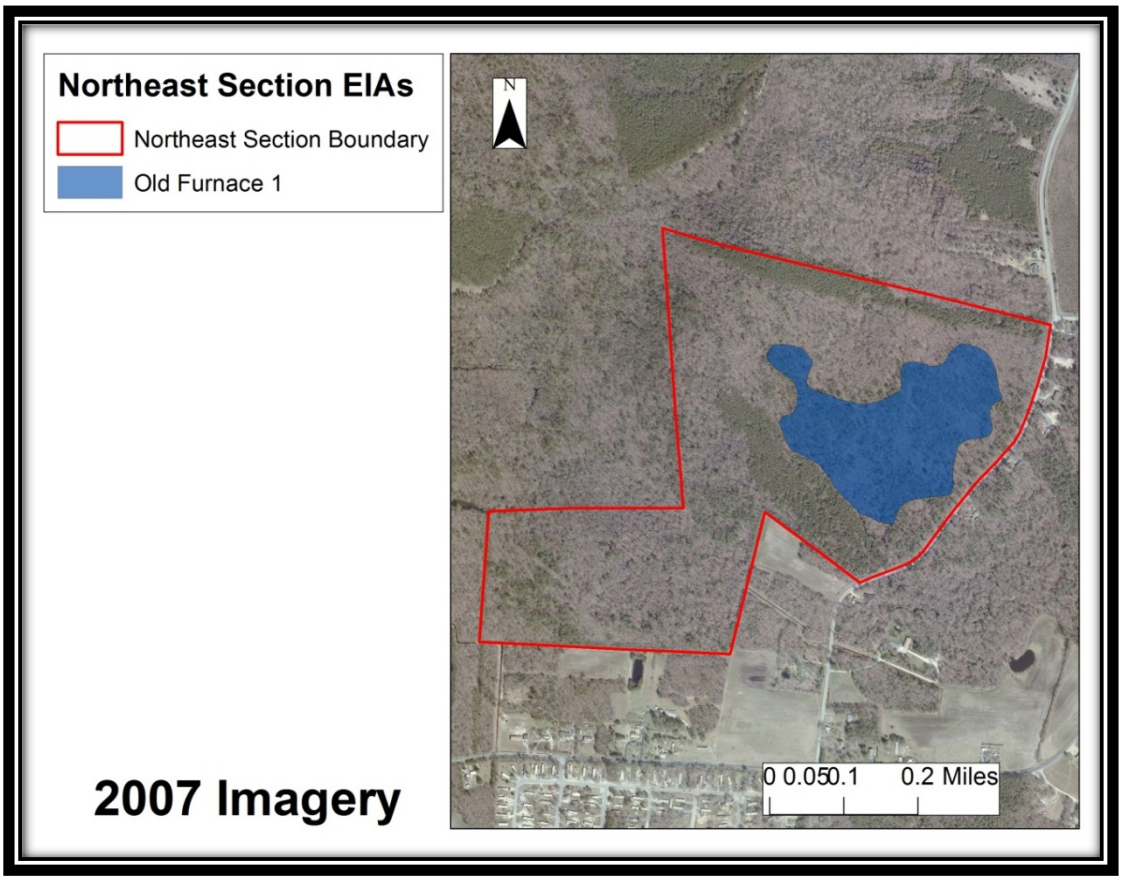

Figure 2.1. Northeast Section EIAs

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 predators[5]. 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 wildlife areas has traditionally favored uses for hunting, which require fields and edges running counter to the habitat needed for forest interior birds. Protecting forest interior bird fauna 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 Old Furnace Wildlife Area

Five forest blocks are present that are more than 100 acres in size and are located in whole or part in the wildlife area (Table 2.4 and Figure 2.2). 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.

Natural Capital Analysis

The natural capital of each vegetation community was determined using a table in Costanza, et al.[6] 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:

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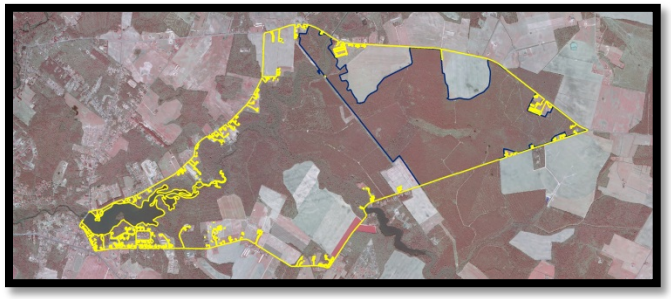
Open Ocean: $102/acre/year

Values were rounded off to the nearest whole dollar.

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

Table 2.4. Forest Blocks located in whole or part in Old Furnace Wildlife Area

Forest Block Map	Block Name/Acreage	Description
	**Old Furnace A** **Current Block = 838 acres (543 acres interior)** **Potential Block = 2,718 acres (1,974 acres interior)**	Old Furnace A encompasses all of the wooded area north Fleetwood Road and east of the powerline R-O-W in the Main Section. It is bounded by a powerline R-O-W on the west, Road 46 on the north and east, and Fleetwood Pond Road on the south. Five vegetation communities are located within this block and include Early to Mid-Successional Loblolly Pine Forest, Loblolly Pine Plantation, Mid-Atlantic Mesic Mixed Hardwood Forest, Northern Coastal Plain Successional Floodplain Forest, and Southern Red Oak/Heath Forest. Deep Creek drains this block. Currently this block contains 543 acres of interior habitat. Potentially this block could be 2,718 acres in size, and contain 1,974 acres of interior habitat. This block shares a potential forest block with forest block B.
	**Old Furnace B** **Current Block = 924 acres (488 acres interior)** **Potential Block = 2,718 acres (1,974 acres interior)**	Old Furnace B encompasses all of the wooded area north of Fleetwood Road and west of the powerline R-O-W in the Main Section and Concord Pond Section. It is bounded by Concord Pond Road on the west, Concord Pond and Road 524 on the north, powerline R-O-W on the east, and Fleetwood Pond and Baker Mill Road on the south. Seven vegetation communities are located within this block and include Early to Mid-Successional Loblolly Pine Forest, Loblolly Pine Plantation, Mid to Late Successional Loblolly Pine-Sweetgum Forest, Mid-Atlantic Mesic Mixed Hardwood Forest, Northern Coastal Plain Successional Floodplain Forest, Southern Red Maple-Blackgum Swamp, and Southern Red Oak/Heath Forest. Deep Creek drains this block. Currently this block contains 488 acres of interior habitat. Potentially this block could be 2,718 acres in size and contain 1,974 acres of interior habitat. This block shares a potential forest block with forest block A.

Forest Block Map	Block Name/Acreage	Description
	**Old Furnace C** **Current Block = 481 acres (204 acres interior)** **Potential Block = 1,861 acres (1,285 acres interior)**	Old Furnace C encompasses all of the wooded area south of Fleetwood Road in the Main Section. It is bounded by agricultural field and tax ditch on the west, Fleetwood Pond Road on the north, agricultural field on the east, and agricultural field and tax ditch on the south. Four vegetation communities are located within this block and include Early to Mid-Successional Loblolly Pine Forest, Loblolly Pine Plantation, Mid to Late Successional Loblolly Pine-Sweetgum Forest, and Southern Red Maple-Blackgum Swamp. Deep Creek drains this block. Currently this block contains 204 acres of interior habitat. Potentially this block could be 1,861 acres in size and contain 1,285 acres of interior habitat.
	**Old Furnace D** **Current Block = 160 acres (40 acres interior)** **Potential Block = 347 acres (226 acres interior)**	Old Furnace D encompasses all of the wooded area in the south section. It is bounded by Fleetwood Pond on the west, agricultural field and Baker Mill Road on the north, agricultural field on the east, and agricultural field and DE 20 on the south. Four vegetation communities are located within this block and include Loblolly Pine Plantation, Mid to Late Successional Loblolly Pine-Sweetgum Forest, and Mid-Atlantic Mesic Mixed Hardwood Forest, and Southern Red Oak/Heath Forest. Deep Creek drains this block. Currently this block contains 40 acres of interior habitat. Potentially this block could be 347 acres in size and contain 226 acres of interior habitat.
	**Old Furnace E** **Current Block = 1,794 acres (1,208 acres interior)** **Potential Block = 2,096 acres (1,715 acres)**	Old Furnace E encompasses all of the Northeast Section and covers most of the headwaters of Deep Creek, Gravelly Branch, and the Broadkill River. It is bounded by Road 565 on the north, Downs Road on the east, agricultural field and lawn on the south, and a railroad on the west. Nine vegetation communities are located within this block and include Chesapeake Bay Non-riverine Wet Hardwood Forest, Early to Mid-Successional Loblolly Pine Forest, Loblolly Pine Plantation, Mid to Late Successional Loblolly Pine-Sweetgum Forest, Mid-Atlantic Mesic Mixed Hardwood Forest, Pond Pine Woodland, Southern Red Oak/Heath Forest, Successional Sweetgum Forest, and Virginia Pine Successional Forest. Deep Creek, Gravelly Branch, and the Broadkill River drain this block. Currently this block contains 1,208 acres of interior habitat. Potentially it could be 2,096 acres in size and contain 1,715 acres of interior habitat.

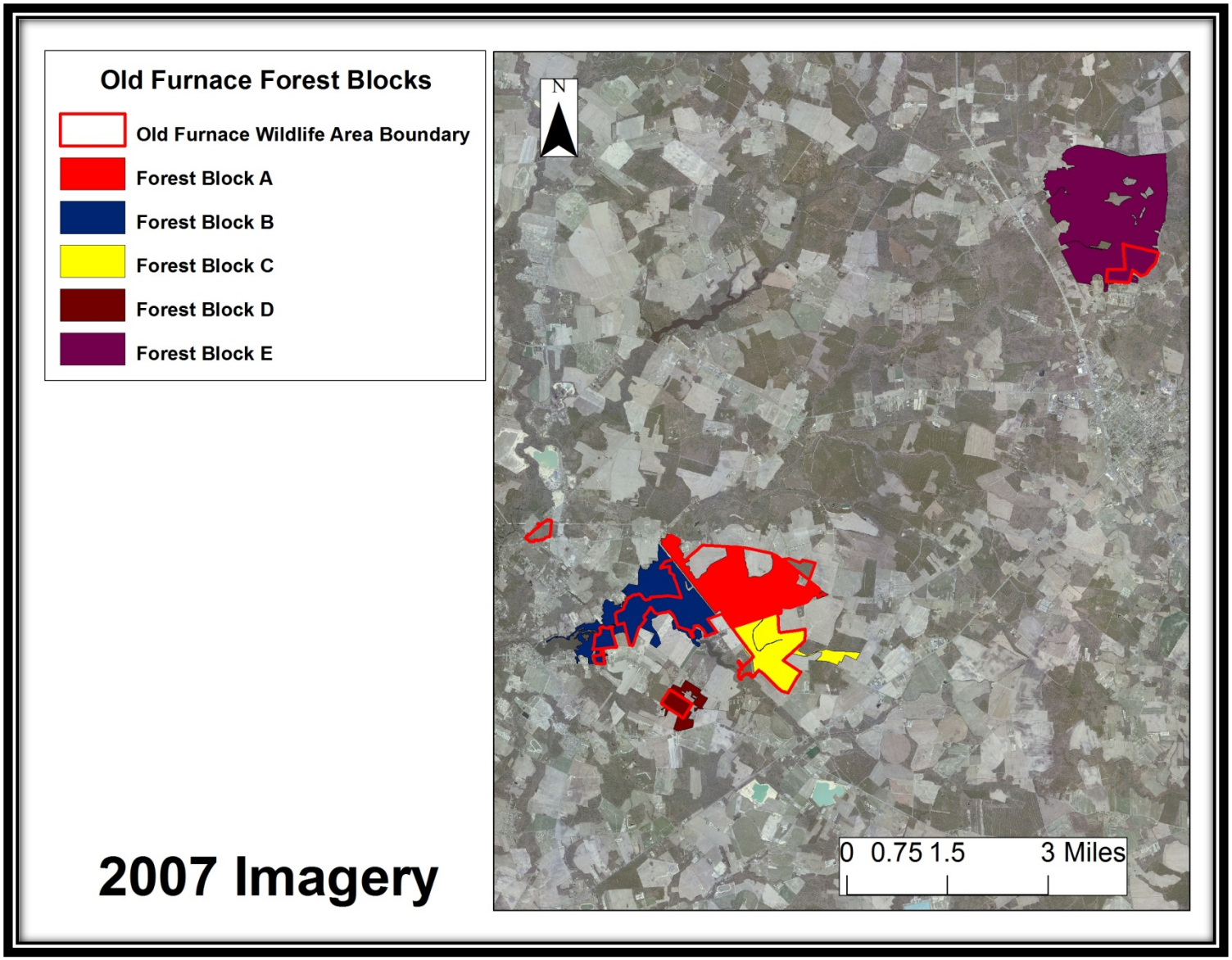
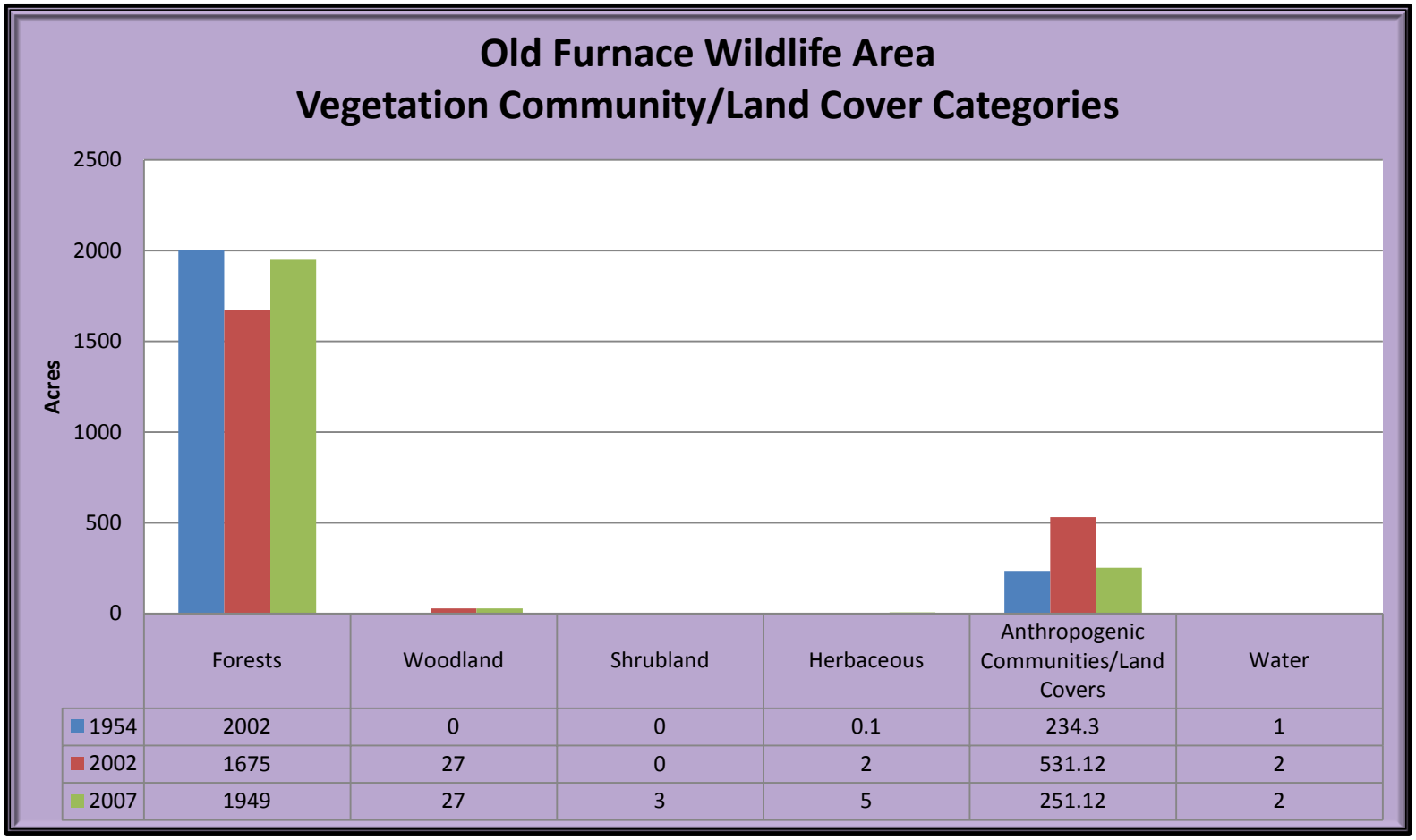


Figure 2.2. Old Furnace Wildlife Area Forest Blocks



	Forests	Woodland	Shrubland	Herbaceous	Anthropogenic Communities/Land Covers	Water
1954	2002	0	0	0.1	234.3	1
2002	1675	27	0	2	531.12	2
2007	1949	27	3	5	251.12	2

Figure 3.1. Old Furnace Wildlife Area Vegetation Categories/Land Covers (1954, 2002, and 2007)

Old Furnace Wildlife Area Broad Trends (Figure 3.1): Forests are the main community type in Old Furnace Wildlife Area with Anthropogenic Communities/Land Covers following in distant second.

Natural Capital (Table 3.1)

Old Furnace Wildlife Area capital has been gaining with increases in the amount of forestland and woodland.

Table 3.1 Natural Capital of Old Furnace Wildlife Area	
Year	**Natural Capital (in 2012 dollars)**
1954	$3,111,154/year
2002	$3,207,002/year
2007	$3,259,810/year

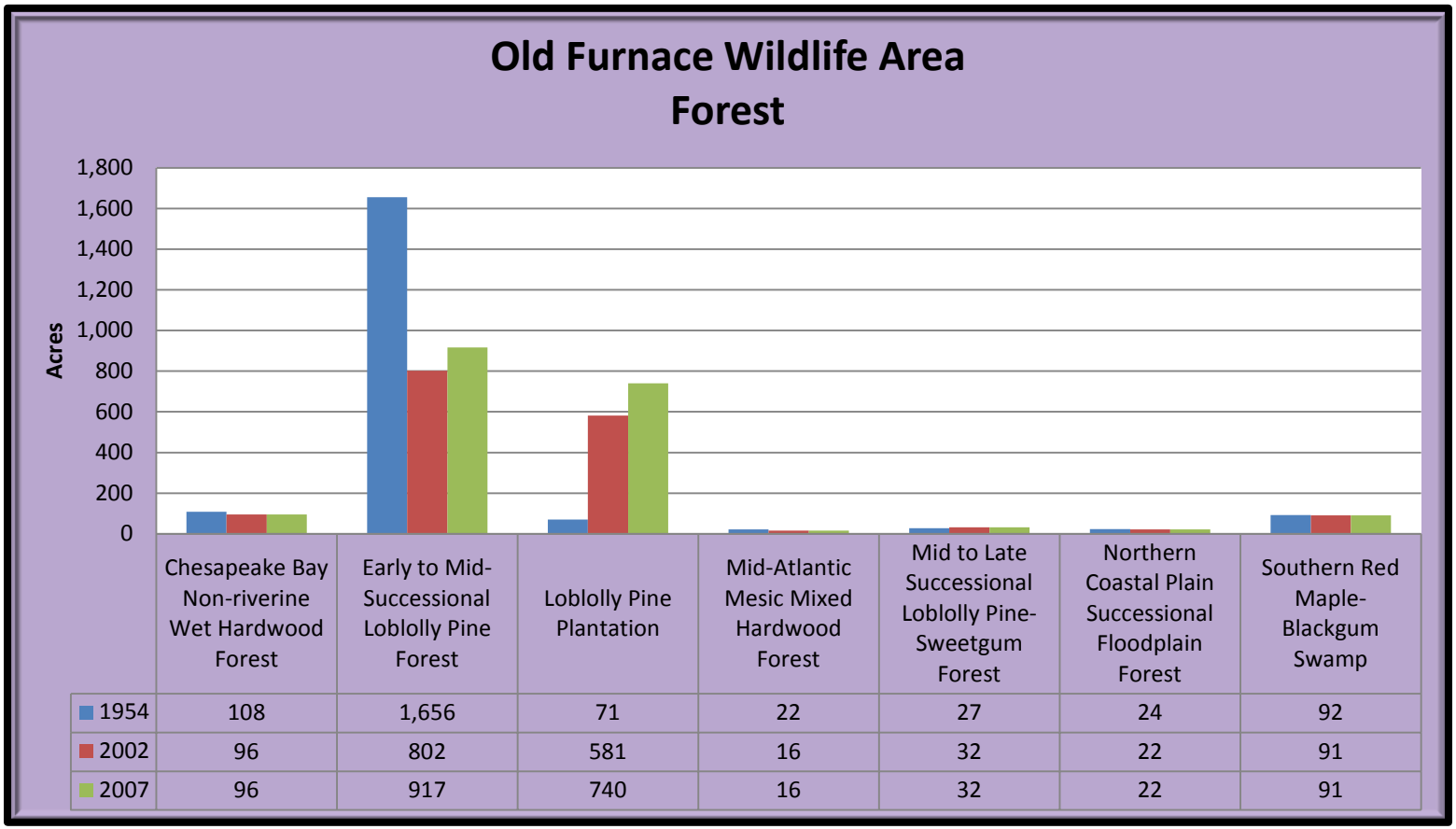


Figure 3.2. Forest at Old Furnace Wildlife Area (1954, 2002, and 2007)

Old Furnace Wildlife Area Forests (Figure 3.2): Early to Mid-Successional Loblolly Pine Forest is the most common forest type and is seconded by Loblolly Pine Plantation (740 acres) that are part of the industrial forest of the area. Most of the hardwood forests are located in thin buffers around the streams.

Natural Capital (Table 3.2)

Capital of forestland has decreased overall, mainly driven by losses in the amount of wetland type forests, which have a higher valuation than upland forests.

Table 3.2. Natural Capital of Old Furnace Wildlife Area Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$3,089,516/year
2002	$2,846,144/year
2007	$2,897,957/year

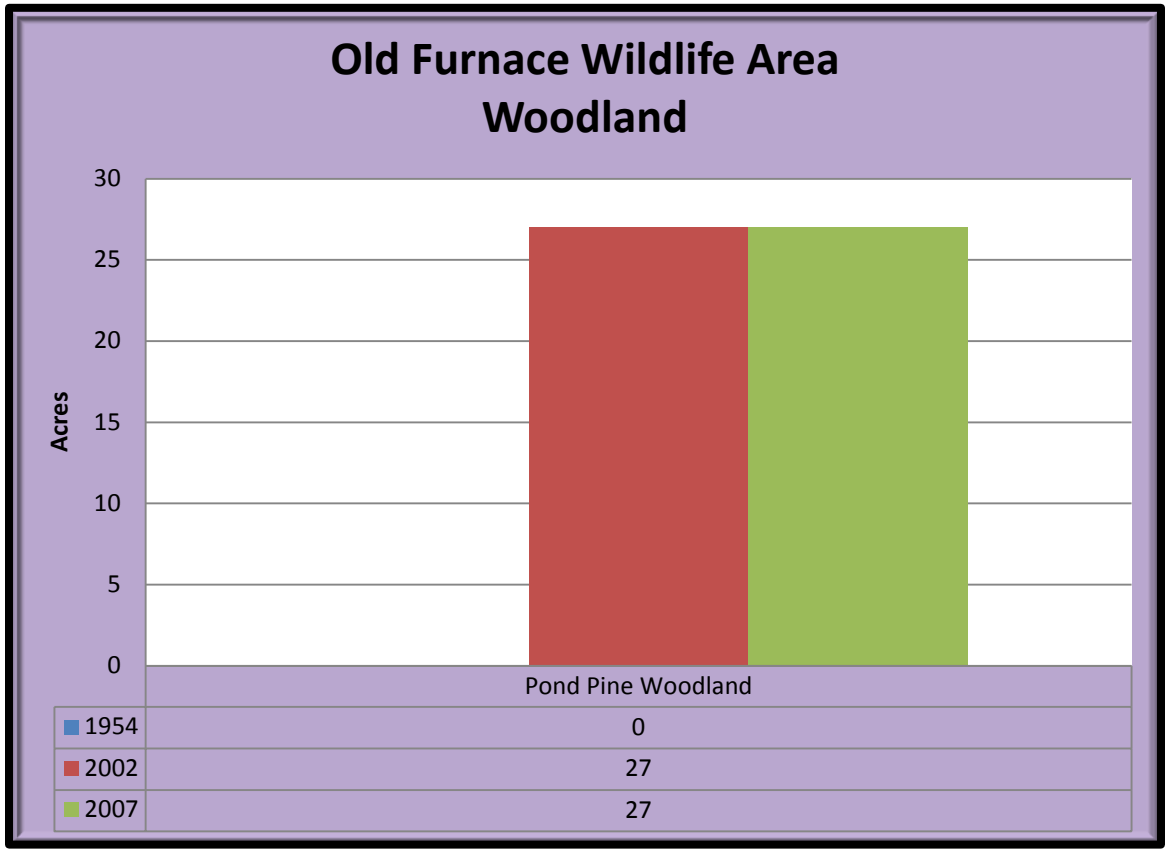


Figure 3.3. Woodland at Old Furnace Wildlife Area (1954, 2002, and 2007)

Old Furnace Wildlife Area Woodland (Figure 3.3): Pond Pine Woodland is the only woodland present in the wildlife area.

Natural Capital (Table 3.3)

Woodland has grown into the Northeast Section and currently has a value of $331,871/year.

Table 3.3. Natural Capital of Old Furnace Wildlife Area Woodland	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$331,871/year
2007	$331,871/year

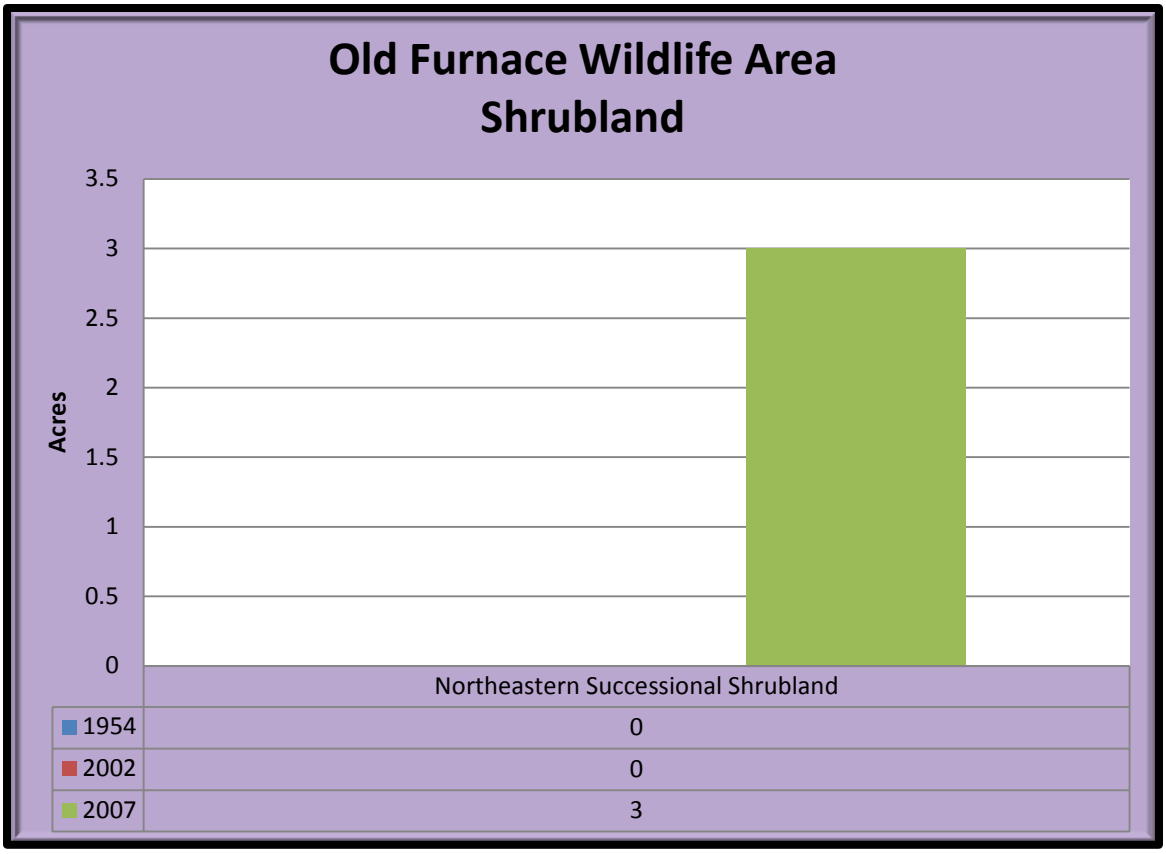


Figure 3.4. Shrubland at Old Furnace Wildlife Area (1954, 2002, and 2007)

Old Furnace Wildlife Area Shrublands (Figure 3.4): Northeastern Successional Shrubland is the only shrubland present in the wildlife area.

Natural Capital (Table 3.4)

Shrubland capital has only very recently come into the wildlife area and has a value of $874.00/year.

Table 3.4. Natural Capital of Old Furnace Wildlife Area Shrubland	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$0/year (not present)
2007	$874/year

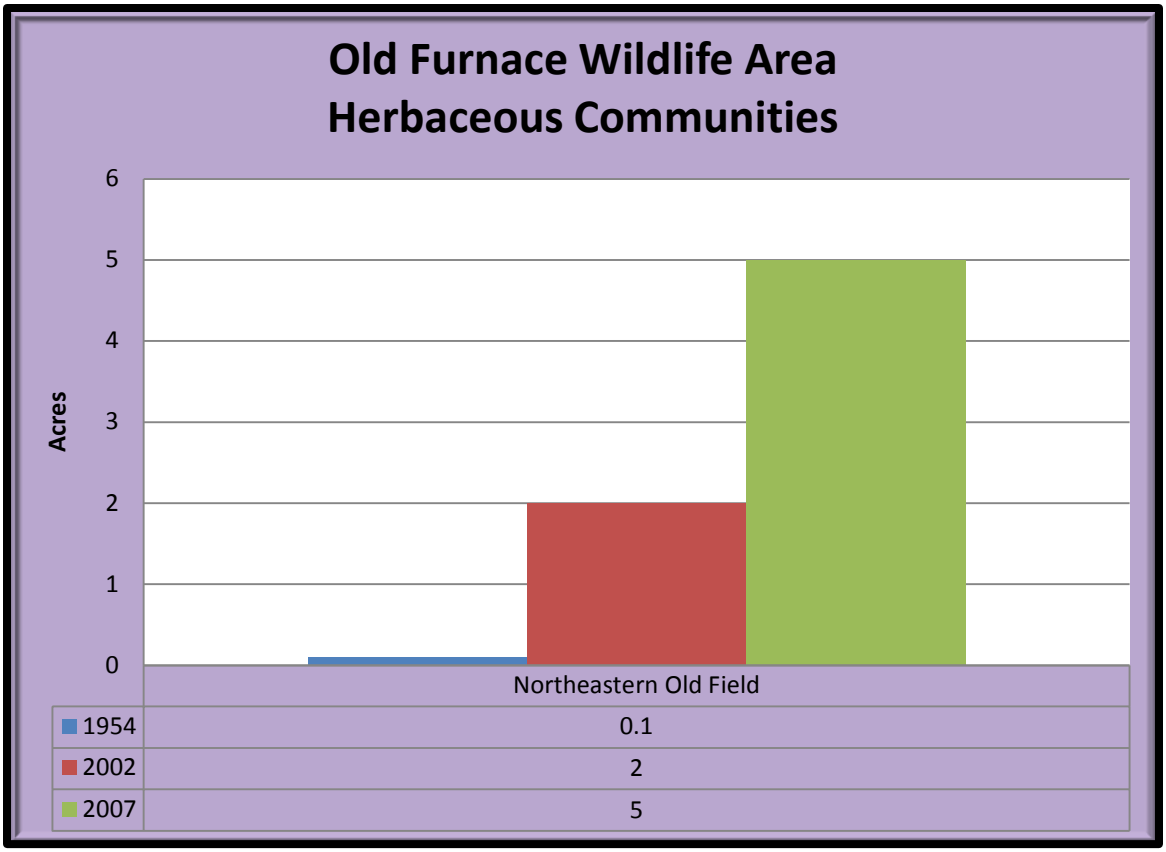


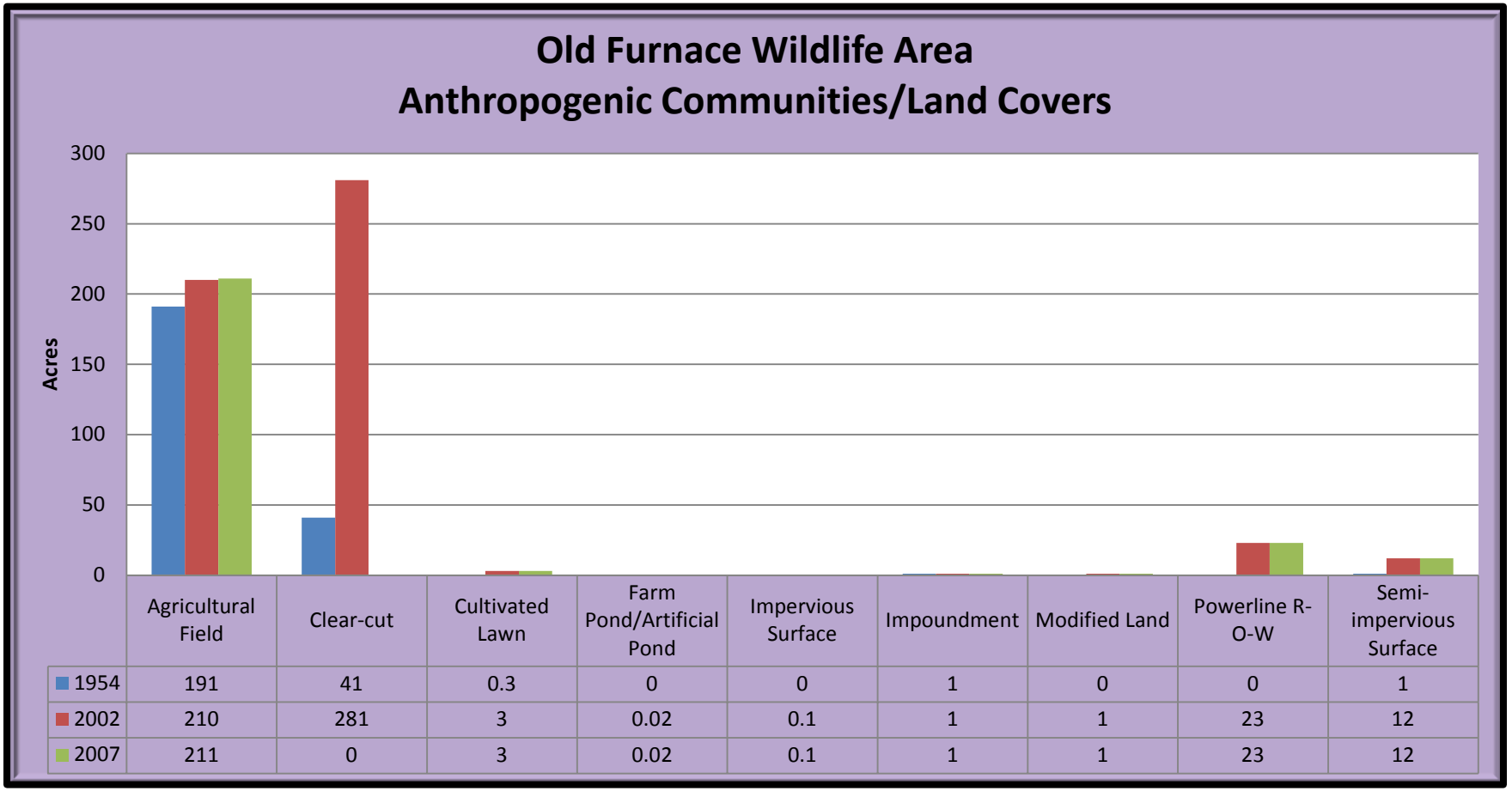
Figure 3.5. Herbaceous Communities at Old Furnace Wildlife Area (1954, 2002, and 2007)

Old Furnace Wildlife Area Herbaceous Communities (Figure 3.5): Northeastern Old Field is the only herbaceous community in the wildlife area and has been increasing in acreage.

Natural Capital (Table 3.5)

As the herbaceous communities have increased in acreage so has its capital in the wildlife area.

Table 3.5. Natural Capital of Old Furnace Wildlife Area Herbaceous Communities	
Year	**Natural Capital (in 2012 dollars)**
1954	$15/year
2002	$291/year
2007	$728/year



	Agricultural Field	Clear-cut	Cultivated Lawn	Farm Pond/Artificial Pond	Impervious Surface	Impoundment	Modified Land	Powerline R-O-W	Semi-impervious Surface
1954	191	41	0.3	0	0	1	0	0	1
2002	210	281	3	0.02	0.1	1	1	23	12
2007	211	0	3	0.02	0.1	1	1	23	12

Figure 3.6. Anthropogenic Communities at Old Furnace Wildlife Area (1954, 2002, and 2007)

Old Furnace Wildlife Area Anthropogenic Communities/Land Covers (Figure 3.6): Old Furnace Wildlife Area has a lot of anthropogenic communities/land covers of which agricultural field is the largest at 211 acres. A powerline R-O-W which passes through the pine areas is the second largest land cover.

Natural Capital (Table 3.6)

Overall capital in anthropogenic communities/land covers in the wildlife area have been going up, being driven by increases in agricultural field.

Table 3.6. Natural Capital of Old Furnace Wildlife Area Anthropogenic Communities/Land Covers

Year	Natural Capital (in 2012 dollars)
1954	$16,289/year
2002	$17,493/year
2007	$17,549/year

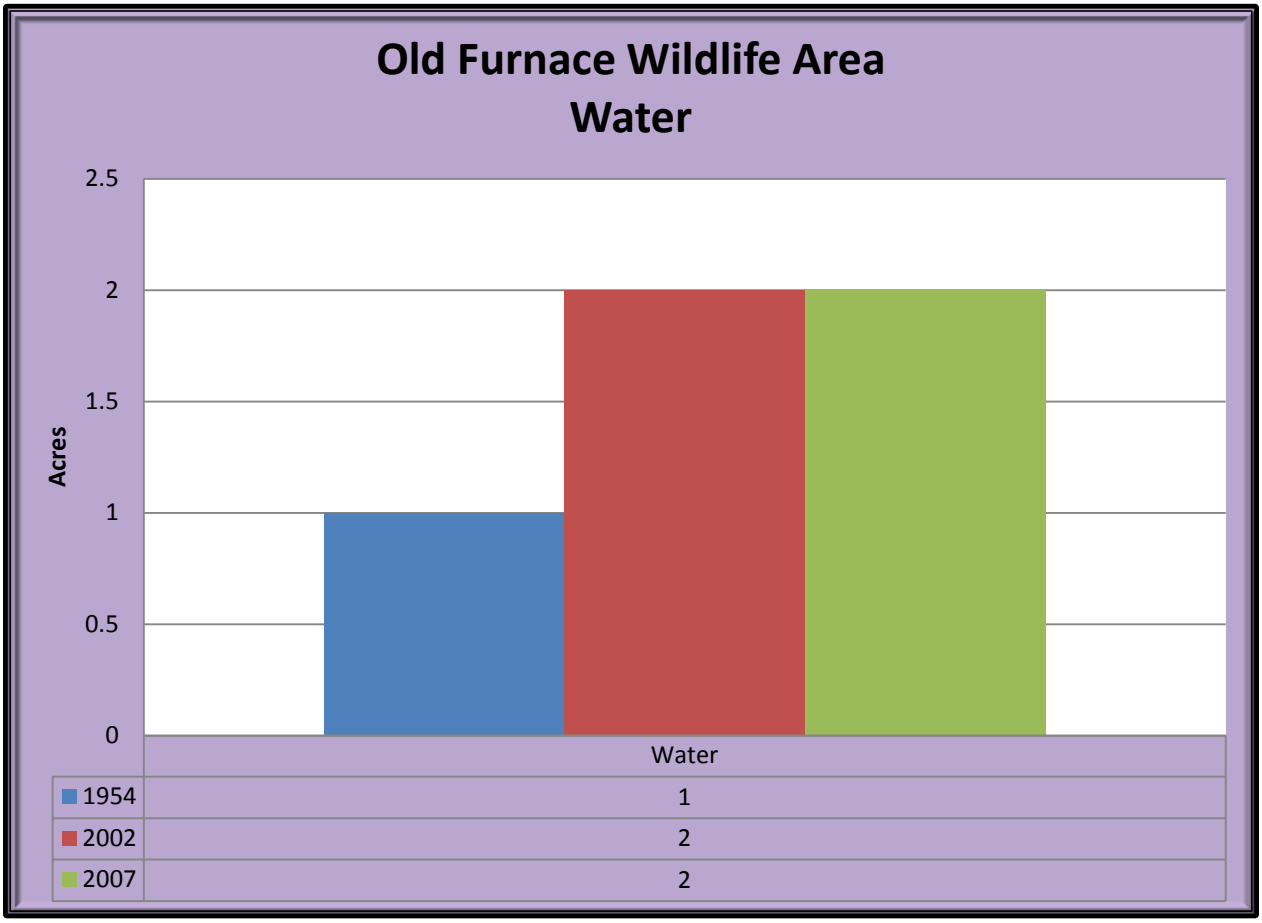


Figure 3.7. Water coverage at Old Furnace Wildlife Area (1954, 2002, and 2007)

Old Furnace Wildlife Area Water (Figure 3.7): Water coverage in Old Furnace Wildlife Area is mainly composed of the main stem of Deep Creek.

Natural Capital (Table 3.7)

Water capital in the wildlife area has increased overall since 1954, but has decreased in the recent period.

Table 3.7. Natural Capital of Old Furnace Wildlife Area Water	
Year	**Natural Capital (in 2012 dollars)**
1954	$5,335/year
2002	$11,204/year
2007	$10,830/year

CHAPTER 4: VEGETATION COMMUNITIES BY SECTION

1. Concord Pond Section

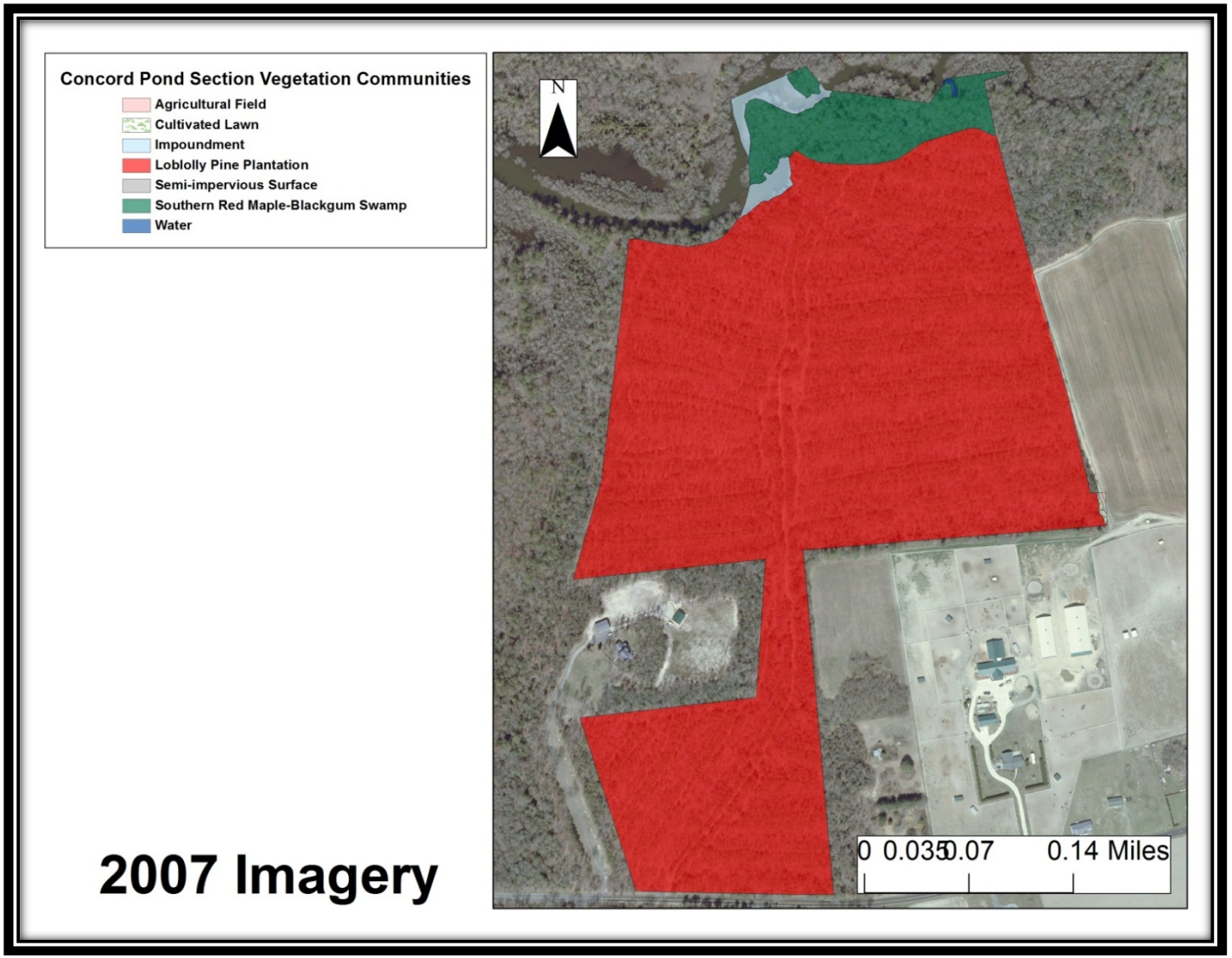


Figure 4-1.1. 2007 Vegetation Community Map of the Concord Pond Section

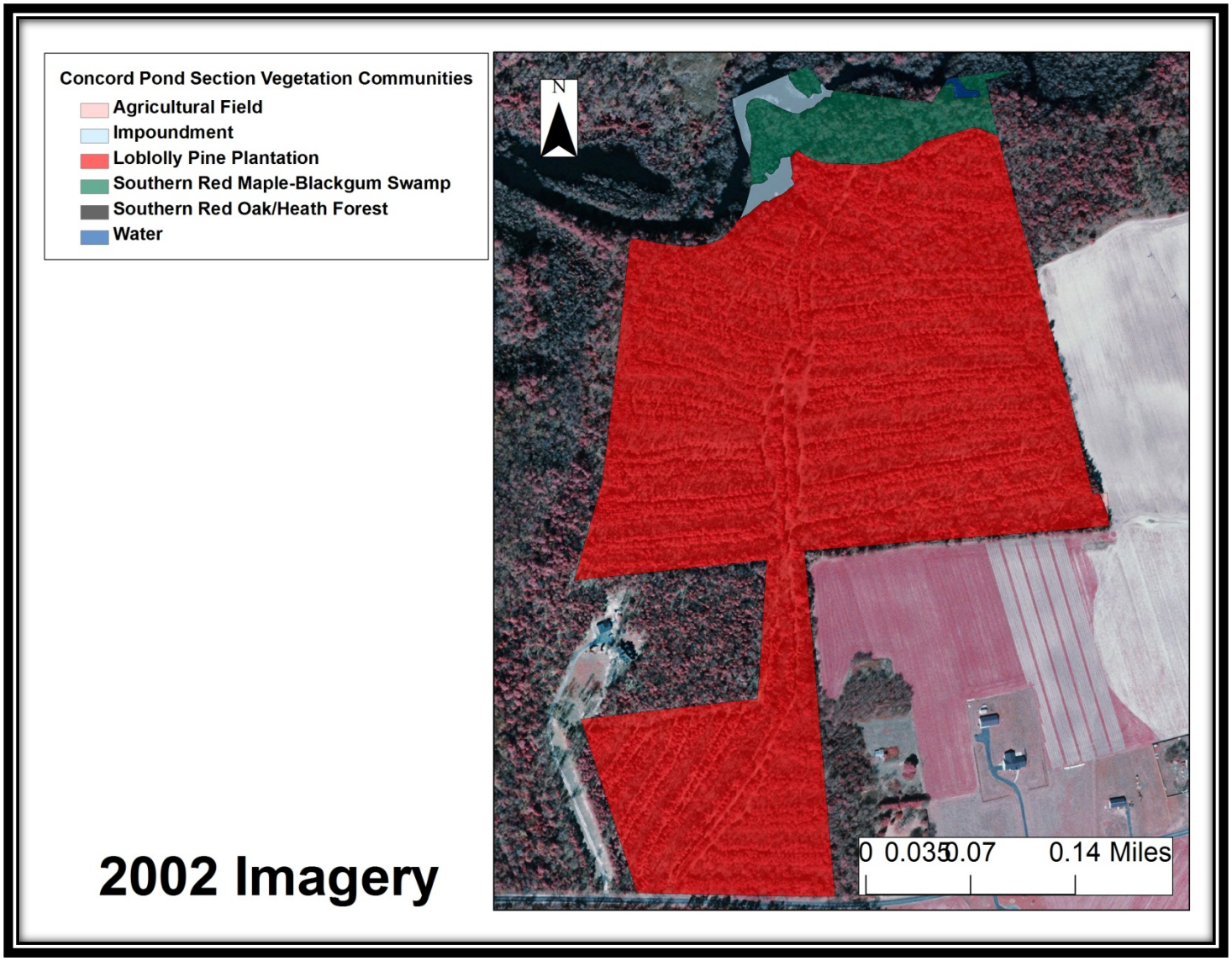


Figure 4-1.2. 2002 Vegetation Community Map of the Concord Pond Section

Figure 4-1.3. 1954 Vegetation Community of the Concord Pond Section

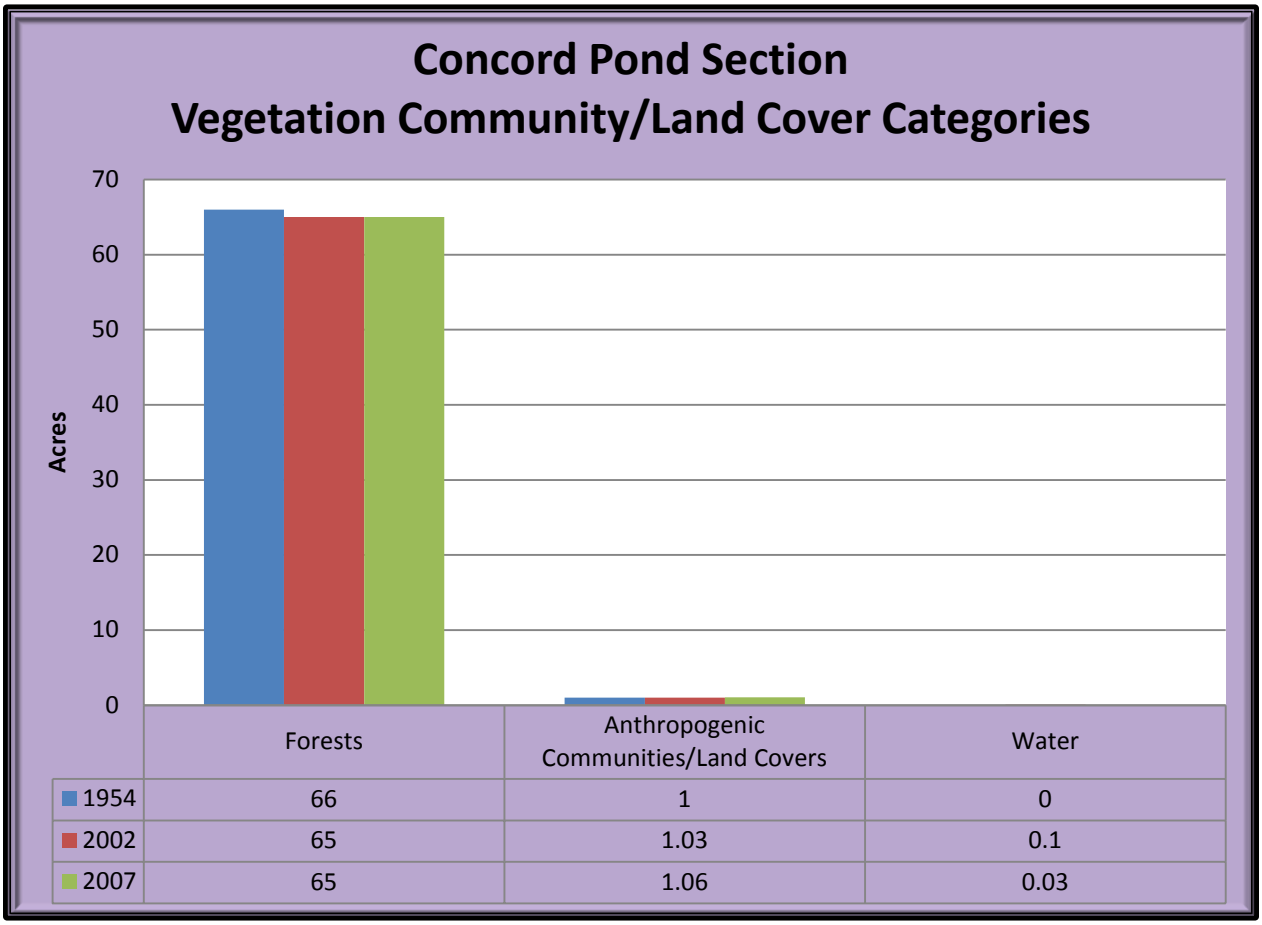


Figure 4-1.4. Concord Pond Section Vegetation Community/Land Cover Categories (1954, 2002, and 2007)

Concord Pond Section Vegetation Categories/Land Covers (Figure 4-1.4): Forestland is the largest vegetation community type, like the rest of the wildlife area, in the Concord Pond Section.

Natural Capital (Table 4-1.1)

Capital in the Concord Pond Section has gradually been going down, mainly driven by a loss in water coverage.

Table 4-1.1. Natural Capital of the Concord Pond Section	
Year	**Natural Capital (in 2012 dollars)**
1954	$78,328/year
2002	$66,571/year
2007	$66,197/year

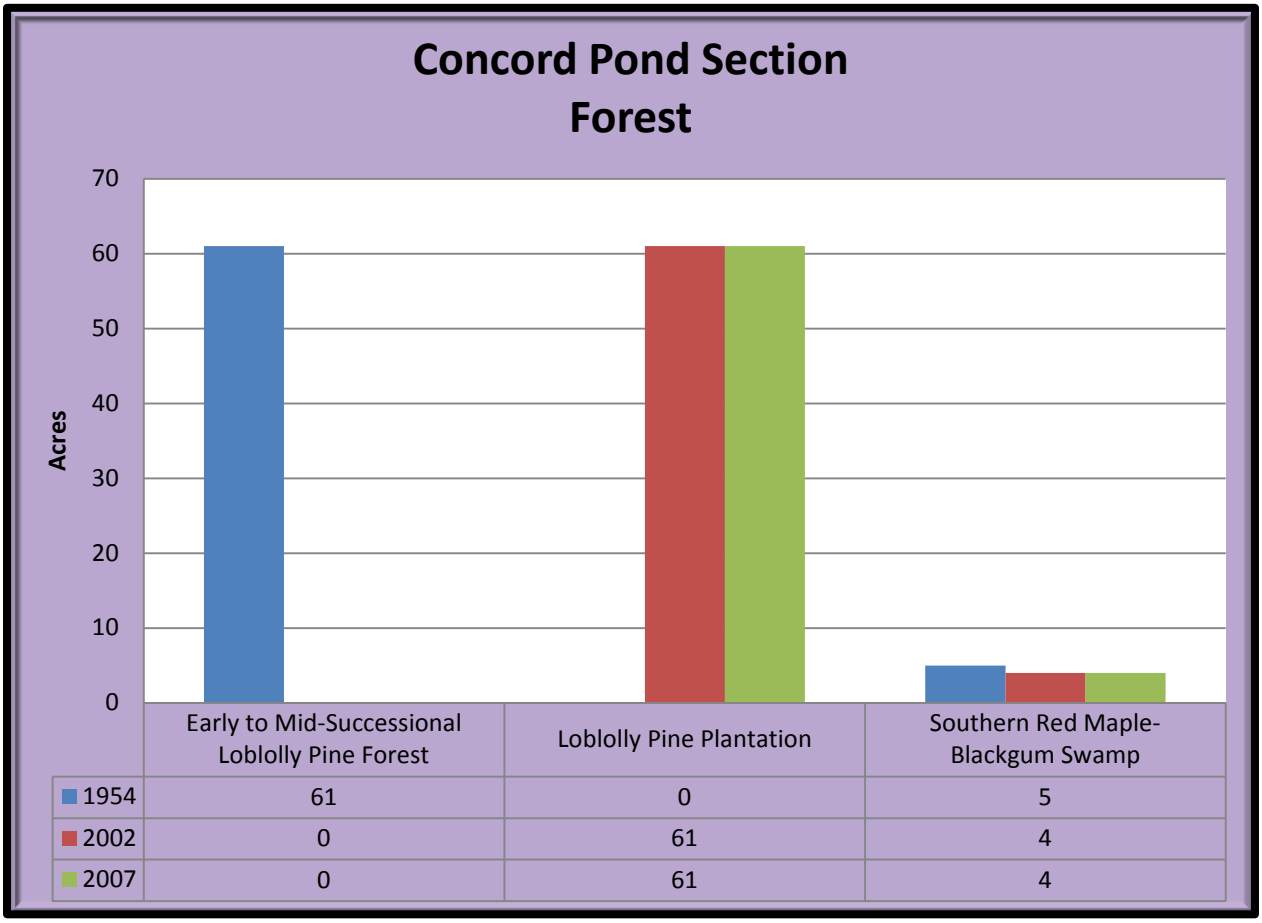


Figure 4-1.5. Concord Pond Section Forest (1954, 2002, and 2007)

Concord Pond Section Forest (Figure 4-1.5): Loblolly Pine Plantation is the largest forest type in the Concord Pond Section.

Natural Capital (Table 4-1.2)

Capital of forest in the Concord Pond Section has declined with a loss in acreage of Southern Red Maple-Blackgum Swamp.

Table 4-1.2. Natural Capital of Concord Pond Section Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$72,993/year
2002	$60,701/year
2007	$60,701/year

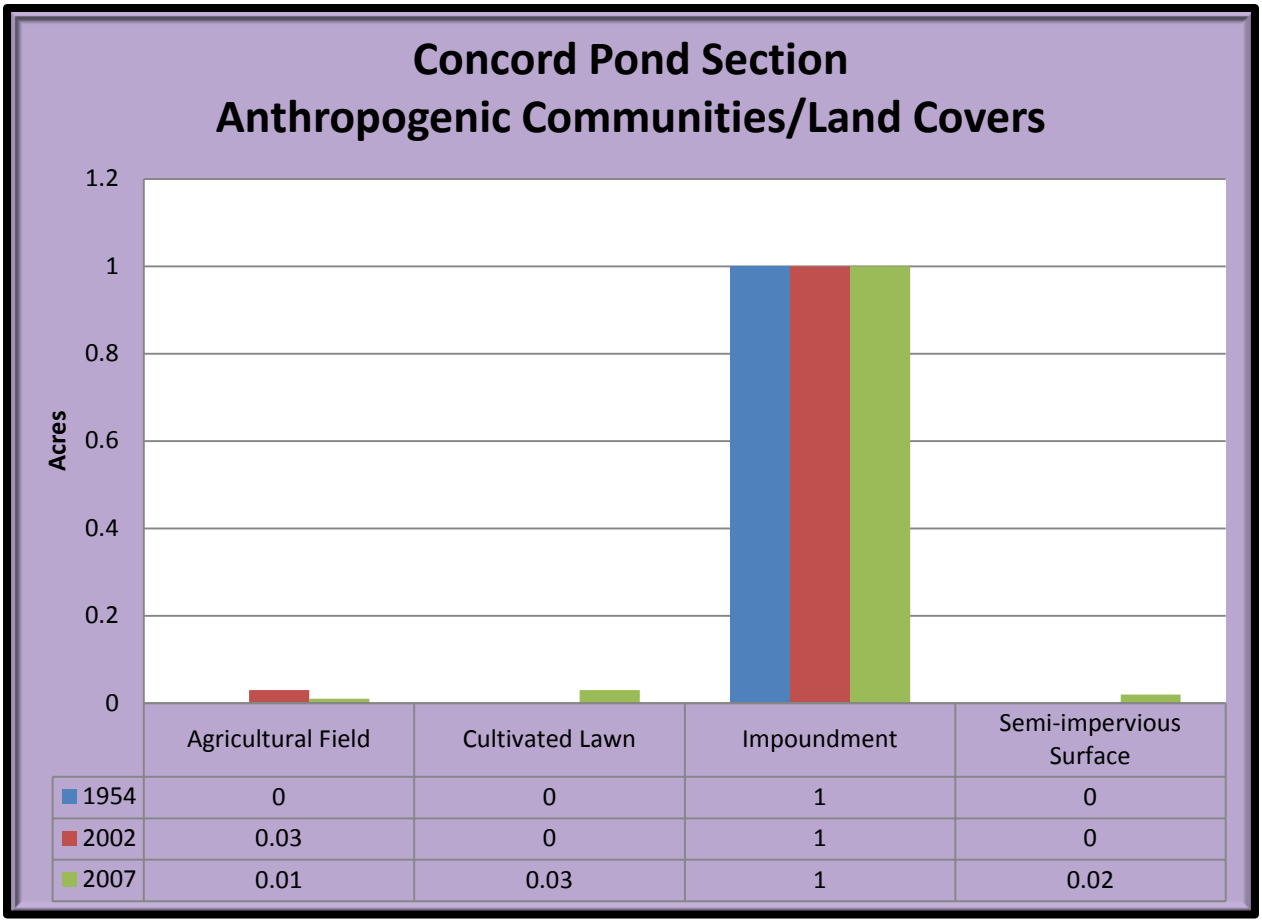


Figure 4-1.6. Concord Pond Section Anthropogenic Communities/Land Covers (1954, 2002, and 2007)

Concord Pond Section Anthropogenic Communities/Land Covers (Figure 4-1.6): Concord Pond (impoundment) is the largest land cover in the Concord Pond Section. All of the other land covers round to 0.1 acres.

Natural Capital (Table 4-1.3)

Impoundment and agricultural field are the only land covers with any natural capital value; an amount that has been roughly stable through the study period.

Table 4-1.3. Natural Capital of Concord Pond Section Anthropogenic Communities/Land Covers	
Year	**Natural Capital (in 2012 dollars)**
1954	$5,335/year
2002	$5,337/year
2007	$5,335/year

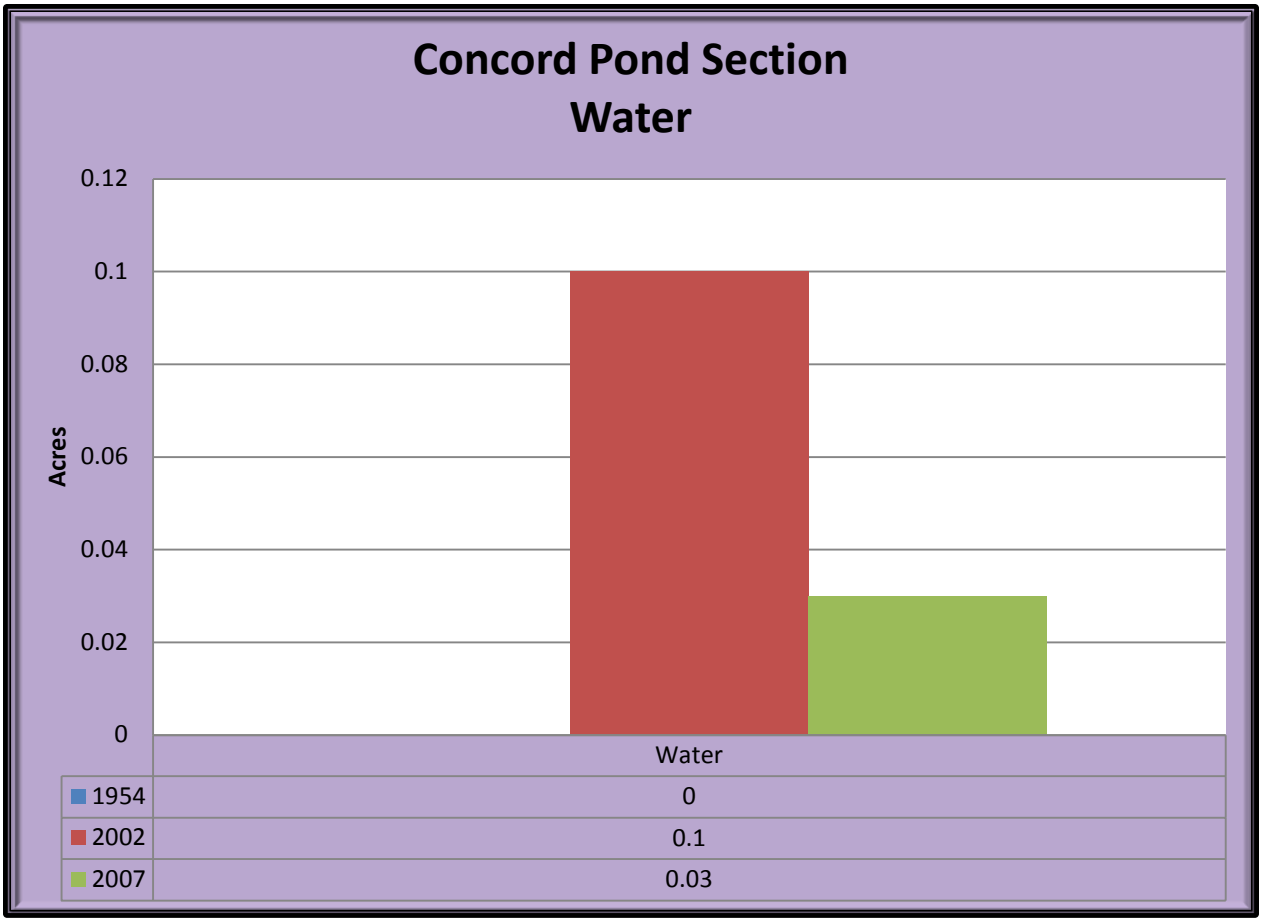


Figure 4-1.7. Concord Pond Section Water (1954, 2002, and 2007)

Concord Pond Section Water (Figure 4-1.7): Water has oscillated in the Concord Pond Section. Most of what would be called water is located in Concord Pond.

Natural Capital (Table 4-1.4)

Capital of water has been oscillating along with the acreage.

Table 4-1.4. Natural Capital of Concord Pond Section Water	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$534/year
2007	$160/year

2. Main Section

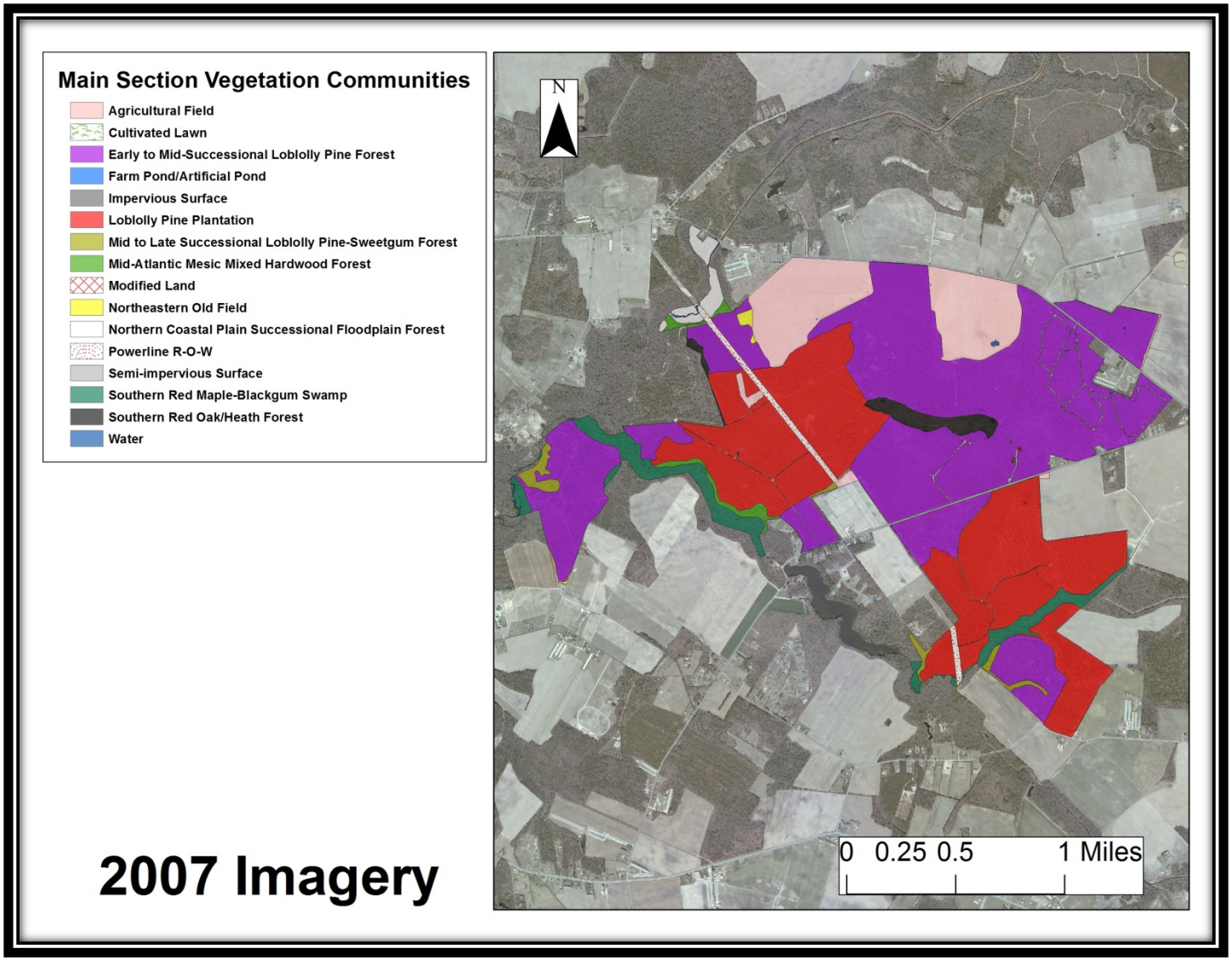


Figure 4-2.1. 2007 Vegetation Community Map of the Main Section

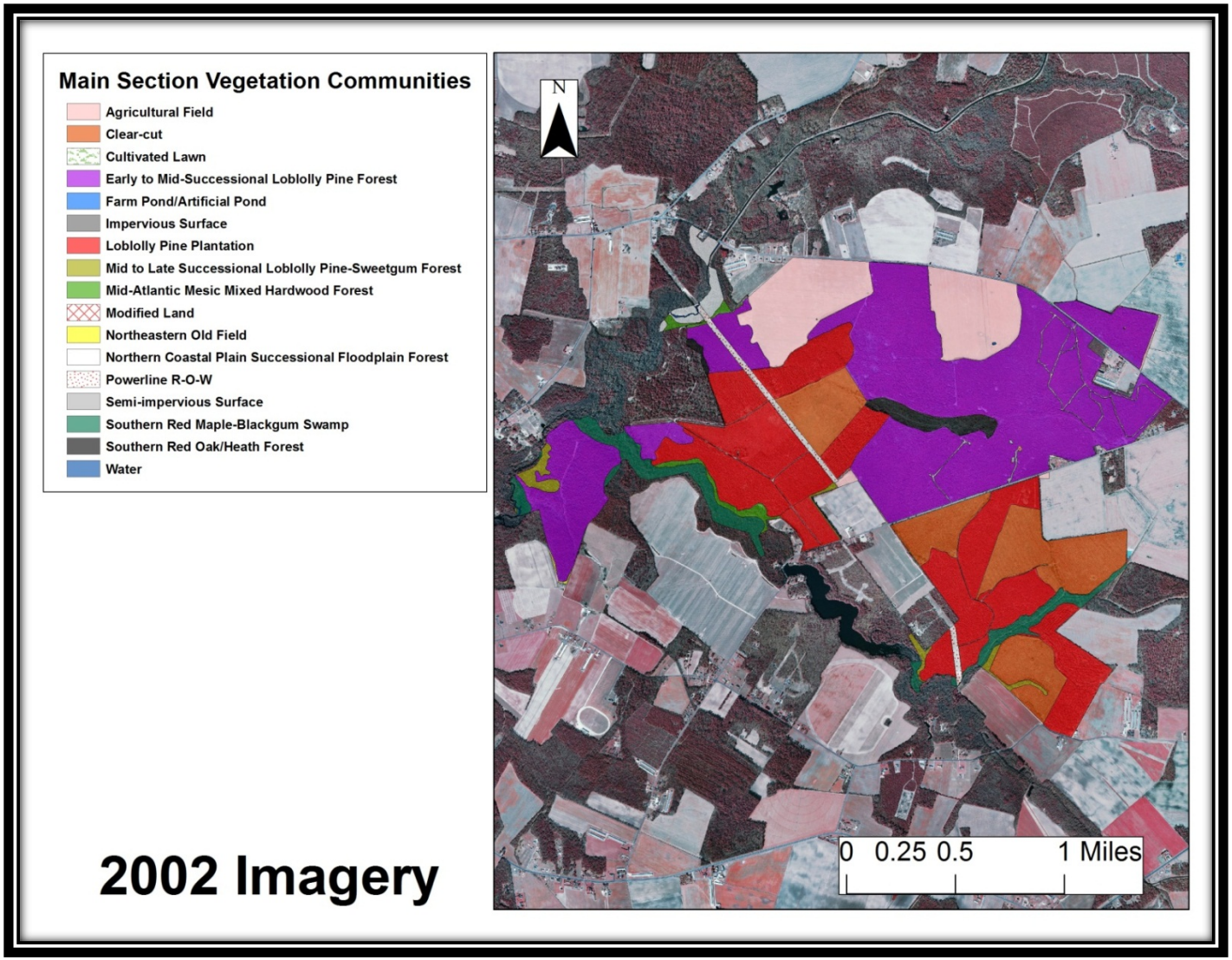


Figure 4-2.2. 2002 Vegetation Community Map of the Main Section

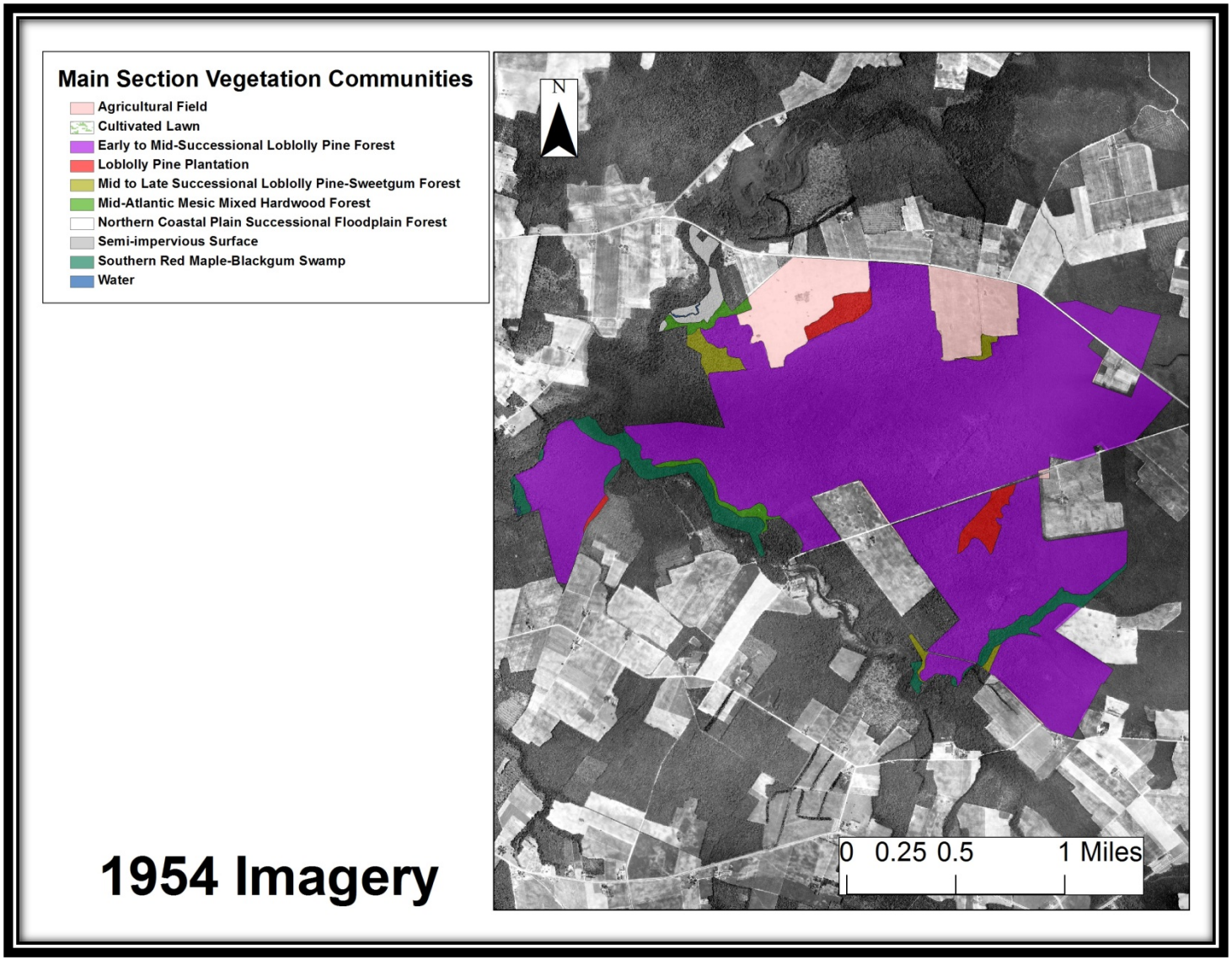


Figure 4-2.3. 1954 Vegetation Community Map of the Main Section

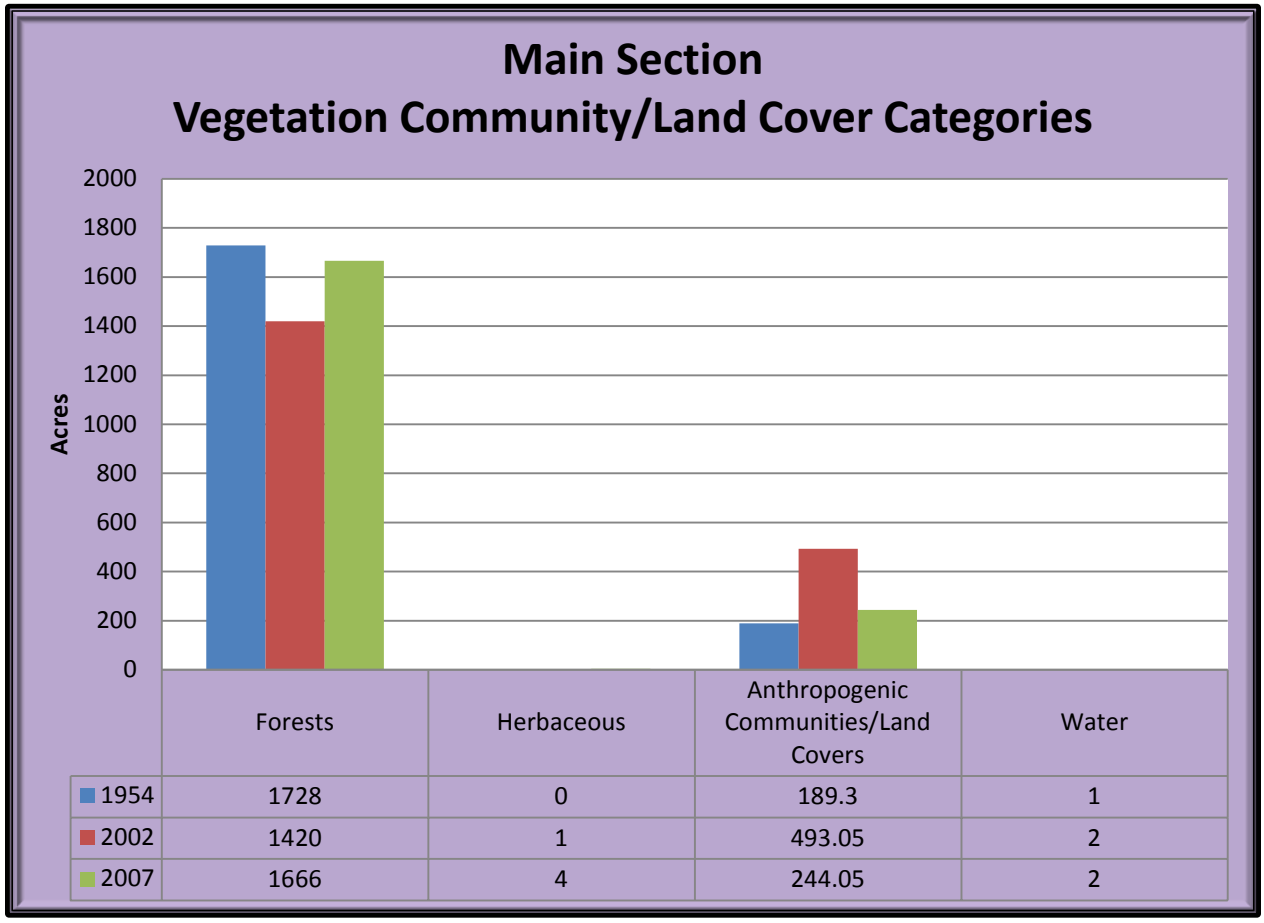


Figure 4-2.4. Main Section Vegetation Community/Land Cover Categories (1954, 2002, and 2007)

Main Section Vegetation Community/Land Covers (Figure 4-2.4): Forestland is the largest community type in the Main Section followed distantly by anthropogenic communities/land covers (244 acres).

Natural Capital (Table 4-2.1)

Capital in the Main section has gone down overall with a decreasing amount of forests. Recently, however, it has increased due to more communities maturing to forests.

Table 4-2.1. Natural Capital of the Main Section	
Year	**Natural Capital (in 2012 dollars)**
1954	$1,637,839/year
2002	$1,562,183/year
2007	$1,609,196/year

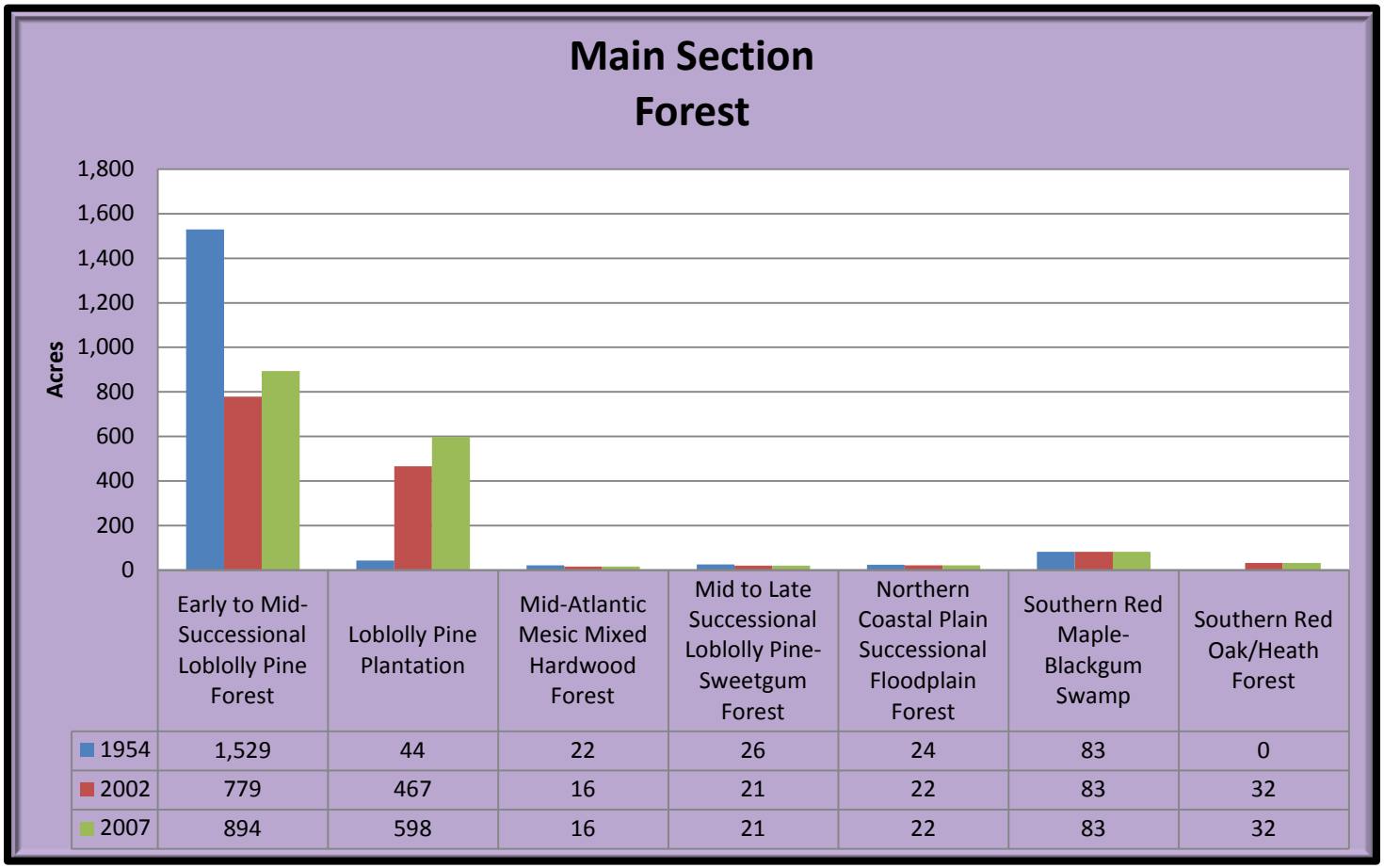


Figure 4-2.5. Main Section Forest (1954, 2002, and 2007)

Main Section Forest (Figure 4-2.5): Early to Mid-Successional Loblolly Pine Forest is the most common forest type in the Main Section, followed by Loblolly Pine Plantation.

Natural Capital (Table 4-2.2)

Capital of Main Section Forest has decreased overall with an increased amount of clear-cuts, but has increased in the recent period (2002-2007).

Table 4-2.2. Natural Capital of Main Section Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$1,612,722/year
2002	$1,539,274/year
2007	$1,585,793/year

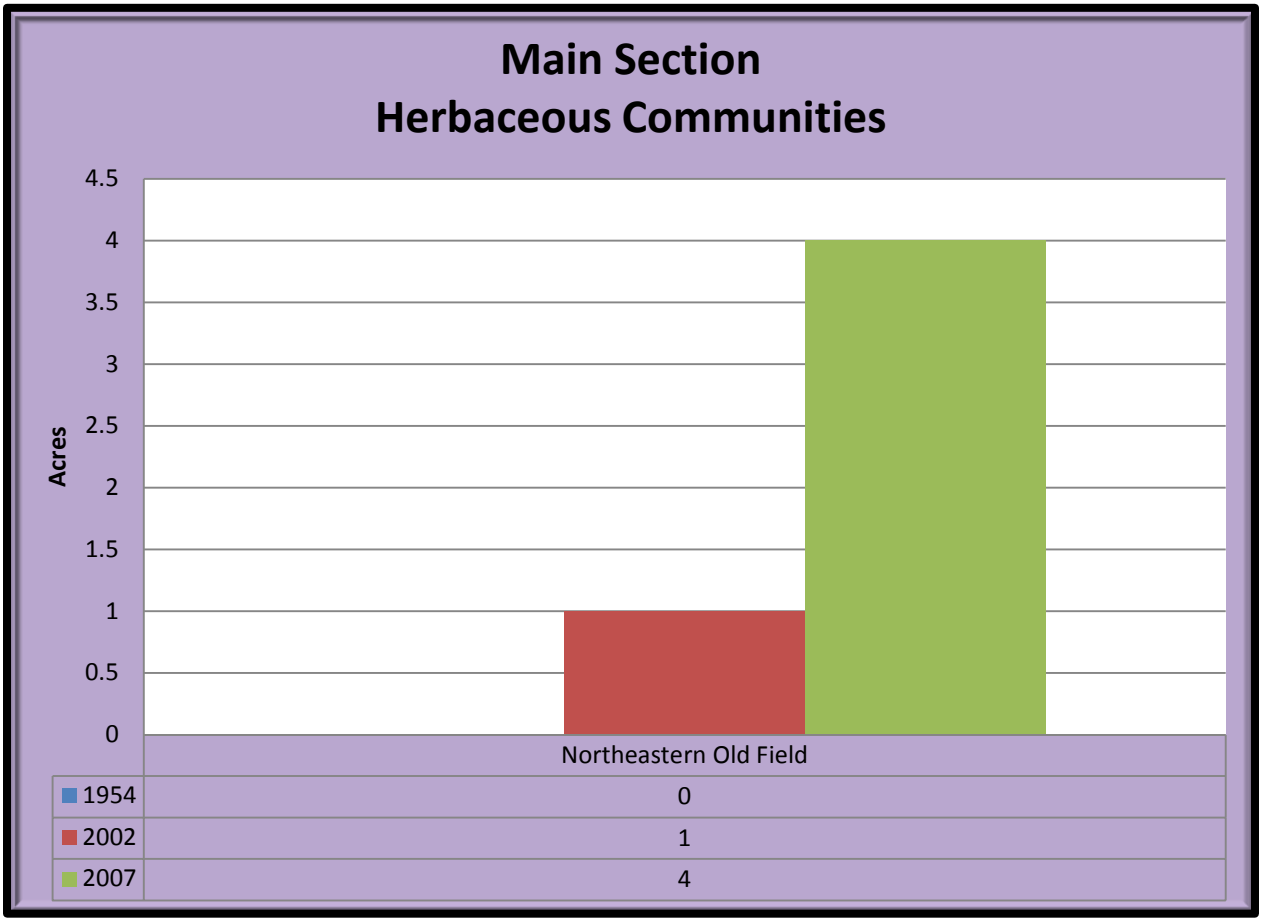


Figure 4-2.6. Main Section Herbaceous Communities (1954, 2002, and 2007)

Main Section Herbaceous Communities (Figure 4-2.6): Northeastern Old Field is the only herbaceous community present in the Main Section.

Natural Capital (Table 4-2.3)

Herbaceous communities were not present in the Main Section in 1954 and have since populated some of the abandoned agricultural fields.

Table 4-2.3. Natural Capital of Main Section Herbaceous Communities	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$146/year
2007	$583/year

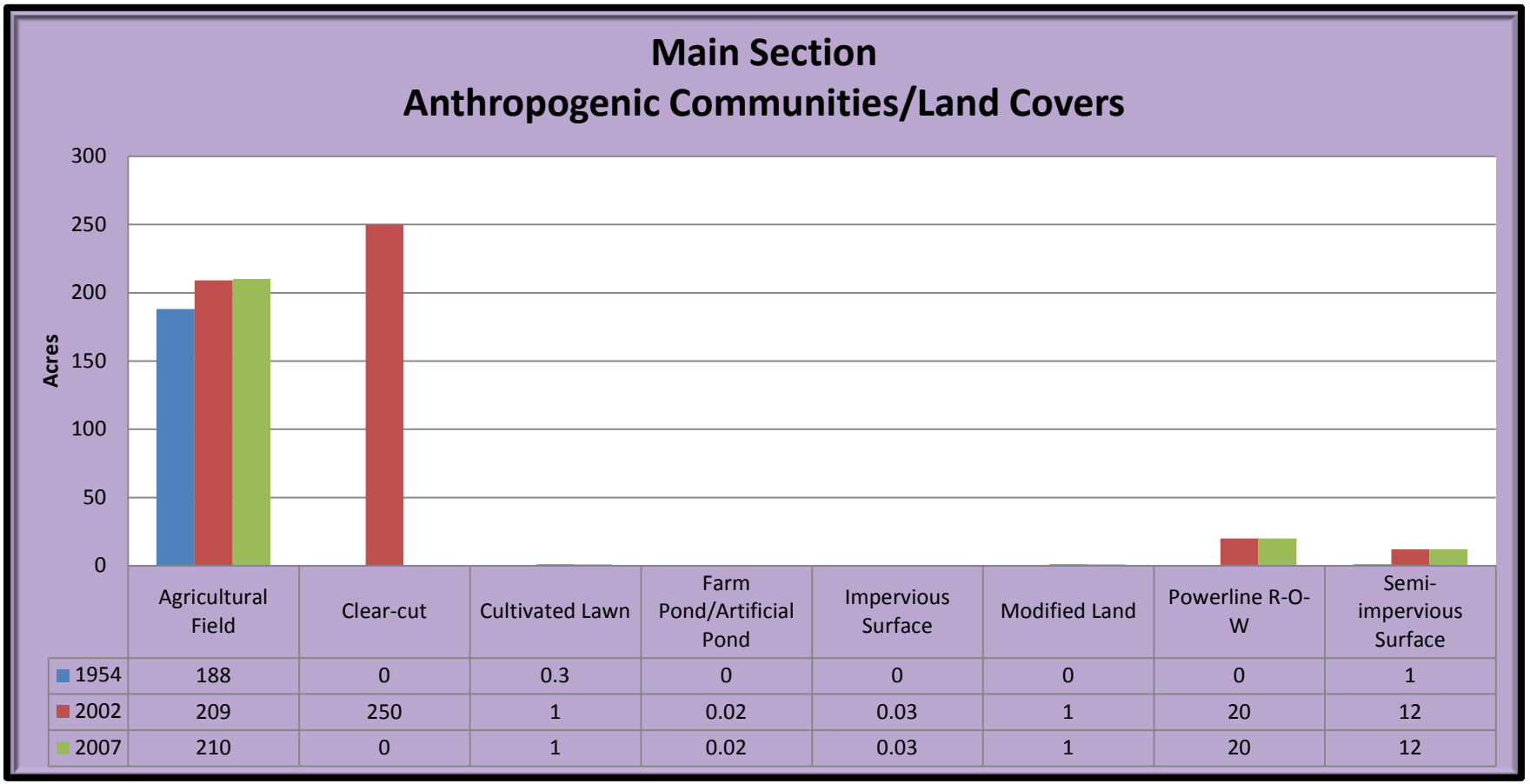


Figure 4-2.7. Main Section Anthropogenic Communities/Land Covers (1954, 2002, and 2007)

Main Section Anthropogenic Communities/Land Covers (Figure 4-2.7): Agricultural Field is the most common anthropogenic community/land cover, followed distantly by Powerline R-O-W.

Natural Capital (Table 4-2.4)

Agricultural field and ponds are the only anthropogenic communities/land covers with any capital value. Overall they have gone up with increasing acreage in agricultural fields.

Table 4-2.4. Natural Capital of Main Section Anthropogenic Communities/Land Covers

Year	Natural Capital (in 2012 dollars)
1954	$10,782/year
2002	$12,093/year
2007	$12,150/year

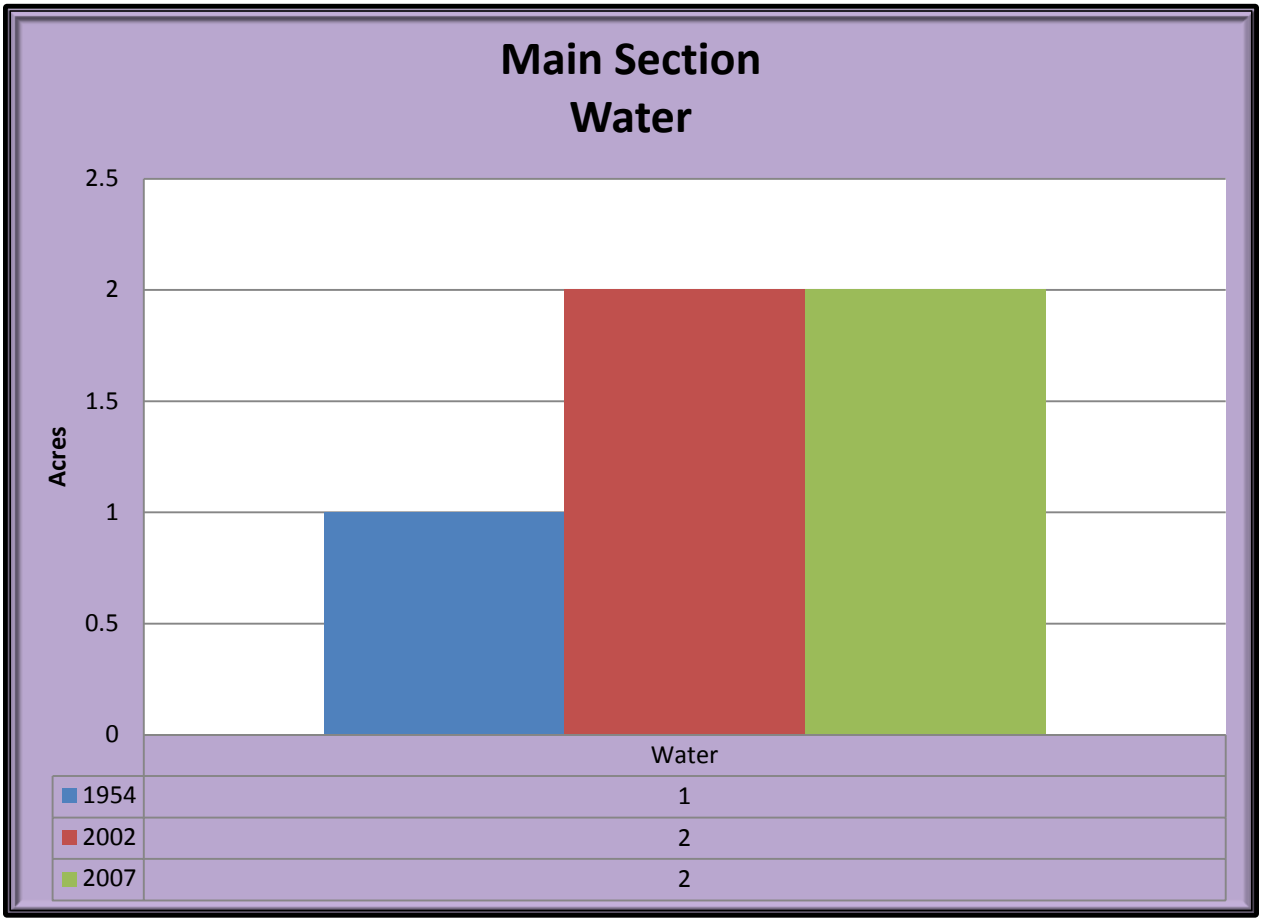


Figure 4-2.8. Main Section Water (1954, 2002, and 2007)

Main Section Water (Figure 4-2.8): The main stem of Deep Creek makes up most of the water coverage in the main section.

Natural Capital (Table 4-2.4)

Capital of water has been going up with increasing acreage.

Table 4-2.4. Natural Capital of Main Section Water	
Year	**Natural Capital (in 2012 dollars)**
1954	$5,335/year
2002	$10,670/year
2007	$10,670/year

3. Middleford Section

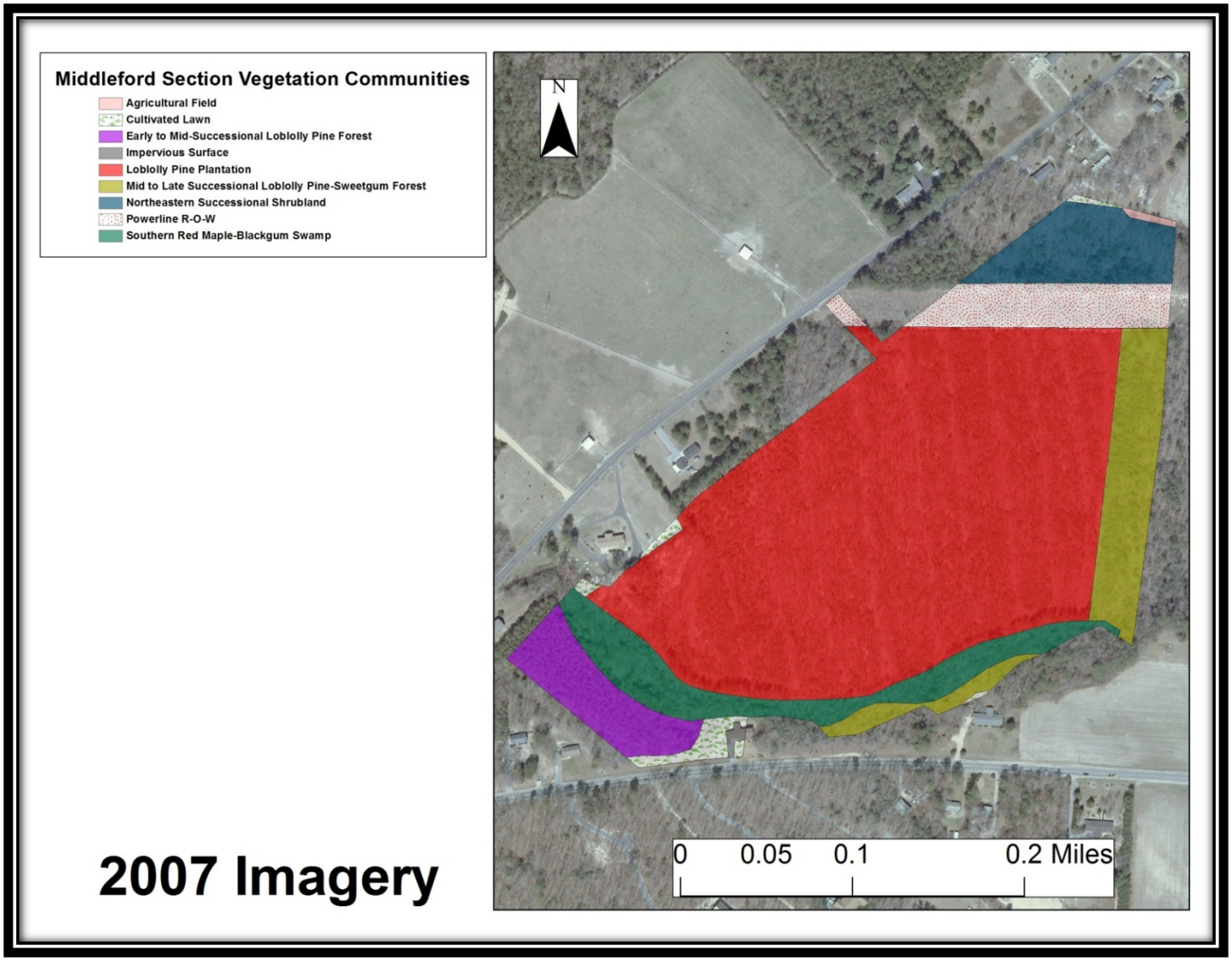


Figure 4-3.1. 2007 Vegetation Community Map of the Middleford Section

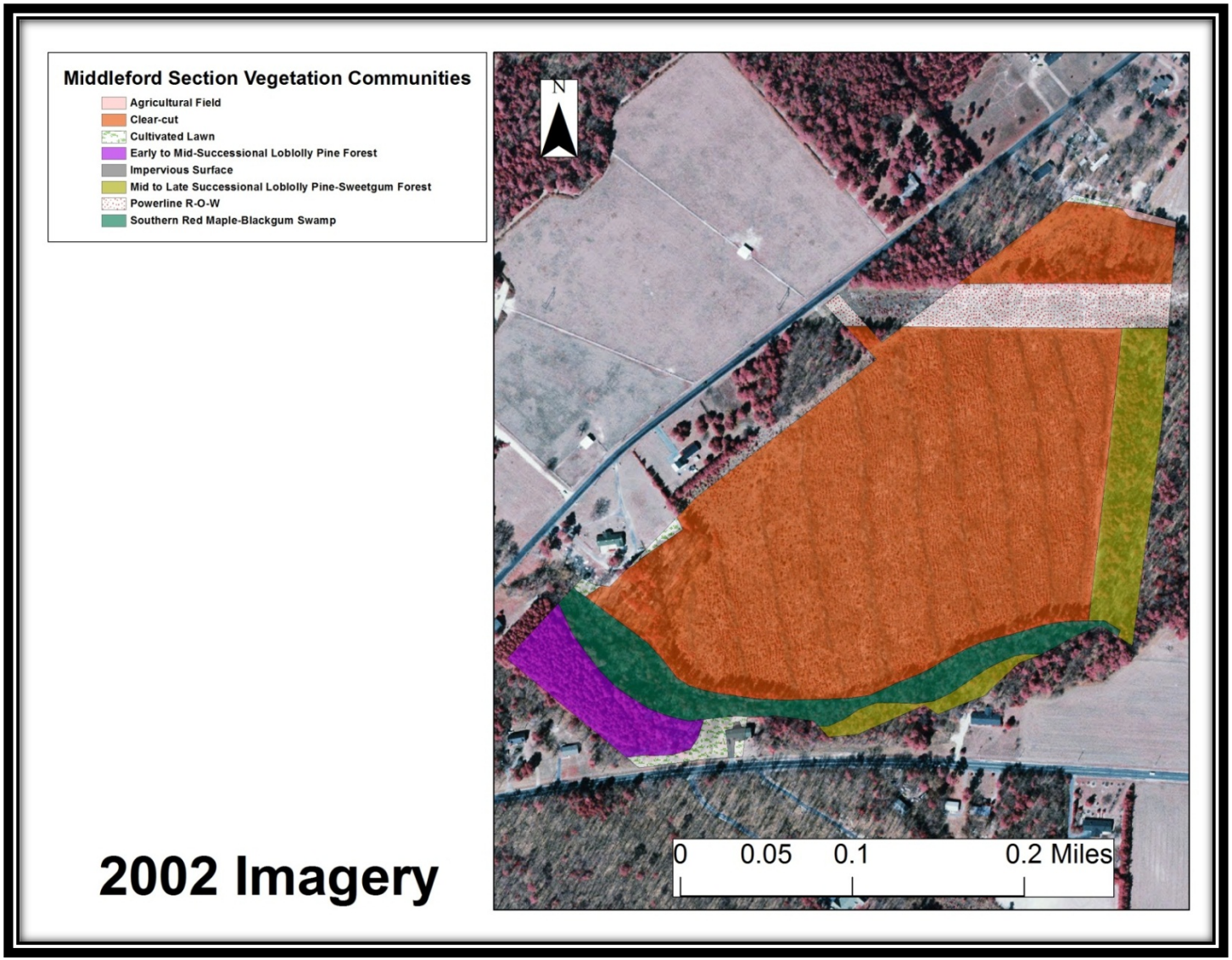


Figure 4-3.2. 2002 Vegetation Community Map of the Middleford Section

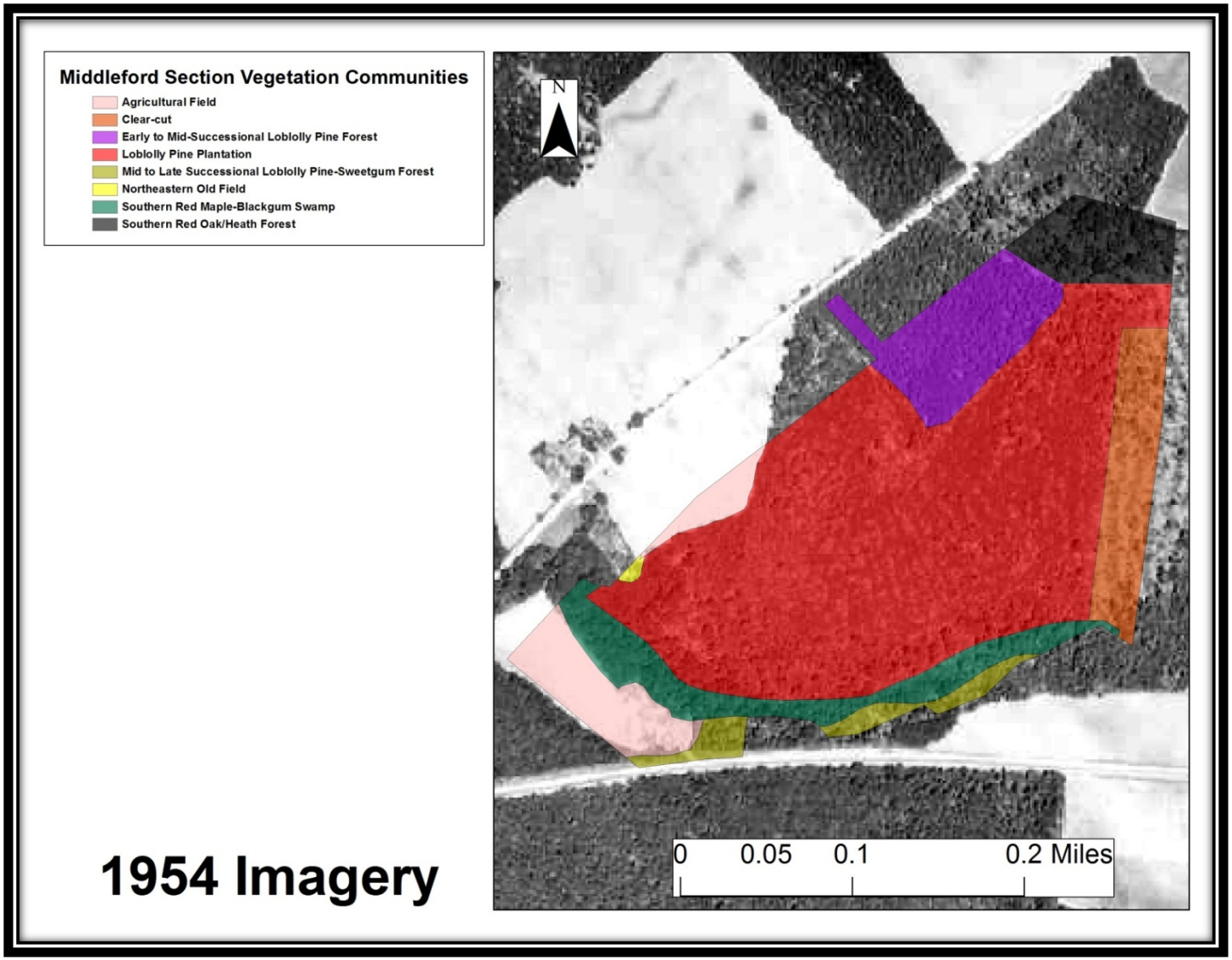


Figure 4-3.3. 1954 Vegetation Community Map of the Middleford Section

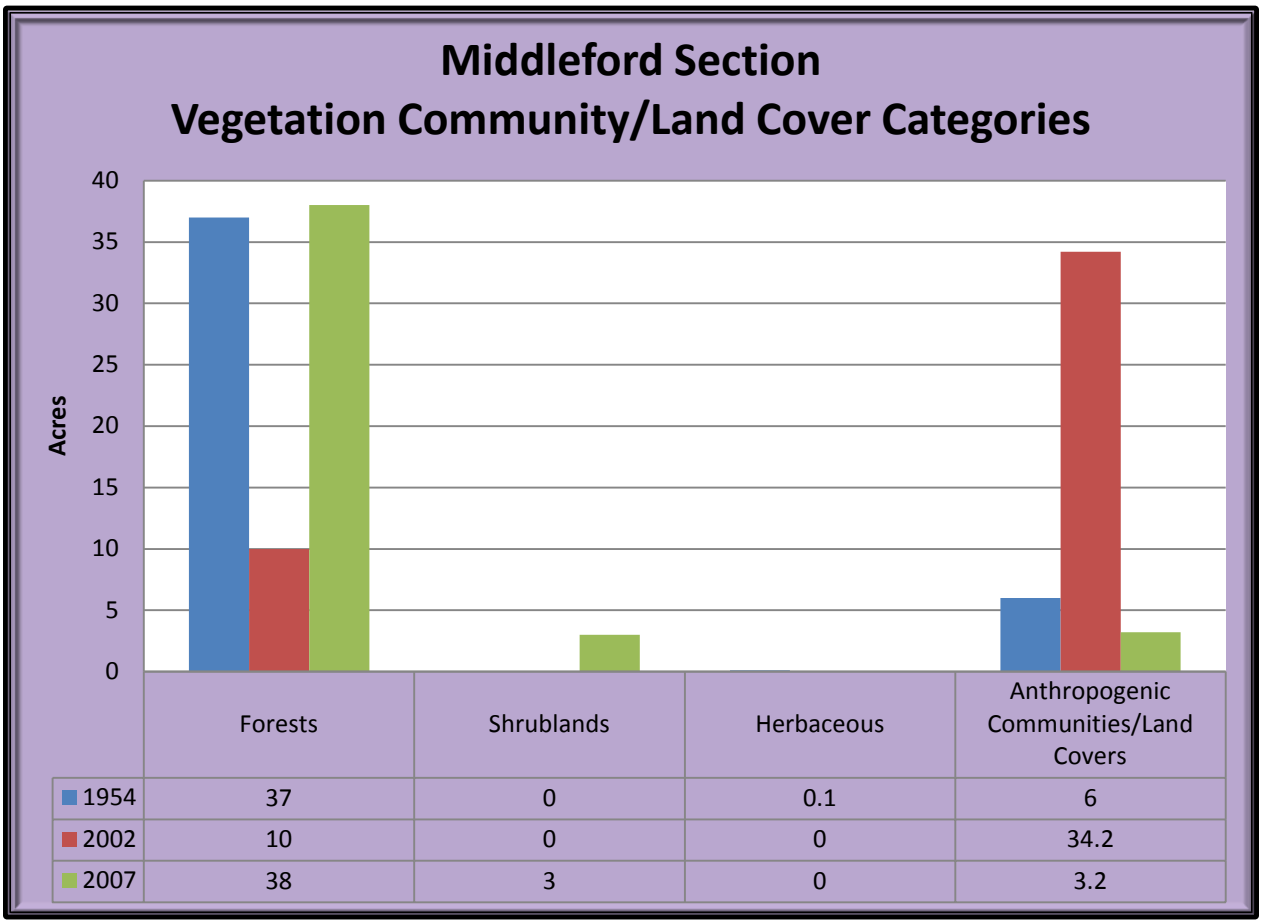


Figure 4-3.4. Middleford Section Vegetation Community/Land Cover Categories (1954, 2002, and 2007)

Middleford Section Vegetation Community/Land Covers (Figure 4-3.4): Forest is the most common vegetation community type in the Middleford Section.

Natural Capital (Table 4-3.1)

Capital in the Middleford Section has increased overall with most of the increase coming recently (2002-2007). The dip in 2002 was from the cutting of a Loblolly Pine Plantation.

Table 4-3.1. Natural Capital of the Middleford Section	
Year	**Natural Capital (in 2012 dollars)**
1954	$55,593/year
2002	$50,306/year
2007	$56,038/year

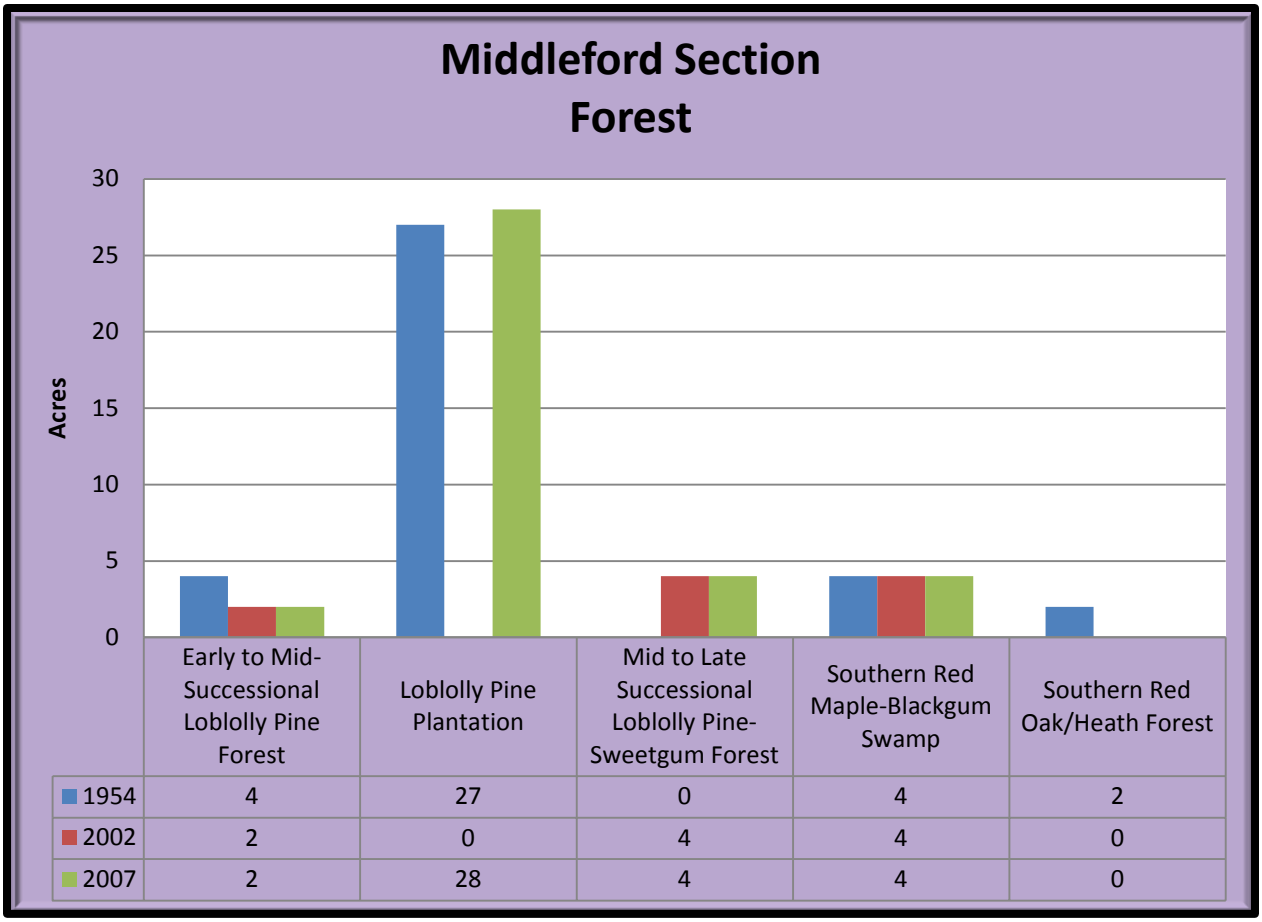


Figure 4-3.5. Middleford Section Forest (1954, 2002, and 2007)

Middleford Section Forests (Figure 4-3.5): Loblolly Pine Plantation is the most common forest type in the Middleford Section followed by Mid to Late Successional Loblolly Pine-Sweetgum Forest and Southern Red Maple-Blackgum Swamp.

Natural Capital (Table 4-3.2)

Capital of forest has gone up slightly from 1954, with a dip in 2002 from the cutting of a Loblolly Pine Plantation.

Table 4-3.2. Natural Capital of Middleford Section Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$55,406/year
2002	$50,301/year
2007	$55,595/year

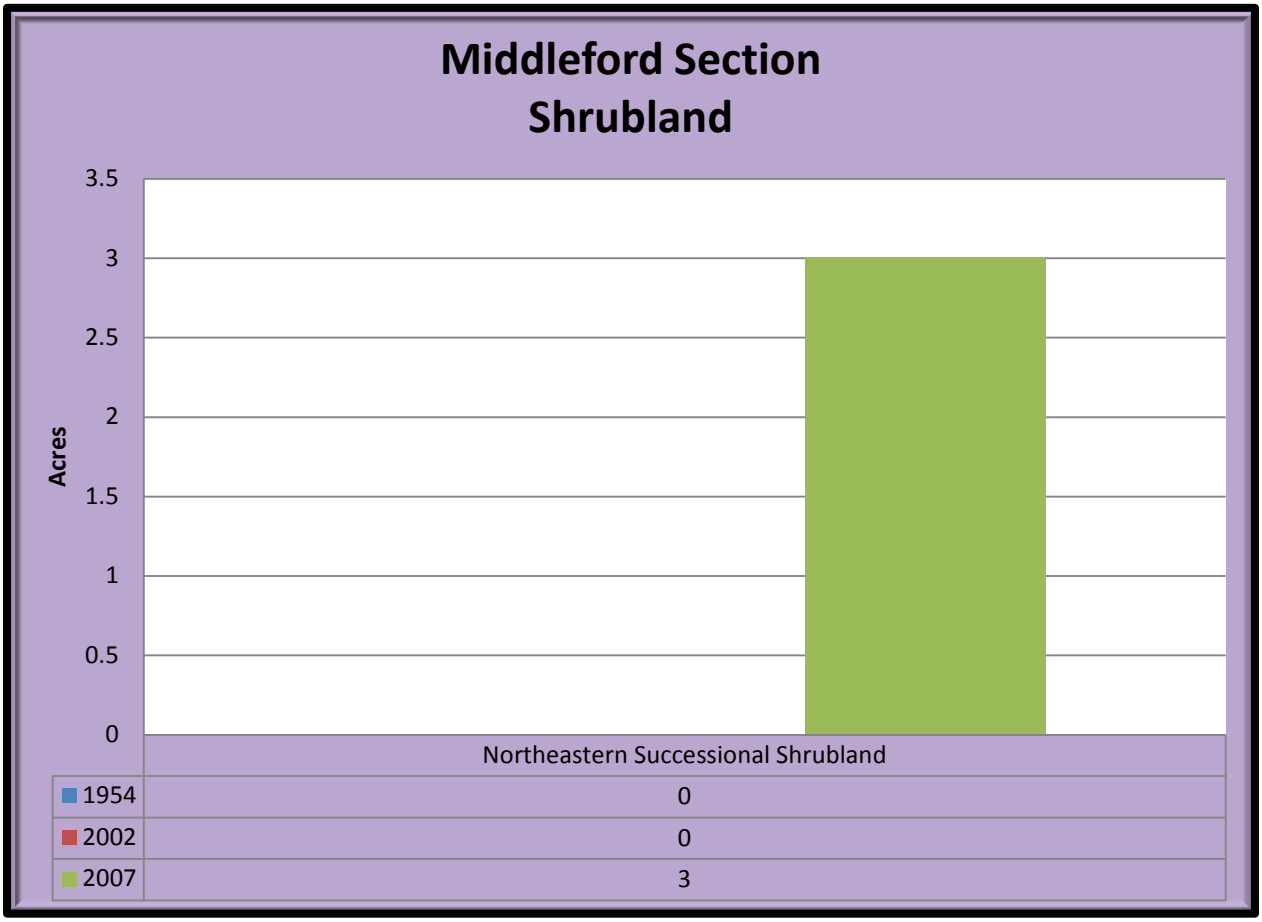


Figure 4-3.6. Middleford Section Shrubland (1954, 2002, and 2007)

Middleford Section Shrubland (Figure 4-3.6): Northeastern Successional Shrubland is the only shrubland located in the Middleford Section.

Natural Capital (Table 4-3.3)

Shrubland was not present in 1954 or 2002, but has recently come in the section with a value of $437.00.

Table 4-3.3. Natural Capital of Middleford Section Shrubland	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$0/year (not present)
2007	$437/year

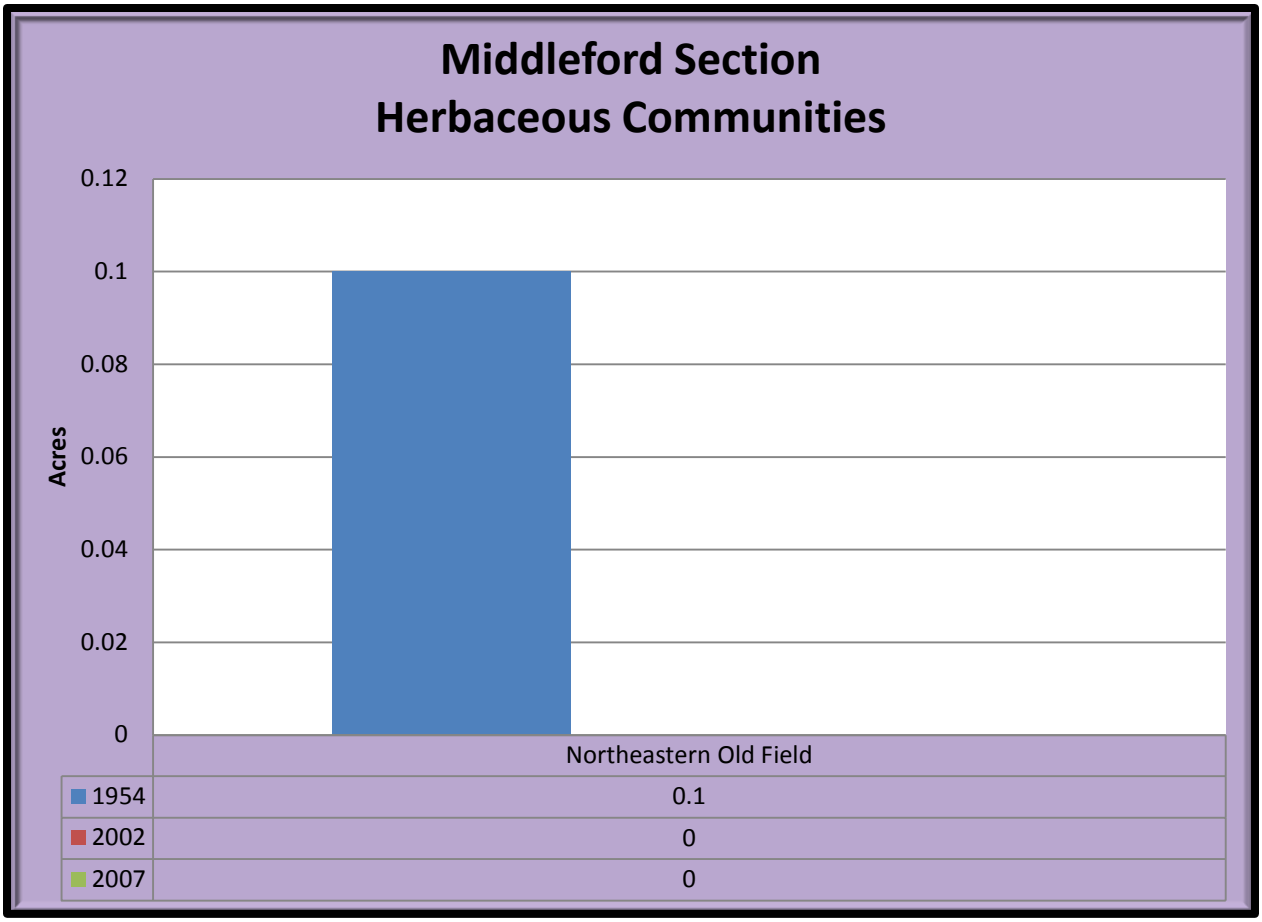


Figure 4-3.7. Middleford Section Herbaceous Communities (1954, 2002, and 2007)

Middleford Section Herbaceous Communities (Figure 4-3.7): Northeastern Old Field used to be present in the Middleford Section but left the section when it matured into a forested community.

Natural Capital (Table 4-3.4)

There is no longer any capital from herbaceous communities in the Middleford Section and in 1954 it only comprised about $15.00.

Table 4-3.4. Natural Capital of Middleford Section Herbaceous Communities	
Year	**Natural Capital (in 2012 dollars)**
1954	$15/year
2002	$0/year (not present)
2007	$0/year (not present)

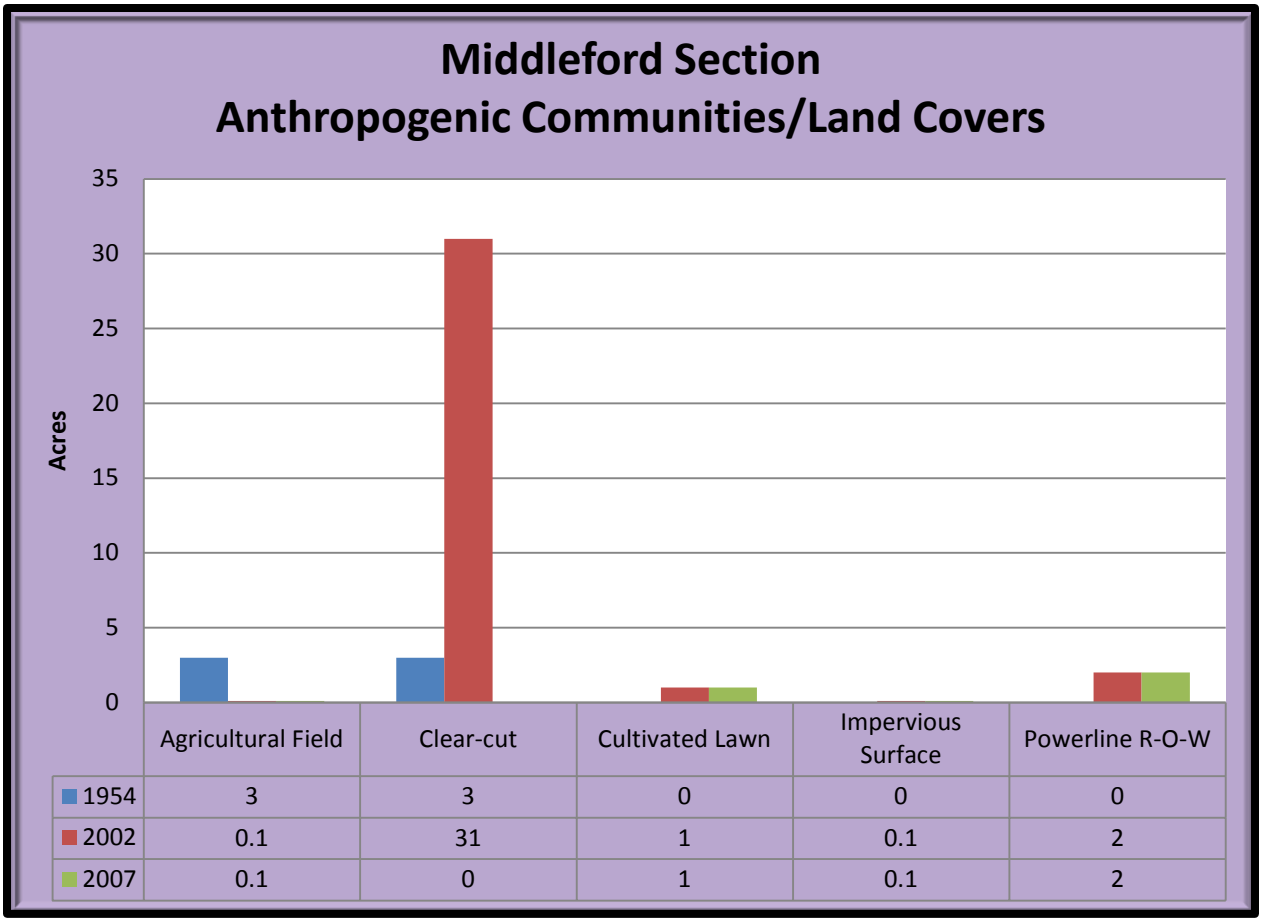


Figure 4-3.8. Middleford Section Anthropogenic Communities/Land Covers (1954, 2002, and 2007)

Middleford Section Anthropogenic Communities/Land Covers (Figure 4-3.8): Powerline R-O-W is the largest anthropogenic community/land cover in the Middleford Section.

Natural Capital (Table 4-3.5)

Agricultural field is the only anthropogenic community/land cover with any natural capital value in the Middleford Section. Since 1954, the agricultural fields that were present have been abandoned except for a very small amount giving a value of $6.00.

Table 4-3.5. Natural Capital of Middleford Section Anthropogenic Communities/Land Covers

Year	Natural Capital (in 2012 dollars)
1954	$172/year
2002	$6/year
2007	$6/year

4. Northeast Section

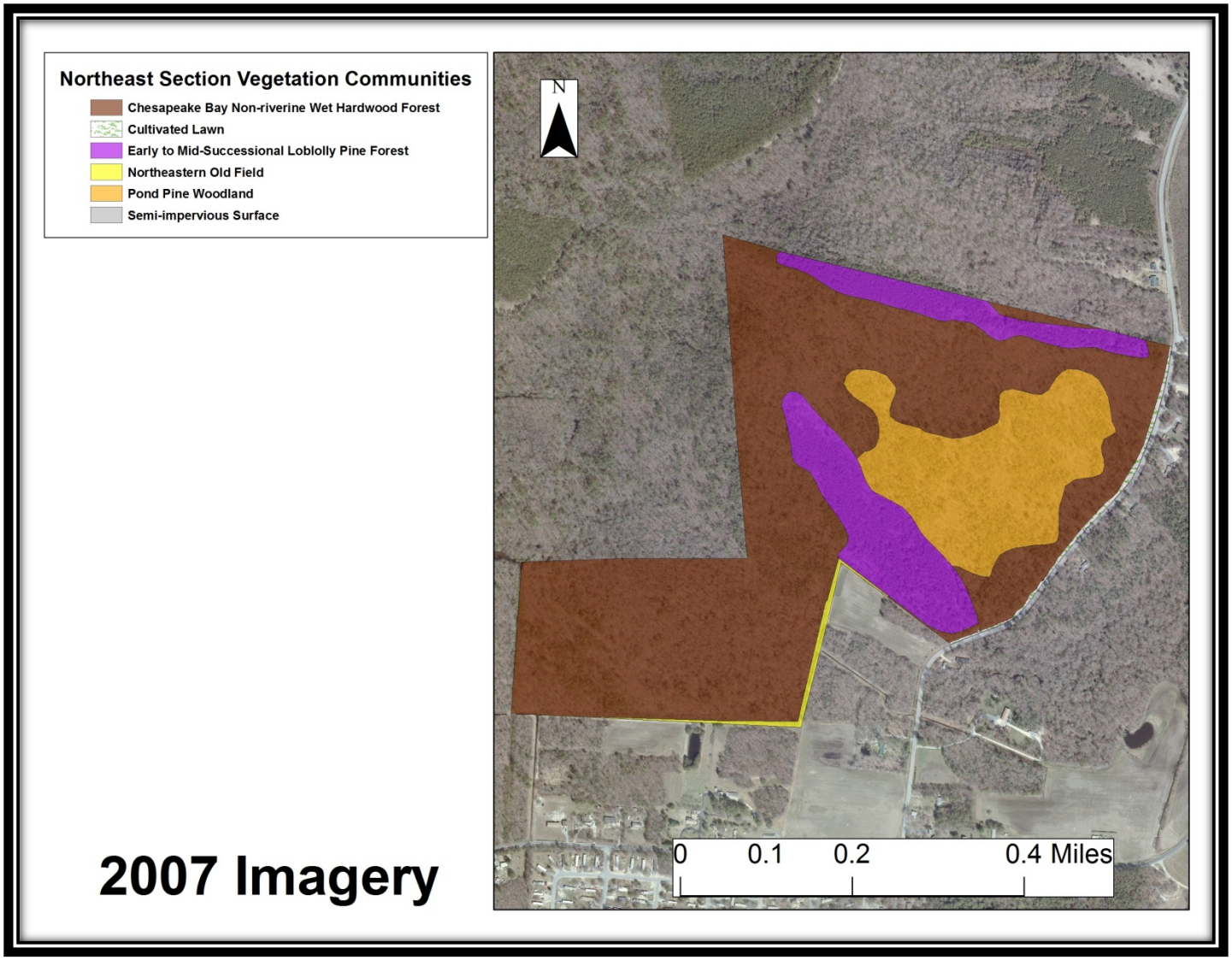


Figure 4-4.1. 2007 Vegetation Community Map of the Northeast Section

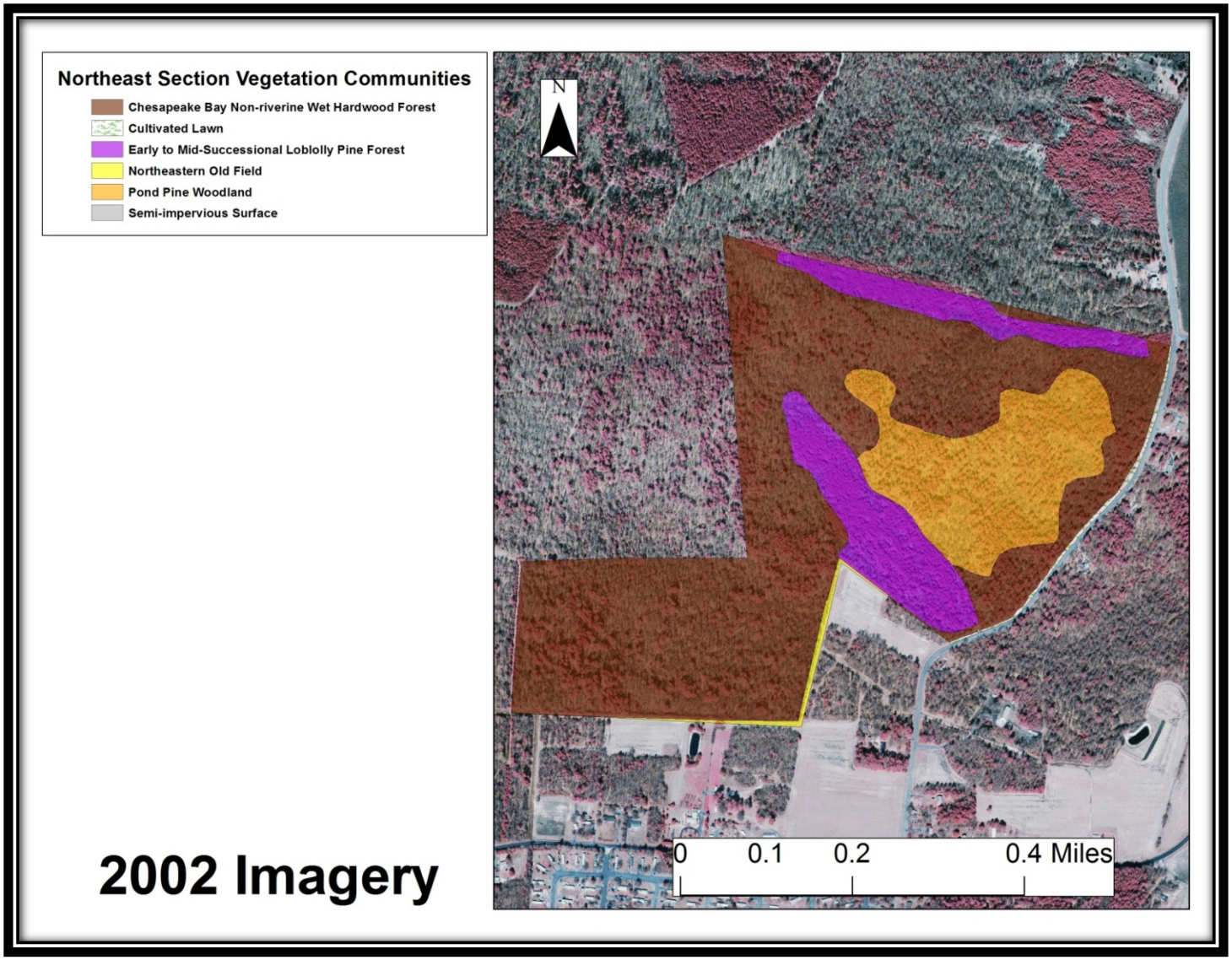


Figure 4-4.2. 2002 Vegetation Community Map of the Northeast Section

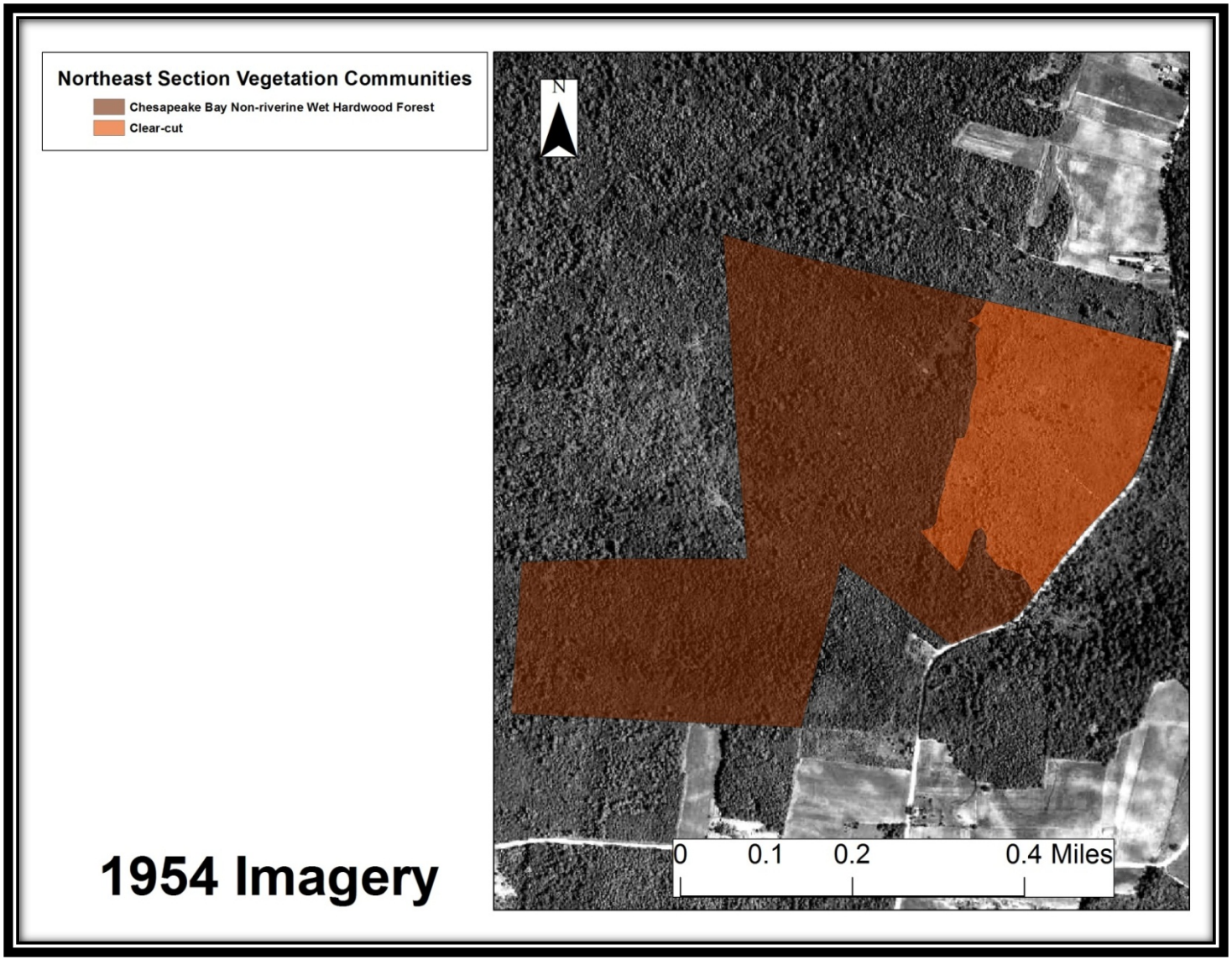


Figure 4-4.3. 1954 Vegetation Community Map of the Northeast Section

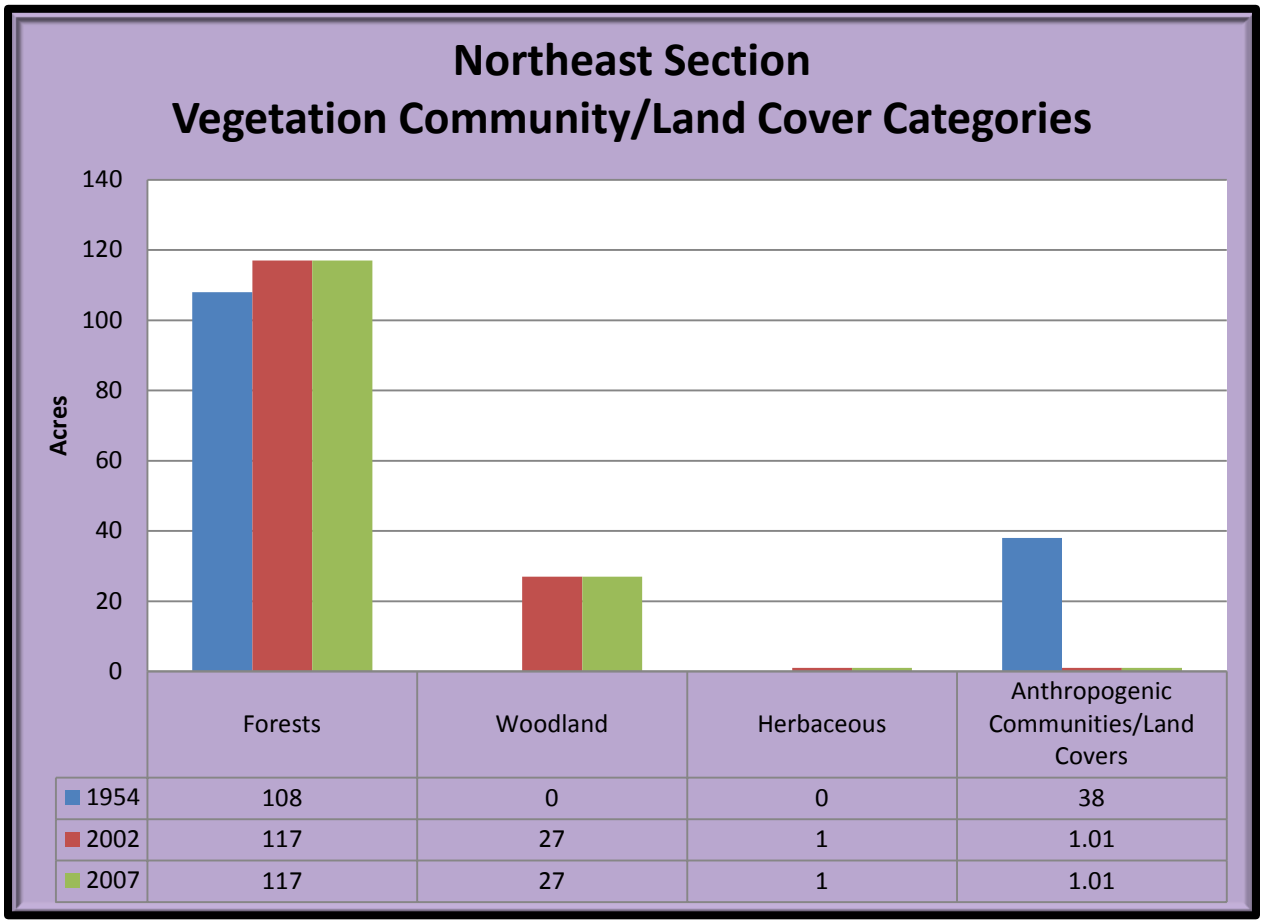


Figure 4-4.4. Northeast Section Vegetation Community/Land Cover Categories (1954, 2002, and 2007)

Northeast Section Vegetation Community/Land Covers (Figure 4-4.4): Forestland is the most common vegetation community type in the Northeast Section. This section is also called the Lang Tract.

Natural Capital (Table 4-4.1)

Capital in the Northeast Section has increased with the maturation of other communities to forest and woodland.

Table 4-4.1. Natural Capital of the Northeast Section	
Year	**Natural Capital (in 2012 dollars)**
1954	$1,327,482/year
2002	$1,515,971/year
2007	$1,515,971/year

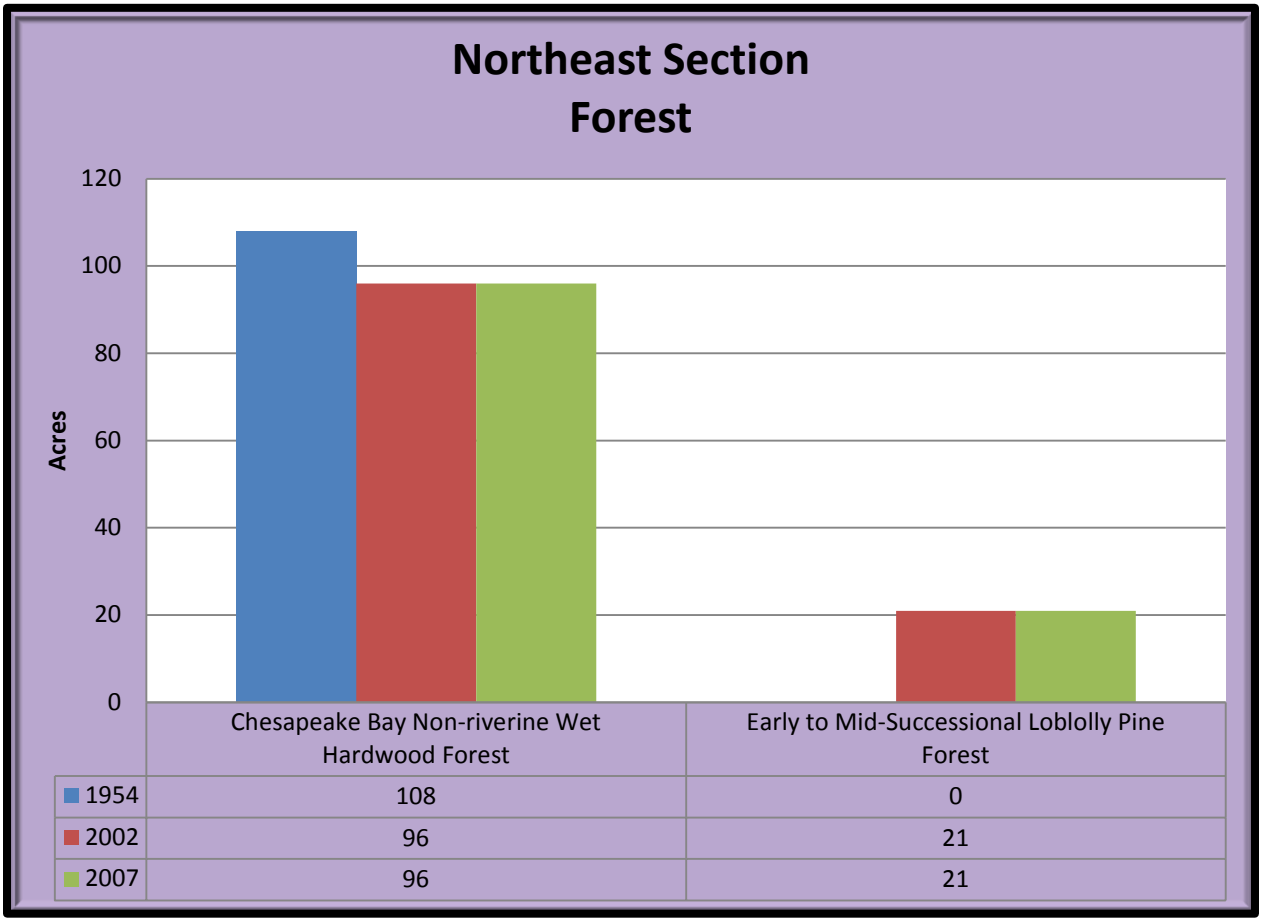


Figure 4-4.5. Northeast Section Forest (1954, 2002, and 2007)

Northeast Section Forests (Figure 4-4.5): Chesapeake Bay Non-riverine Wet Hardwood Forest is the most common forest type in the Northeast Section and is the only section with a dominant natural type community.

Natural Capital (Table 4-4.2)

Forest capital has decreased with decreasing acreage of Chesapeake Bay Non-riverine Wet Hardwood Forest.

Table 4-4.2. Natural Capital of Northeast Section Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$1,327,482/year
2002	$1,183,955/year
2007	$1,183,955/year

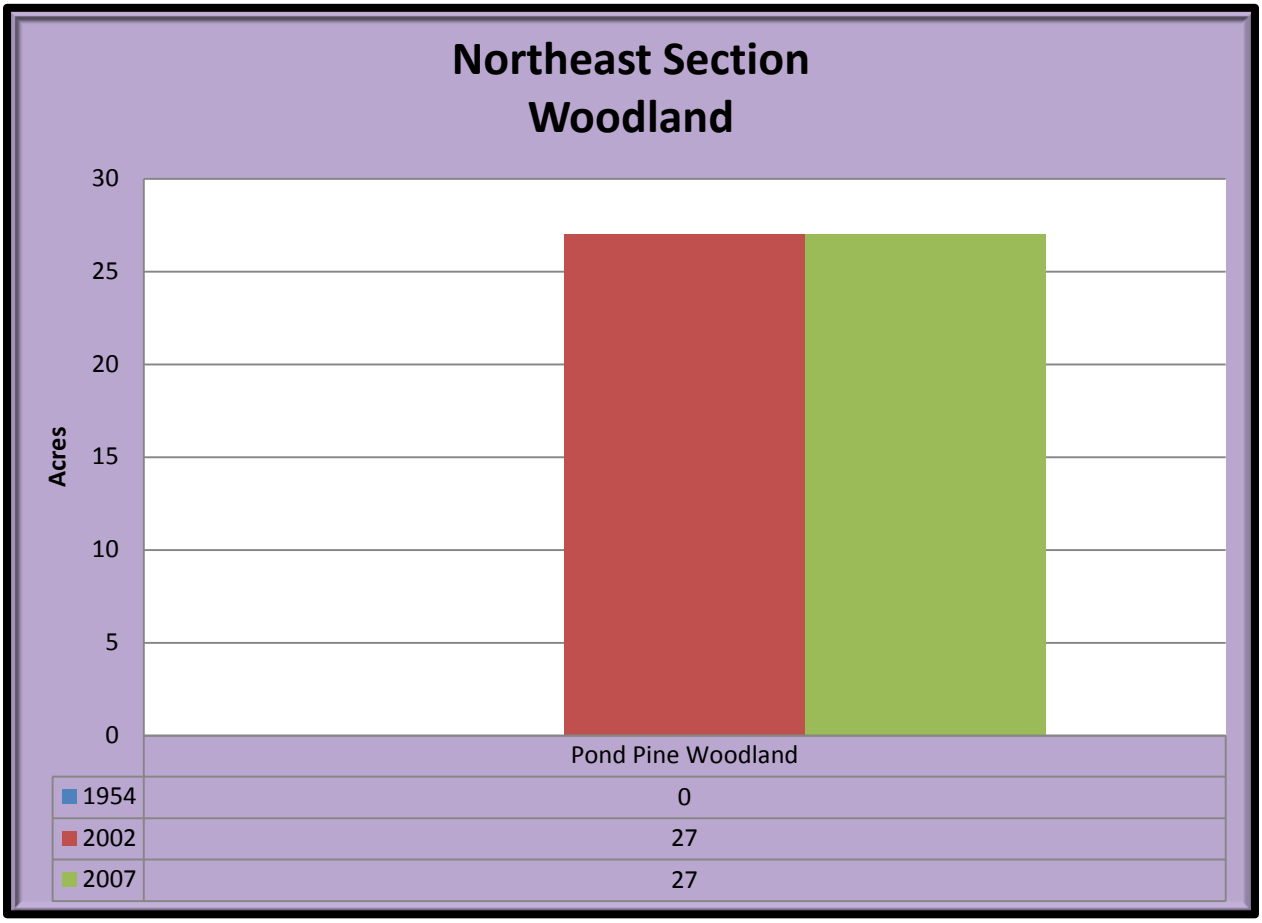


Figure 4-4.6. Northeast Section Woodland (1954, 2002, and 2007)

Northeast Section Woodland (Figure 4-4.6): Pond Pine Woodland is the only woodland present in the Northeast Section and is a rare woodland for Delaware.

Natural Capital (Table 4-4.3)

Woodland has come into this section since 1954 and has attained a stable capital value since.

Table 4-4.3. Natural Capital of Northeast Section Woodland	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$331,871/year
2007	$331,871/year

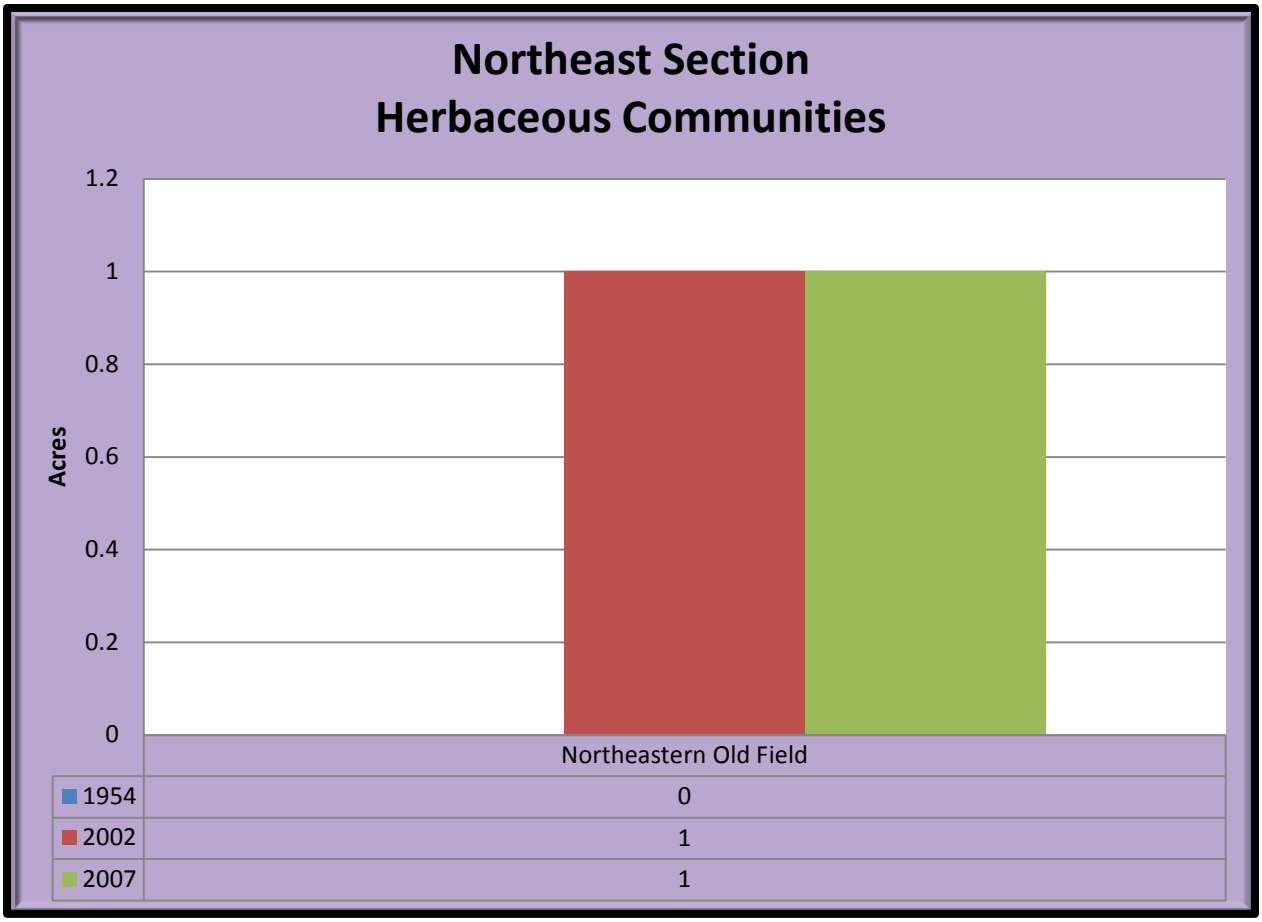


Figure 4-4.7. Northeast Section Herbaceous Communities (1954, 2002, and 2007)

Northeast Section Herbaceous Communities (Figure 4-4.7): Northeastern Old Field is the only herbaceous community present in the Northeast Section.

Natural Capital (Table 4-4.4)

Herbaceous communities do not have much capital value in the Northeast section and they have been stable in amount in the recent period (2002-2007).

Table 4-4.4. Natural Capital of Northeast Section Herbaceous Communities	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$146/year
2007	$146/year

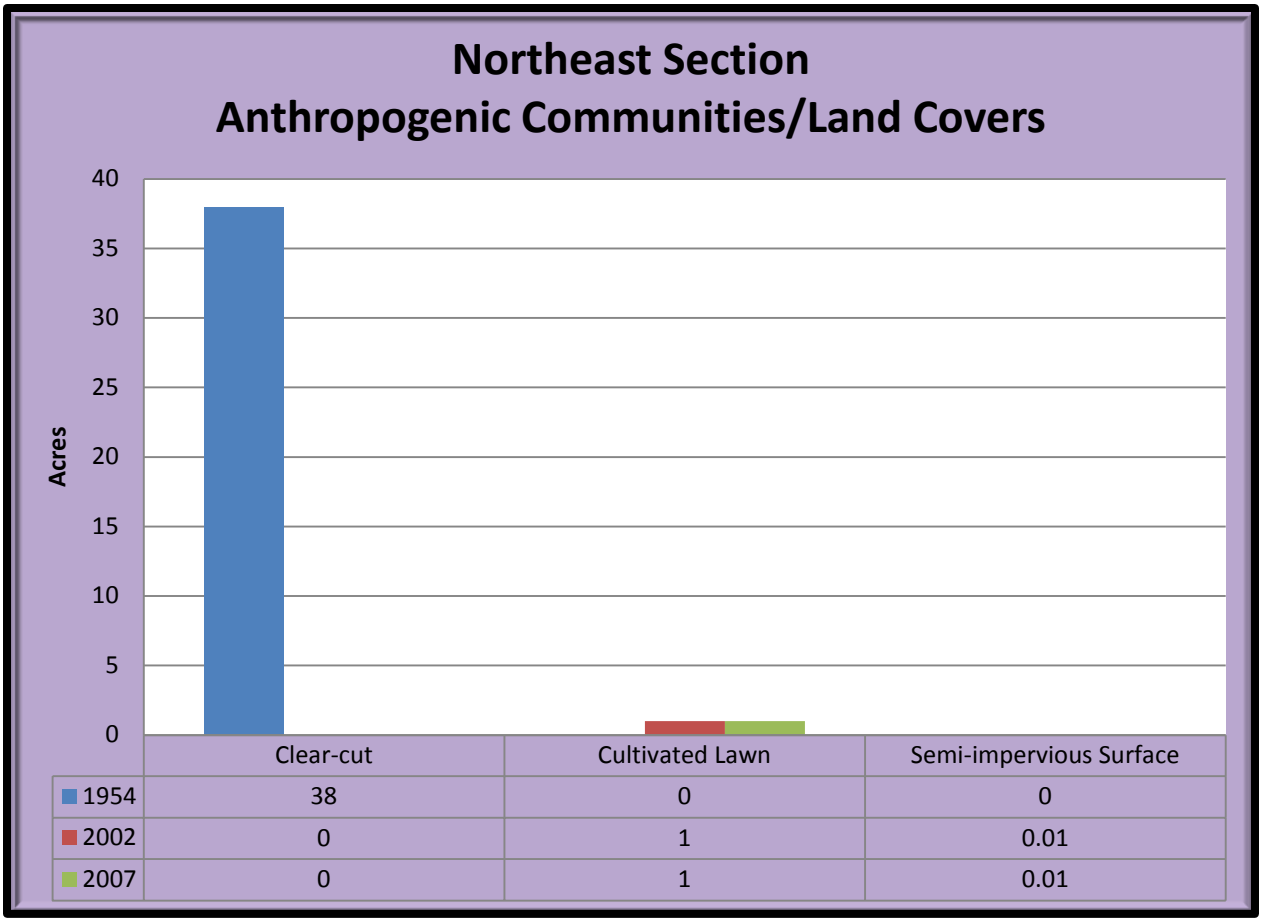


Figure 4-4.8. Northeast Section Herbaceous Communities (1954, 2002, and 2007)

Northeast Section Herbaceous Communities (Figure 4-4.8): Cultivated lawn is currently the most common anthropogenic community/land cover in the Northeast Section. Clear-cut was once a lot more common in the section in 1954.

Natural Capital

None of the anthropogenic communities/land covers in the Northeast Section have any natural capital value.

5. South Section

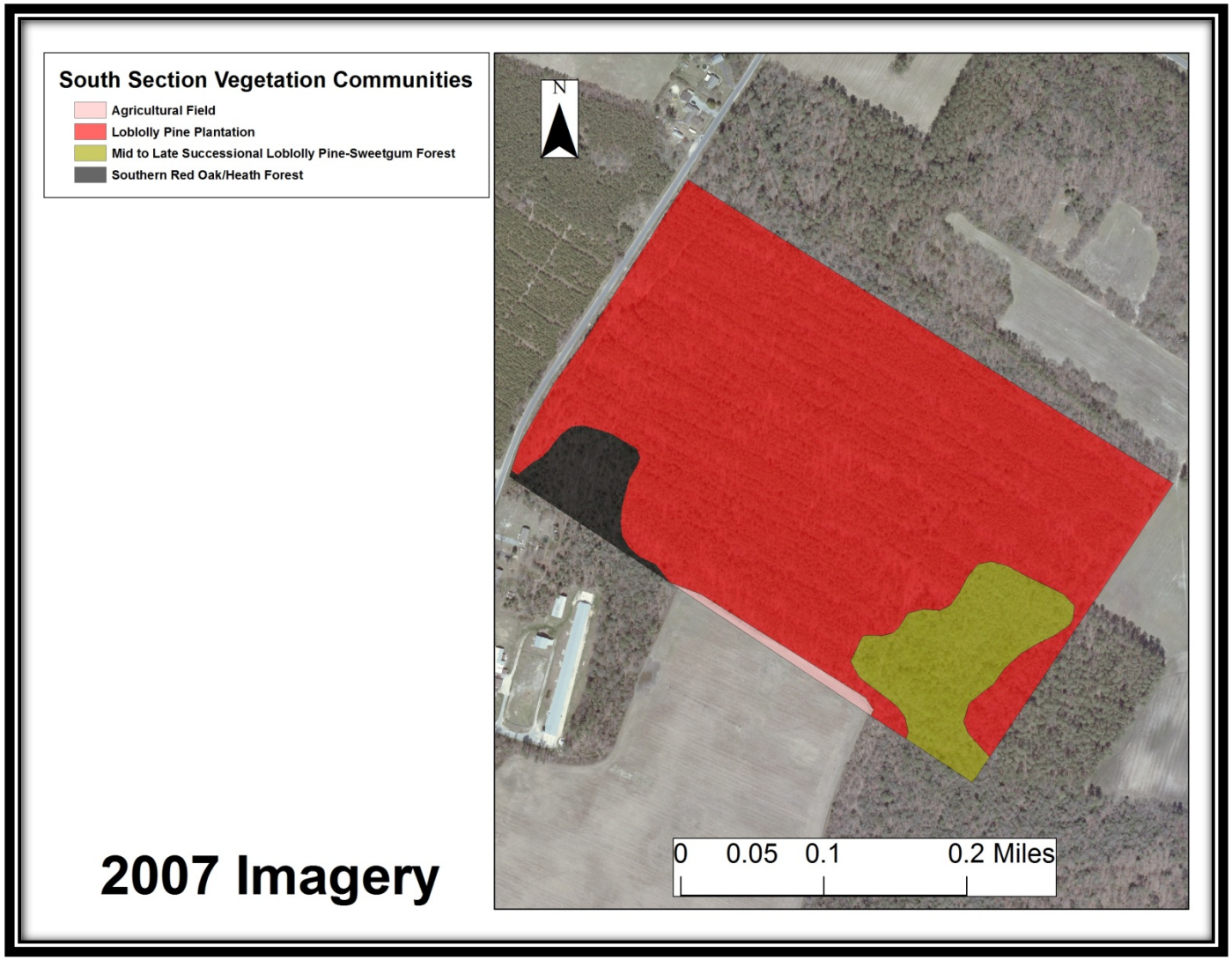


Figure 4-5.1. 2007 Vegetation Community Map of the South Section

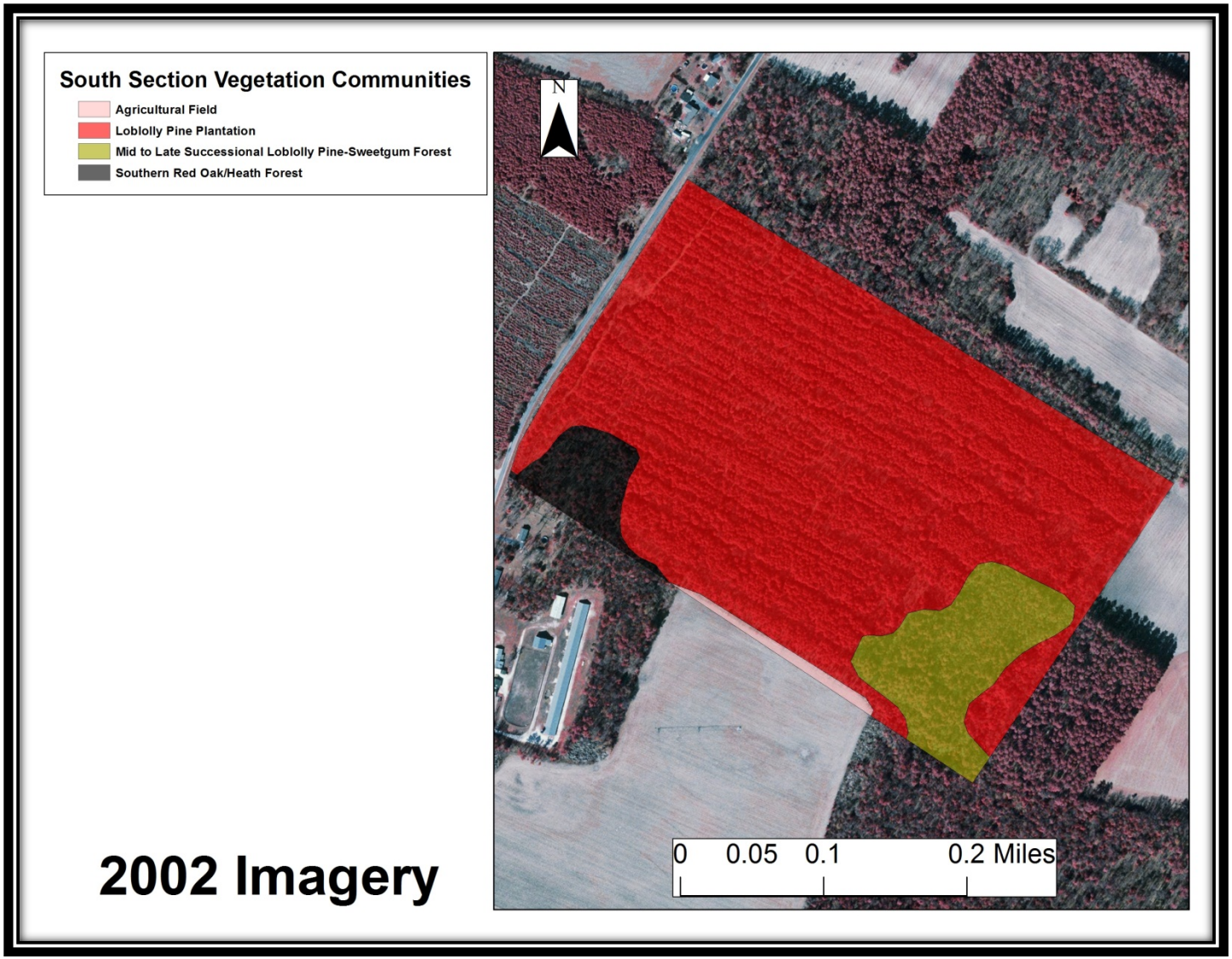


Figure 4-5.2. 2002 Vegetation Community Map of the South Section

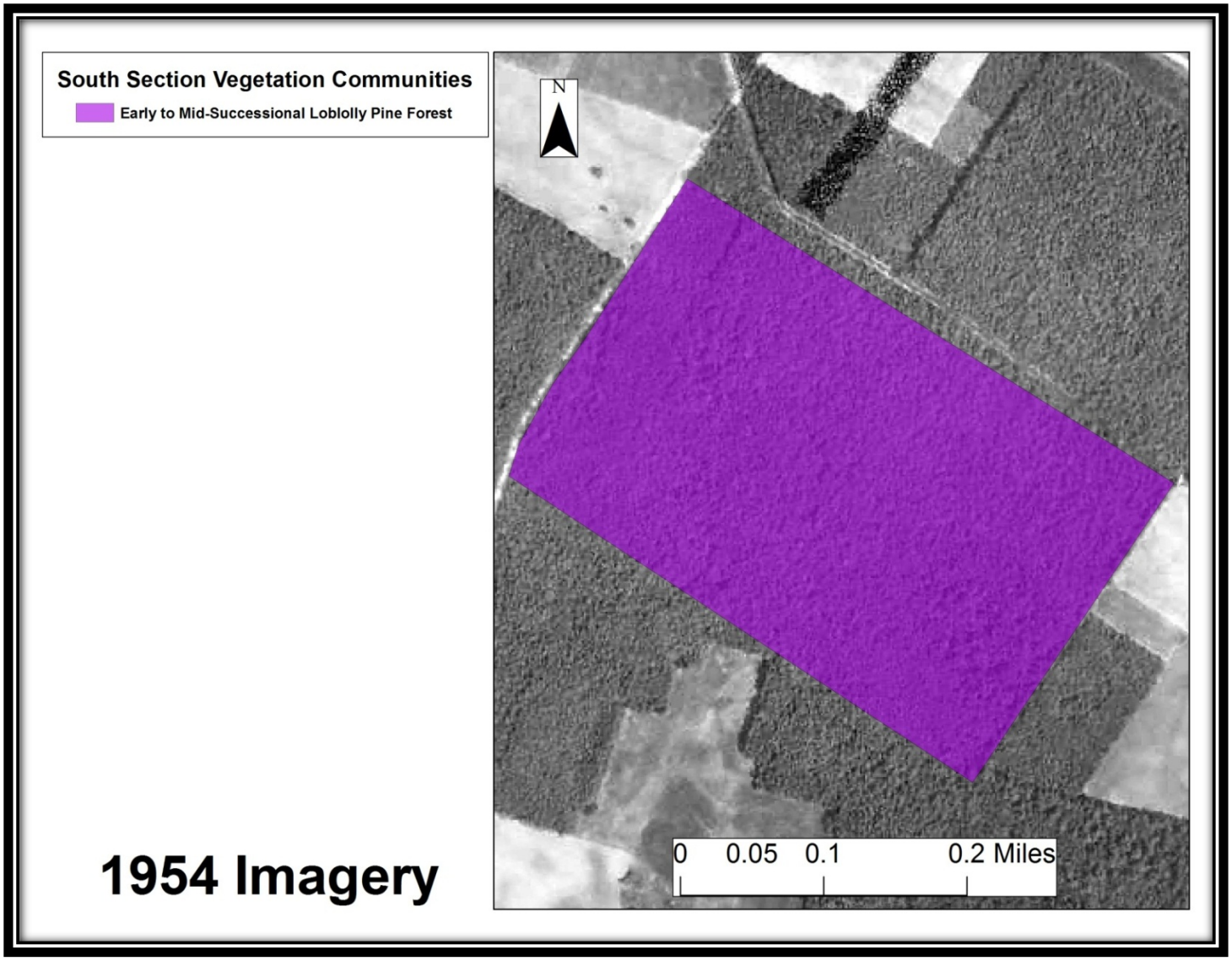


Figure 4-5.3. 1954 Vegetation Community Map of the South Section

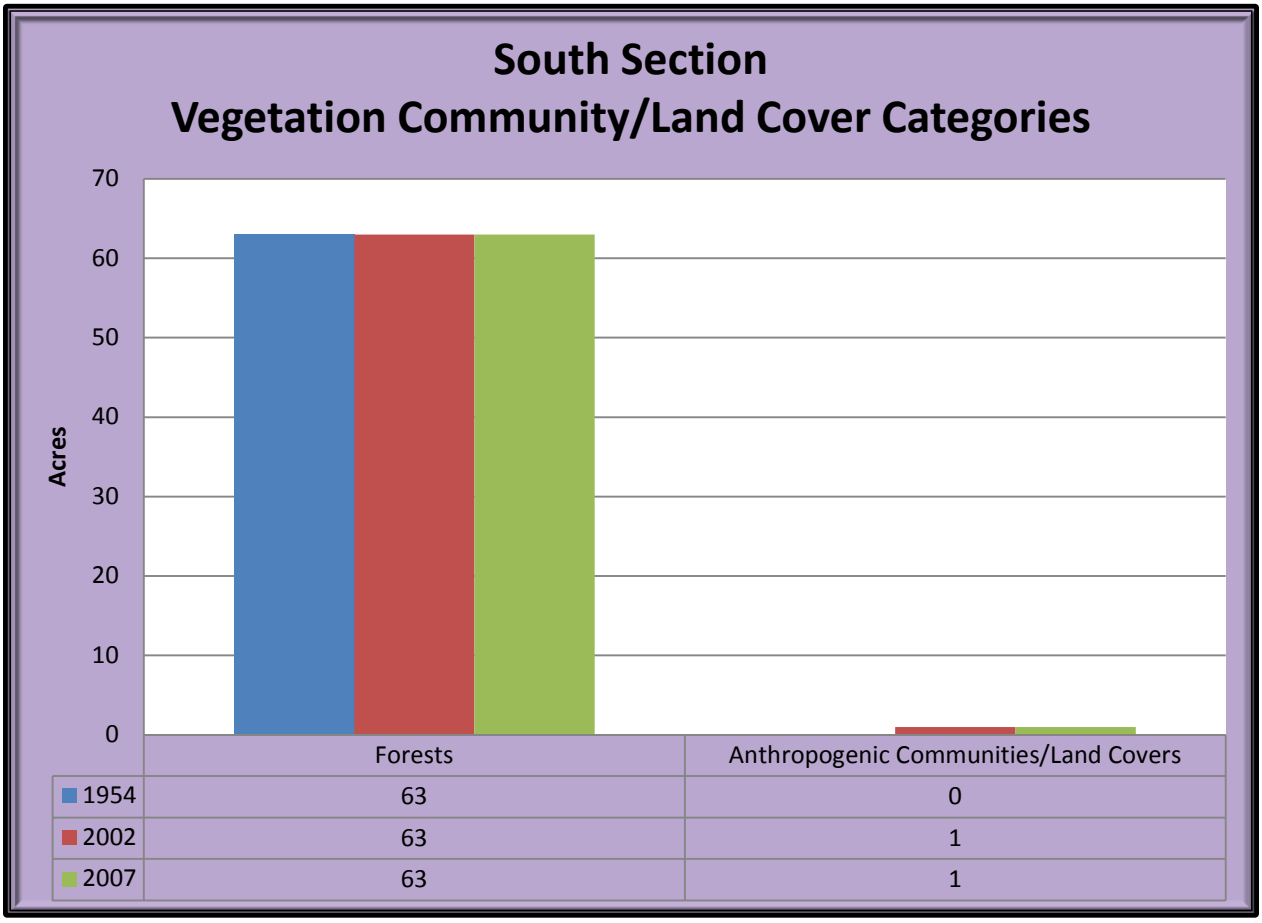


Figure 4-5.4. South Section Vegetation Community/Land Cover Categories (1954, 2002, and 2007)

South Section Vegetation Community/Land Covers (Figure 4-5.4): Forest is the most vegetation community type in the South Section.

Natural Capital (Table 4-5.1)

Capital in the South Section has increased slightly with the appearance of agricultural field in the section.

Table 4-5.1. Natural Capital of the South Section	
Year	**Natural Capital (in 2012 dollars)**
1954	$11,913/year
2002	$11,971/year
2007	$11,971/year

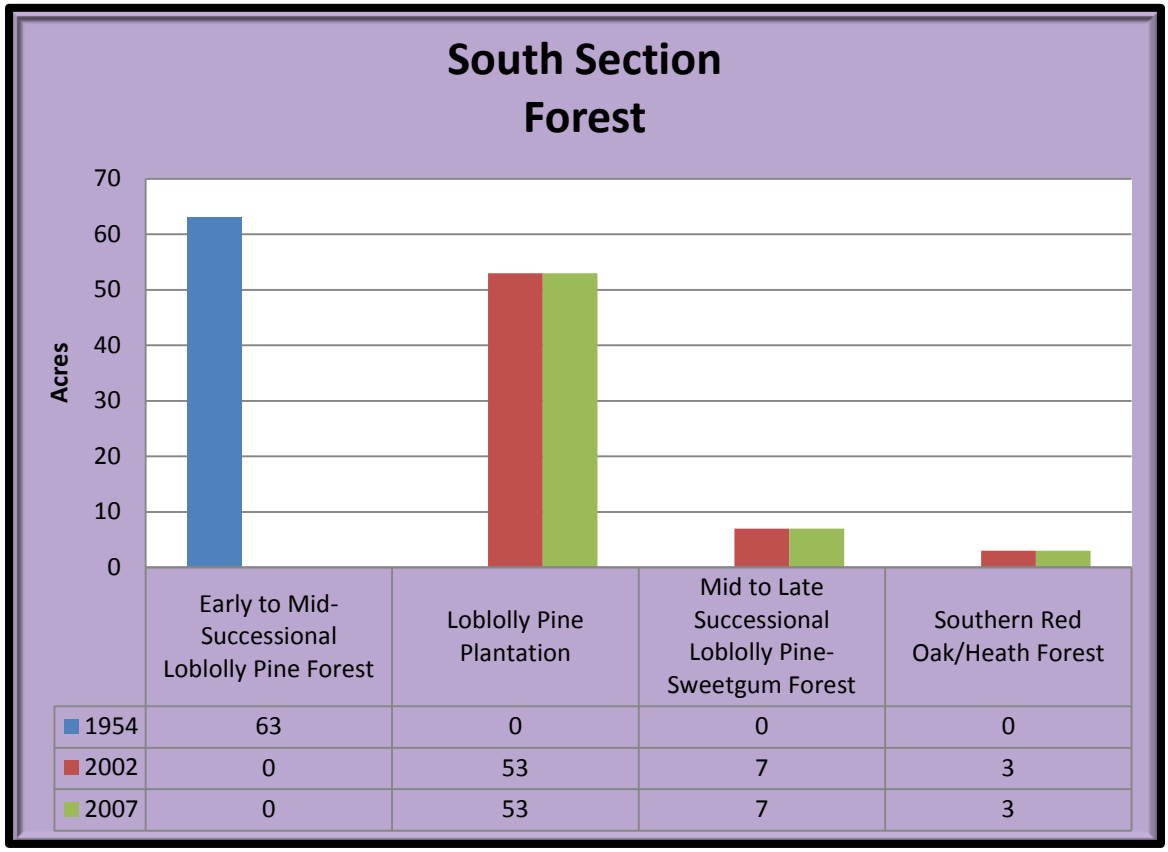


Figure 4-5.5. South Section Forest (1954, 2002, and 2007)

South Section Forests (Figure 4-5.5): Loblolly Pine Plantation is the most common forest community in the South Section followed by Mid to Late Successional Loblolly Pine-Sweetgum Forest.

Natural Capital (Table 4-5.2)

Even though some of the communities have changed, the amount of forestland has stayed constant resulting in a stable capitalization.

Table 4-5.2. Natural Capital of South Section Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$11,913/year
2002	$11,913/year
2007	$11,913/year

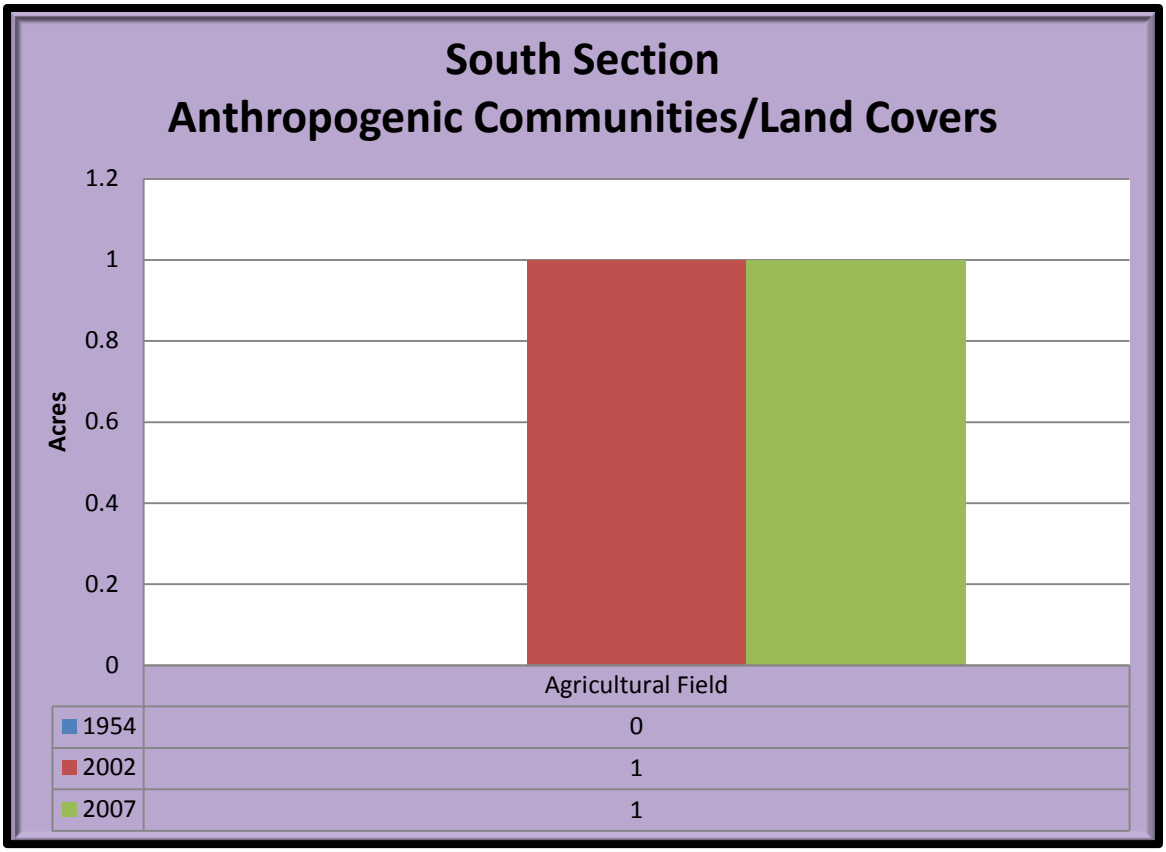


Figure 4-5.6. South Section Anthropogenic Communities/Land Covers (1954, 2002, and 2007)

South Section Anthropogenic Communities/Land Covers (Figure 4-5.6): Agricultural field is the only anthropogenic community/land cover present in the South Section.

Natural Capital (Table 4-5.2)

Agricultural fields have come into the South Section since 1954 and amount to one acre giving a capital value of $57.00/year.

Table 4-5.2. Natural Capital of South Section Anthropogenic Communities/Land Covers	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$57/year
2007	$57/year

CHAPTER 5: DESCRIPTIONS AND ANALYSIS OF THE VEGETATION COMMUNITIES

Eleven vegetation communities and seven 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. Chesapeake Bay Non-riverine Wet Hardwood Forest (CEGL004644)—96 acres
2. Cultivated Lawn (CEGL008462)—3 acres
3. Early to Mid-Successional Loblolly Pine Forest (CEGL006011)—1,010 acres
4. Loblolly Pine Plantation (CEGL007179)—626 acres
5. Mid-Atlantic Mesic Mixed Hardwood Forest (CEGL006075)—16 acres
6. Mid to Late Successional Loblolly Pine-Sweetgum Forest (CEGL008462)—50 acres
7. Northeastern Old Field (CEGL006107)—5 acres
8. Northern Coastal Plain Successional Floodplain Forest (CEGL006976)—22 acres
9. Pond Pine Woodland (CEGL006470)—27 acres
10. Southern Red Maple-Blackgum Swamp (CEGL006238)—91 acres
11. Southern Red Oak/Heath Forest (CEGL006269)—40 acres

The land covers include:

1. Agricultural Field—211 acres
2. Farm Pond/Artificial Pond—0.1 acres
3. Impervious Surface—0.1 acres
4. Impoundment—1 acre
5. Modified Land—1 acre
6. Powerline R-O-W—23 acres
7. Water—2 acres

Chesapeake Bay Non-riverine Wet Hardwood Forest **[96 acres (Figures 5.1-5.2, Tables 5.1-5.3)]**
G2? S4

DEWAP: Isolated Forested Wetlands
NHC: Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest

Description

This community is located in the Northeast Section (Lang Tract) northeast of Georgetown, Delaware and covers a large part of the tract. Red maple (*Acer rubrum*), southern red oak (*Quercus falcata*), willow oak (*Quercus phellos*), swamp chestnut oak (*Quercus michauxii*), white oak (*Quercus alba*), pin oak (*Quercus palustris*), scarlet oak (*Quercus coccinea*), and a small amount of pond pine (*Pinus palustris*) compose the canopy. The understory contains American holly (*Ilex opaca*), water oak (*Quercus nigra*), and a few sweetbay (*Magnolia virginiana*). The shrub and vine layer is composed of common greenbrier (*Smilax rotundifolia*), highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), and white-leaf greenbrier (*Smilax glauca*). Virginia chainfern (*Woodwardia virginica*), cinnamon fern (*Osmunda cinnamomea*), Walter's sedge (*Carex striata*), royal fern (*Osmunda regalis*), and wintergreen (*Gaultheria procumbens*) compose the herbaceous layer.

Figure 5.1. Chesapeake Bay Non-riverine Wet Hardwood Forest

The examples of this community appear to be late successional to mature most of the site as evidenced by aerial imagery is more than 60 years old. Definition of layer is good. Diameters of trees range from 0.5 feet to 1.5 feet.

Analysis of Condition at Old Furnace Wildlife Area

In 2007, 81 acres of the original 108 acres from 1954 still remained in the wildlife area. The rest of the acreage has become 18 acres of Early to Mid-Successional Loblolly Pine Forest, 8 acres of Pond Pine Woodland, 1 acre of Northeastern Old Field, and 0.2 acres of Cultivated Lawn (Table 5.1).

Since 1954 this community has populated about 3 acres of former clear-cut (Table 5.2).

Table 5.1. What was Chesapeake Bay Non-riverine Wet Hardwood Forest in 1954 has become X or remained in 2007	
X	**Acreage**
Chesapeake Bay Non-riverine Wet Hardwood Forest	81 acres
Early to Mid-Successional Loblolly Pine Forest	18 acres
Pond Pine Woodland	8 acres
Northeastern Old Field	1 acre
Cultivated Lawn	0.2 acres

Table 5.2. Chesapeake Bay Non-riverine Wet Hardwood Forest has migrated into X or remained since 1954	
X	**Acreage**
Chesapeake Bay Non-riverine Wet Hardwood Forest	10 acres
Clear-cut	3 acres

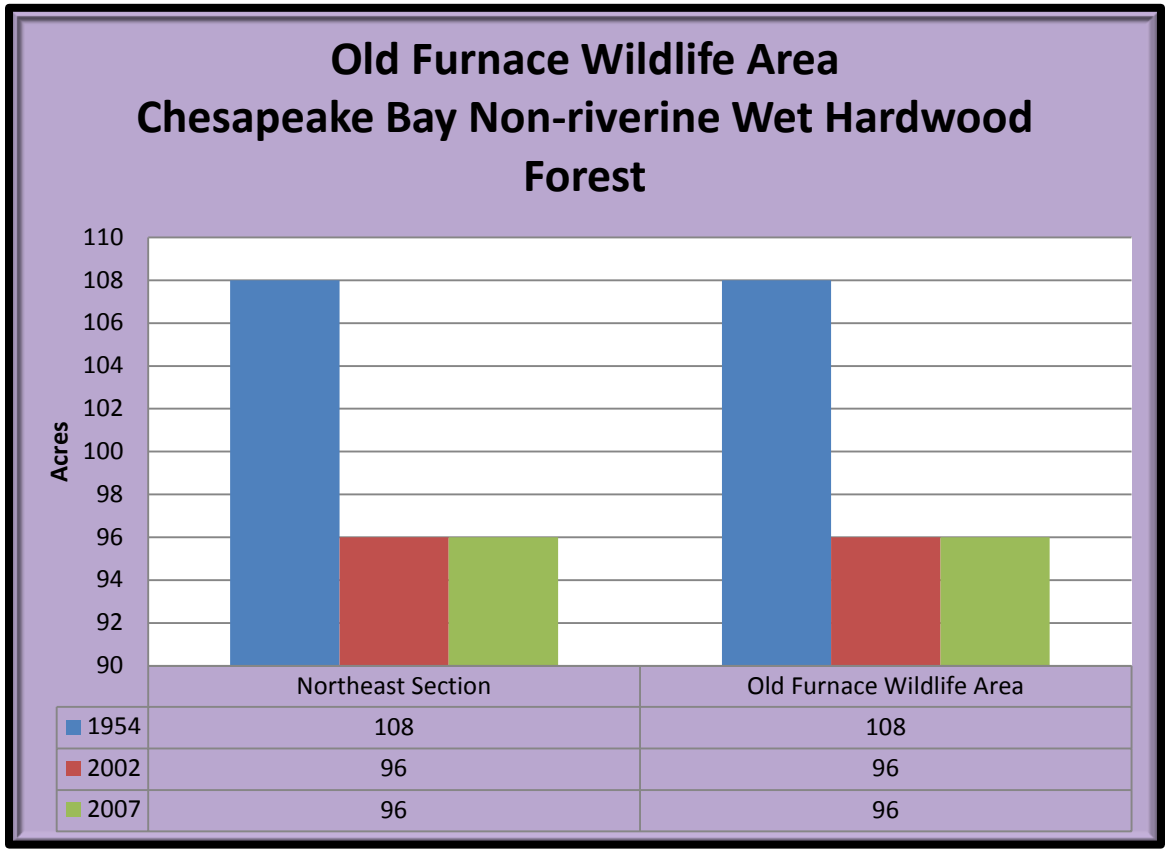


Figure 5.2. Chesapeake Bay Non-riverine Wet Hardwood Forest at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.3)

Capital of Chesapeake Bay Non-riverine Wet Hardwood Forest has decreased with it acreage since 1954, but has been stable in the recent period (2002-2007).

Table 5.3. Natural Capital of Chesapeake Bay Non-riverine Wet Hardwood Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$1,327,482/year
2002	$1,179,984/year
2007	$1,179,984/year

Cultivated Lawn **[3 acres (Figure 5.3, Tables 5.4-5.5)] GNA SNA**

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

Description

Cultivated lawn is most often found along roadsides at Old Furnace Wildlife Area and is composed primarily of tall fescue (*Festuca arundinacea*).

Analysis of Condition at Old Furnace Wildlife Area

About 0.2 acres of the original 0.3 acres of Cultivated Lawn still persisted in 2007. The rest of the lawn area has become 0.1 acres of agricultural field and 0.02 acres of Early to Mid-Successional Loblolly Pine Forest (Table 5.4).

Since 1954, Cultivated Lawn has been developed on 1 acre each of Early to Mid-Successional Loblolly Pine Forest, Clear-cut, Mid to Late Successional Loblolly Pine-Sweetgum Forest, and 0.2 acres of Chesapeake Bay Non-riverine Wet Hardwood Forest (Table 5.5).

Table 5.4. What was once Cultivated Lawn in 1954 has become X or remained in 2007	
X	**Acreage**
Cultivated Lawn	0.2 acres
Agricultural Field	0.1 acres
Early to Mid-Successional Loblolly Pine Forest	0.02 acres

Table 5.5. Cultivated Lawn has migrated into X or remained since 1954	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	1 acre
Clear-cut	1 acre
Mid to Late Successional Loblolly Pine-Sweetgum Forest	1 acre
Chesapeake Bay Non-riverine Wet Hardwood Forest	0.2 acres
Cultivated Lawn	0.2 acres
Other communities/land covers	0.3 acres

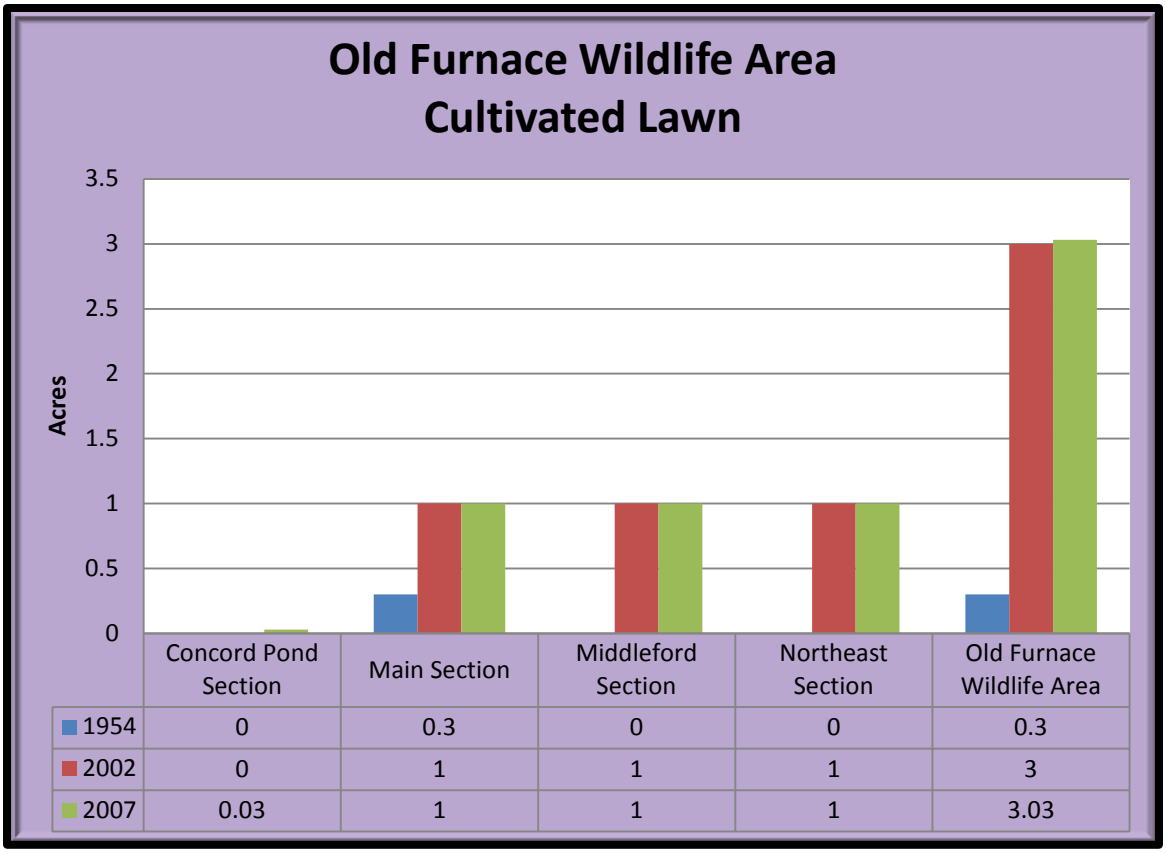


Figure 5.3. Cultivated Lawn at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital

Cultivated lawn does not contain any natural capital value.

Early to Mid-Successional Loblolly Pine Forest **[1,010 acres (Figures 5.4-5.5, Tables 5.6-5.8)]**
GNA SNA

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

Description

Early to Mid-Successional Loblolly Pine Forest and Loblolly Pine Plantation are virtually identical as far as species composition. Generally, the Loblolly Pine Plantation has slightly less understory composition due to management, but at Old Furnace Wildlife Area the reverse is true. The two communities can be distinguished in aerial imagery by the ground beef look of the Loblolly Pine Plantation, while the Early to Mid-Successional Loblolly Pine Plantation looks more like pink slime.

Figure 5.4. Early to Mid-Successional Loblolly Pine Forest (Main Section)

By definition the Early to Mid-Successional Loblolly Pine Forest is solely dominated by loblolly pine (*Pinus taeda*) in the canopy. Understory associates include American holly (*Ilex opaca*), Virginia pine (*Pinus virginiana*), and sweetbay (*Magnolia virginiana*). The shrub and vine layer contains common greenbrier (*Smilax rotundifolia*). No herbs were noted in this community in Old Furnace Wildlife Area. This could be due to the acidity of the needles or the time of year.

Analysis of Condition at Old Furnace Wildlife Area

About half of the 1657 acres from 1954 have matured into older forests leaving 860 acres still present in 2007 from the original acreage. The other forests were converted to 692 acres of Loblolly Pine Plantation, 31 acres of Southern Red Oak/Heath Forest, 22 acres of Mid to Late Successional Loblolly Pine-Sweetgum Forest, and 19 acres of Powerline R-O-W (Table 5.6).

Since 1954, Early to Mid-Successional Loblolly Pine Forest has grown into 18 acres of Chesapeake Bay Non-riverine Wet Hardwood Forest, 15 acres of Loblolly Pine Plantation, 12 acres of Mid to Late Successional Loblolly Pine-Sweetgum Forest, and 5 acres of Mid-Atlantic Mesic Mixed Hardwood Forest (Table 5.7). All of these forests were likely logged and then this community grew into the area.

Table 5.6. What was once Early to Mid-Successional Loblolly Pine Forest in 1954 has become X or remained in 2007	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	860 acres
Loblolly Pine Plantation	692 acres
Southern Red Oak/Heath Forest	31 acres
Mid to Late Successional Loblolly Pine Forest	22 acres
Powerline R-O-W	19 acres
Other communities/land covers	32 acres

Table 5.7. Early to Mid-Successional Loblolly Pine Forest has migrated into X or remained since 1954	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	860 acres
Chesapeake Bay Non-riverine Wet Hardwood Forest	18 acres
Loblolly Pine Plantation	15 acres
Mid to Late Successional Loblolly Pine-Sweetgum Forest	12 acres
Mid-Atlantic Mesic Mixed Hardwood Forest	5 acres
Other communities/land covers	8 acres

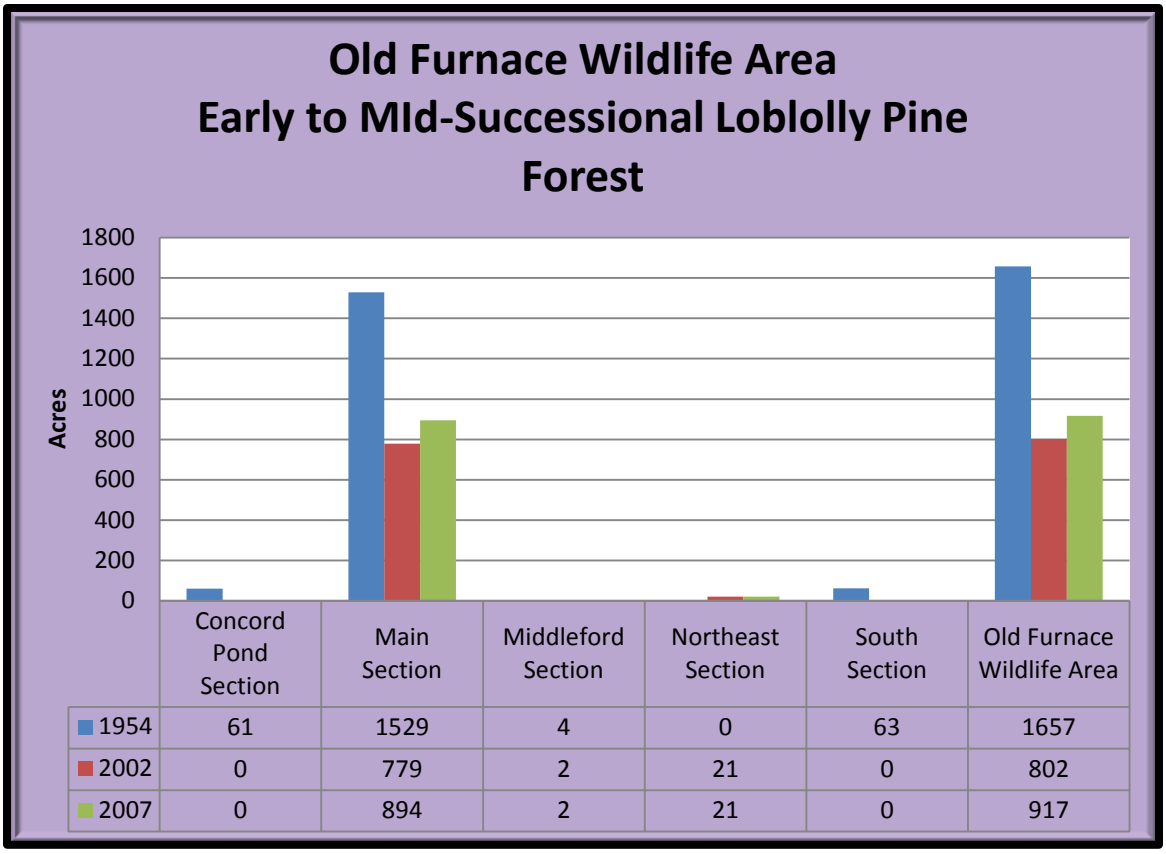


Figure 5.5. Early to Mid-Successional Loblolly Pine Forest at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.8)

Capital of Early to Mid-Successional Loblolly Pine Forest has oscillated as new areas are cut and then regenerate.

Table 5.8. Natural Capital of Early to Mid-Successional Loblolly Pine Forest

Year	Natural Capital (in 2012 dollars)
1954	$313,339/year
2002	$151,658/year
2007	$173,405/year

Loblolly Pine Plantation **[626 acre (Figures 5.6-5.7, Tables 5.9-5.11)] GNA SNA**

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

Description

As stated above this community is like the Early to Mid-Successional Loblolly Pine Forest. Loblolly Pine (*Pinus taeda*) is the sole canopy member in younger stands but may be joined by Virginia pine (*Pinus virginiana*) in the older stands. The understory contains American holly (*Ilex opaca*), red maple (*Acer rubrum*), Hercules's club (*Aralia spinosa*), wild black cherry (*Prunus serotina*), sweetgum (*Liquidambar styraciflua*), and southern red oak (*Quercus falcata*). The shrub and vine layer contains summer grape (*Vitis aestivalis*), lowbush blueberry (*Vaccinium pallidum*), Japanese honeysuckle (*Lonicera* japonica), and common greenbrier (*Smilax rotundifolia*). No herbs were noted in this community at Old Furnace Wildlife Area.

Figure 5.6. Loblolly Pine Plantation (Northeastern Section)

Analysis of Condition at Old Furnace Wildlife Area

Approximately 2/3 of the original acreage of Loblolly Pine Plantation from 1954 still existed in 2007. The rest of the acreage became 15 acres of Early to Mid-Successional Loblolly Pine Forest, 8 acres of agricultural field, and 1 acre of Powerline R-O-W (Table 5.9).

Since 1954, Loblolly Pine Plantations have been developed on 692 acres of Early to Mid-Successional Loblolly Pine Forest, 1 acre of agricultural field, 0.5 acres of Semi-impervious surface, and 0.1 acres of Northeastern Old Field (Table 5.10).

Table 5.9. What was once Loblolly Pine Plantation in 1954 has become X or remained in 2007	
X	**Acreage**
Loblolly Pine Plantation	47 acres
Early to Mid-Successional Loblolly Pine Forest	15 acres
Agricultural Field	8 acres
Powerline R-O-W	1 acre

Table 5.10. Loblolly Pine Plantation has migrated into X or remained since 1954	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	692 acres
Loblolly Pine Plantation	47 acres
Agricultural Field	1 acre
Semi-impervious Surface	0.5 acres
Northeastern Old Field	0.1 acres

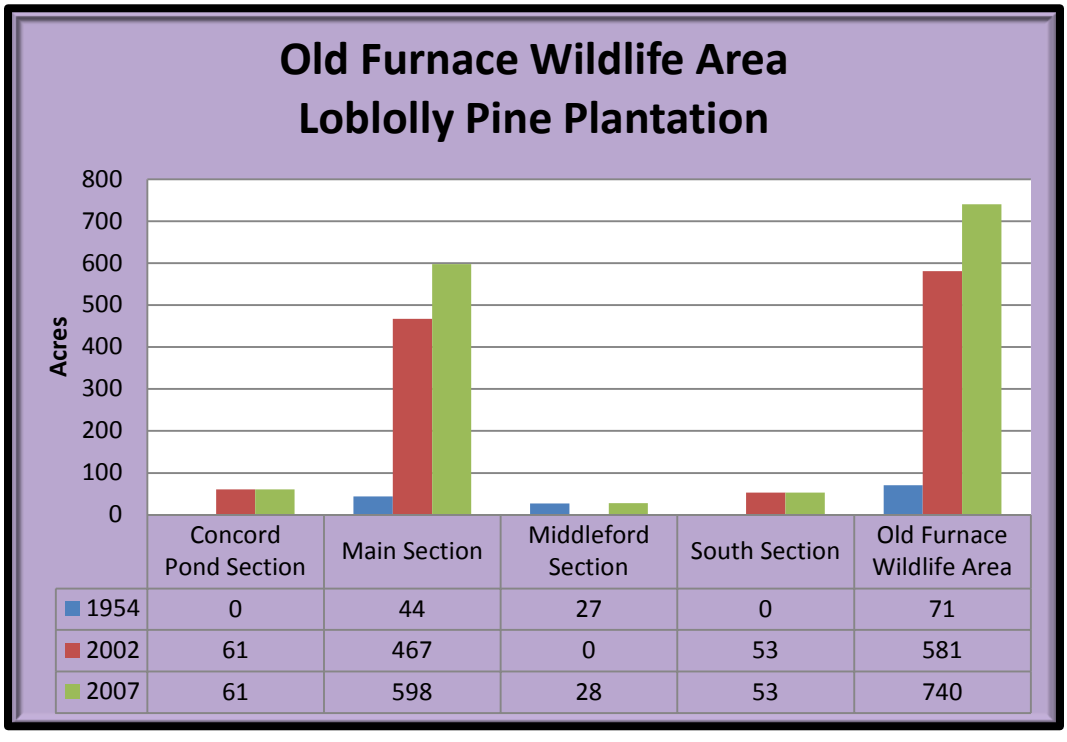


Figure 5.7. Loblolly Pine Plantation at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.11)

Loblolly Pine Plantations have been developed on Old Furnace Wildlife Area as an investment and have been increasing capital with increasing acreage.

Table 5.11. Natural Capital of Loblolly Pine Plantation	
Year	**Natural Capital (in 2012 dollars)**
1954	$13,426/year
2002	$109,867/year
2007	$139,934/year

Mid-Atlantic Mesic Mixed Hardwood Forest **[16 acres (Figures 5.8-5.9, Tables 5.12-5.14)]**
G5 S5

DEWAP: Coastal Plain Upland Forest
NHC: Northern Atlantic Coastal Plain Hardwood Forest

Description

This community exists along the edges of the Loblolly Pine Plantations on higher ground. The canopy of this community is comprised of southern red oak (*Quercus falcata*), white oak (*Quercus alba*), Virginia pine (*Pinus virginiana*), American beech (*Fagus grandifolia*), and northern red oak (*Quercus rubra*). The understory contains smaller members of the canopy plus American holly (*Ilex opaca*), eastern red cedar (*Juniperus virginiana*), and sassafras (*Sassafras albidum*). The shrub and vine layer is composed of common greenbrier (*Smilax rotundifolia*) and a few mountain laurel (*Kalmia latifolia*). Speargrass (*Chasmanthium laxum*) was the only herb noted in this community.

Figure 5.8. Mid-Atlantic Mesic Mixed Hardwood Forest (Main Section)

This community appears to be Mid-successional with a few large specimen trees and many smaller ones, such as you would get if had a clear-cut. The larger trees have diameters up to 1.5 feet, while the smaller ones are mostly less than 1 foot.

Analysis of Condition at Old Furnace Wildlife Area

In 2007, 16 of the original 22 acres from 1954 were still present as Mid-Atlantic Mesic Mixed Hardwood Forest. The rest of the acreage has become 5 acres of Early to Mid-Successional Loblolly Pine Forest, 1 acre of Powerline R-O-W, and 0.3 acres of Semi-impervious Surface (Table 5.12).

Since 1954, this forest has not migrated into any other communities resulting in a straight loss of acreage.

Table 5.12. What was once Mid-Atlantic Mesic Mixed Hardwood Forest in 1954 has become X or remained in 2007	
X	**Acreage**
Mid-Atlantic Mesic Mixed Hardwood Forest	16 acres
Early to Mid-Successional Loblolly Pine Forest	5 acres
Powerline R-O-W	1 acre
Semi-impervious Surface	0.3 acres

Table 5.13. Mid-Atlantic Mesic Mixed Hardwood Forest has migrated into X or remained since 1954	
X	**Acreage**
Mid-Atlantic Mesic Mixed Hardwood Forest	16 acres

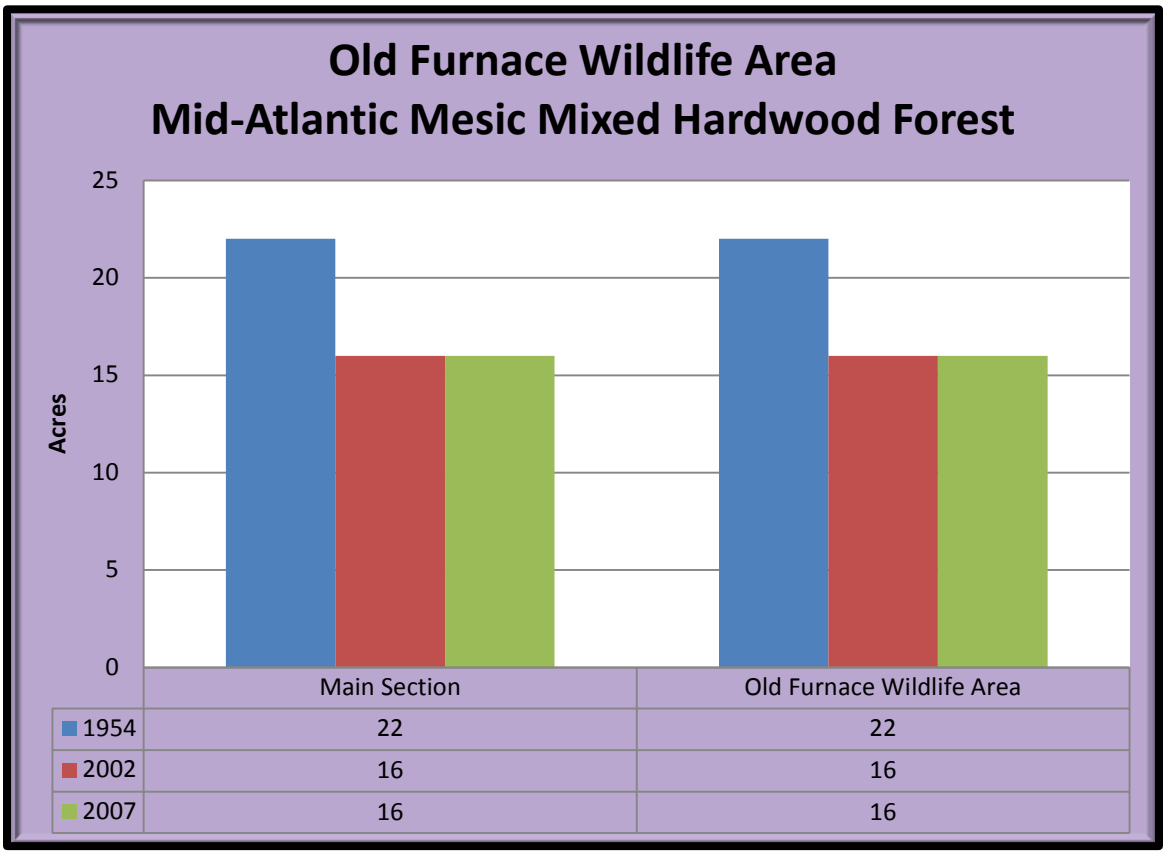


Figure 5.9. Mid-Atlantic Mesic Mixed Hardwood Forest at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.14)

Loblolly Pine Plantations have been developed on Old Furnace Wildlife Area as an investment and have been increasing capital with increasing acreage.

Table 5.14. Natural Capital of Mid-Atlantic Mesic Mixed Hardwood Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$4,160/year
2002	$3,026/year
2007	$3,026/year

Mid to Late Successional Loblolly Pine-Sweetgum Forest **[50 acres (Figures 5.10-5.11, Tables 5.15-5.17)] GNA SNA**

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

Description

Figure 5.10. Mid to Late Successional Loblolly Pine-Sweetgum Forest (Main Section)

This community is an older version of the Early to Mid-Successional Loblolly Pine Forest where the canopy has been joined by other species such as southern red oak (*Quercus falcata*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and white oak (*Quercus alba*). The layers below are identical to that found in the Loblolly Pine Plantation.

Analysis of Condition at Old Furnace Wildlife Area

In 2007, 6 acres of the original 26 acres from 1954 were still present. The rest of the acreage has become 12 acres of Early to Mid-Successional Loblolly Pine Forest, most likely through a clear-cut, 4 acres of agricultural field, 3 acres of Southern Red Oak/Heath Forest, and 1 acre of Powerline R-O-W (Table 5.15).

Since 2007, Mid to Late Successional Loblolly Pine-Sweetgum Forest has migrated or matured from 22 acres of Early to Mid-Successional Loblolly Pine Forest, 3 acres of clear-cut, 0.4 acres of Southern Red Maple-Blackgum Swamp, and 0.3 acres of agricultural field (Table 5.16).

Table 5.15. What was once Mid to Late Successional Loblolly Pine-Sweetgum Forest in 1954 has become X or remained in 2007	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	12 acres
Mid to Late Successional Loblolly Pine-Sweetgum Forest	6 acres
Agricultural Field	4 acres
Southern Red Oak/Heath Forest	3 acres
Powerline R-O-W	1 acre
Other communities/land covers	1 acre

Table 5.16. Mid to Late Successional Loblolly Pine-Sweetgum Forest has migrated into X or remained since 1954	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	22 acres
Mid to Late Successional Loblolly Pine-Sweetgum Forest	6 acres
Clear-cut	3 acres
Southern Red Maple-Blackgum Swamp	0.4 acres
Agricultural Field	0.3 acres

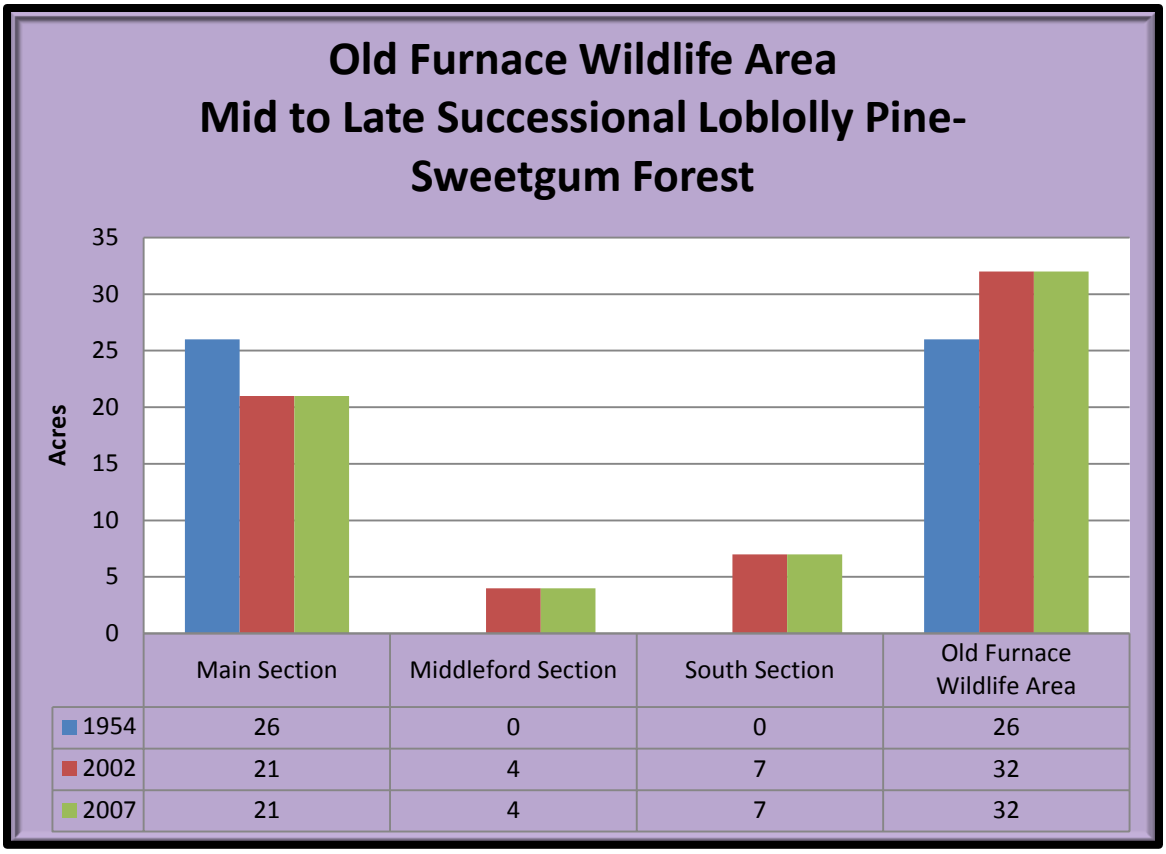


Figure 5.11. Mid to Late Successional Loblolly Pine-Sweetgum Forest at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.17)

Capital of Mid to Late Successional Loblolly Pine-Sweetgum Forest has increased with increasing acreage.

Table 5.17. Natural Capital of Mid to Late Successional Loblolly Pine-Sweetgum Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$4,917/year
2002	$6,051/year
2007	$6,051/year

Northeastern Old Field **[5 acres (Figures 5.12-5.13, Tables 5.18-5.20)] GNA SNA**

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

Description

Figure 5.12. Northeastern Old Field on edge of ditch (Main Section)

Northeastern Old Field is found on the edges of some of the agricultural fields. This community is different from the Cultivated Lawn in that it is mowed less than one time a year. Common species in the fields include broom-sedge (*Andropogon virginicus*), horseweed (*Conyza canadensis*), blackberry (*Rubus* sp.), purple top (*Tridens flavus*), eastern red cedar (*Juniperus virginiana*), American holly (*Ilex opaca*), woolly ragwort (*Senecio tomentosa*), and yarrow (*Achillea millefolium*).

Analysis of Condition at Old Furnace Wildlife Area

All of the area that was Northeastern Old Field in 1954 has become Loblolly Pine Plantation in 2007 (Table 5.18).

Since 1954, Northeastern Old Field has formed in 3 acres of agricultural field, 1 acre of Chesapeake Bay Non-riverine Wet Hardwood Forest, and 1 acre of Early to Mid-Successional Loblolly Pine Forest (Table 5.19).

Table 5.18. What was once Northeastern Old Field in 1954 has become X or remained in 2007	
X	**Acreage**
Loblolly Pine Plantation	0.1 acres

Table 5.19. Northeastern Old Field has migrated into X or remained since 1954	
X	**Acreage**
Agricultural Field	3 acres
Chesapeake Bay Non-riverine Wet Hardwood Forest	1 acre
Early to Mid-Successional Loblolly Pine Forest	1 acre

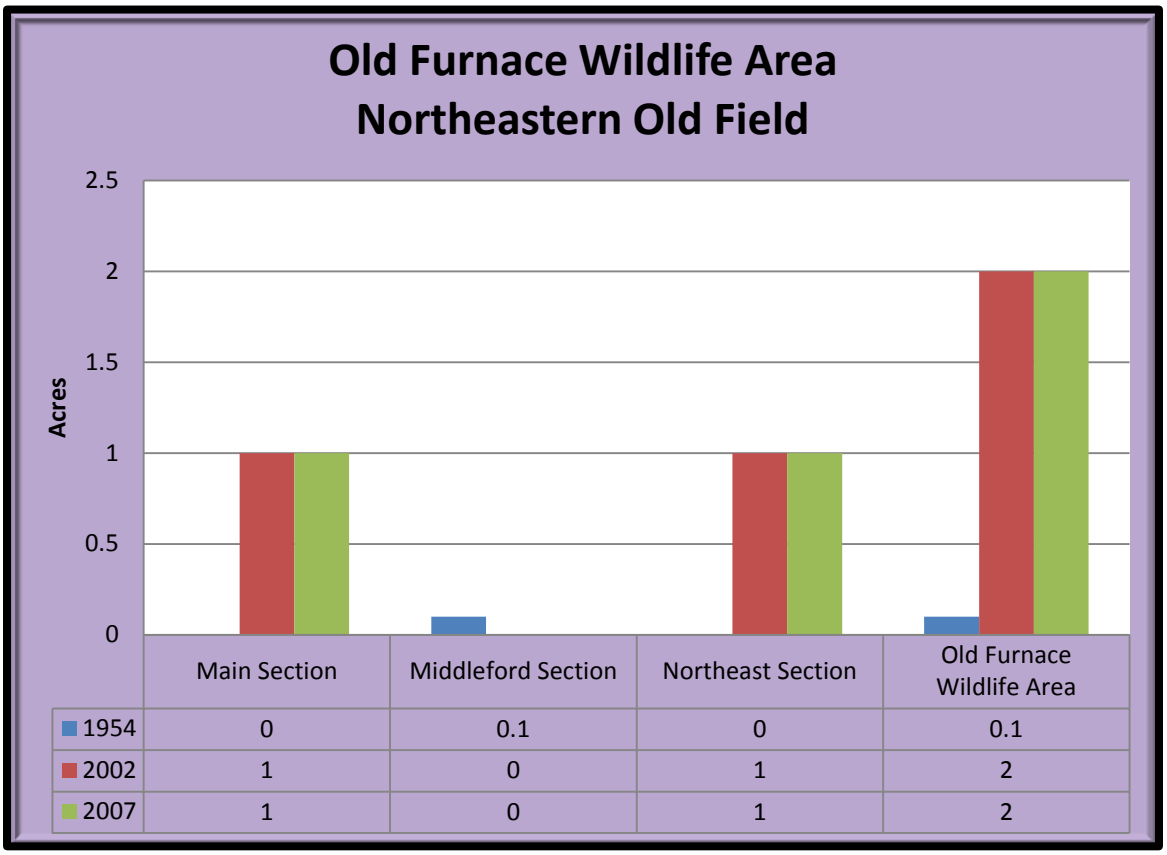


Figure 5.13. Northeastern Old Field at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.20)

Capital of Northeastern Old Field has increased from 1954, but has been steady in the recent period (2002-2007).

Table 5.20. Natural Capital of Northeastern Old Field	
Year	**Natural Capital (in 2012 dollars)**
1954	$15/year
2002	$291/year
2007	$291/year

Northern Coastal Plain Successional Floodplain Forest **[22 acres (Figures 5.14-5.15, Tables 5.21-5.23)] GNA SNA**

DEWAP: Forested Floodplains and Riparian Swamps
NHC: Semi-natural/Altered vegetation and Conifer Plantations

Description

This floodplain forest is found along Deep Creek and contains a high amount of river birch (*Betula nigra*), distinguishing it from the Southern Red Maple-Blackgum Swamp. Other canopy associates include sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), blackgum (*Nyssa sylvatica*), swamp white oak (*Quercus bicolor*), and green ash (*Fraxinus pennsylvanica*). The understory is composed of smaller members of the canopy plus sweetbay (*Magnolia virginiana*) and American holly (*Ilex opaca*). The shrub and vine layer is primarily composed of common greenbrier (*Smilax rotundifolia*) and highbush blueberry (*Vaccinium corymbosum*). No herbs were noted for this community but this could be due to time of year.

Figure 5.14. Northern Coastal Plain Successional Floodplain Forest (Main Section)

The stands of this community along Deep Creek are at least 60 years old and appear to be late successional in stage. Most trees are around 1 foot to 1.5 feet in diameter. The understory is thick in places showing the successional nature of the community.

Analysis of Condition at Old Furnace Wildlife Area

In 2007, 22 acres of the original 24 from 1954 were still present. The rest of the acreage had become 1 acre of Powerline R-O-W and 0.3 acres of water (Table 5.21). Since 1954, this community has not migrated resulting in a straight loss of acreage (Table 5.22).

Table 5.21. What was once Northern Coastal Plain Successional Floodplain Forest in 1954 has become X or remained in 2007	
X	**Acreage**
Northern Coastal Plain Successional Floodplain Forest	22 acres
Powerline R-O-W	1 acre
Water	0.3 acres

Table 5.22. Northern Coastal Plain Successional Floodplain Forest has migrated into X or remained since 1954	
X	**Acreage**
Northern Coastal Plain Successional Floodplain Forest	22 acres

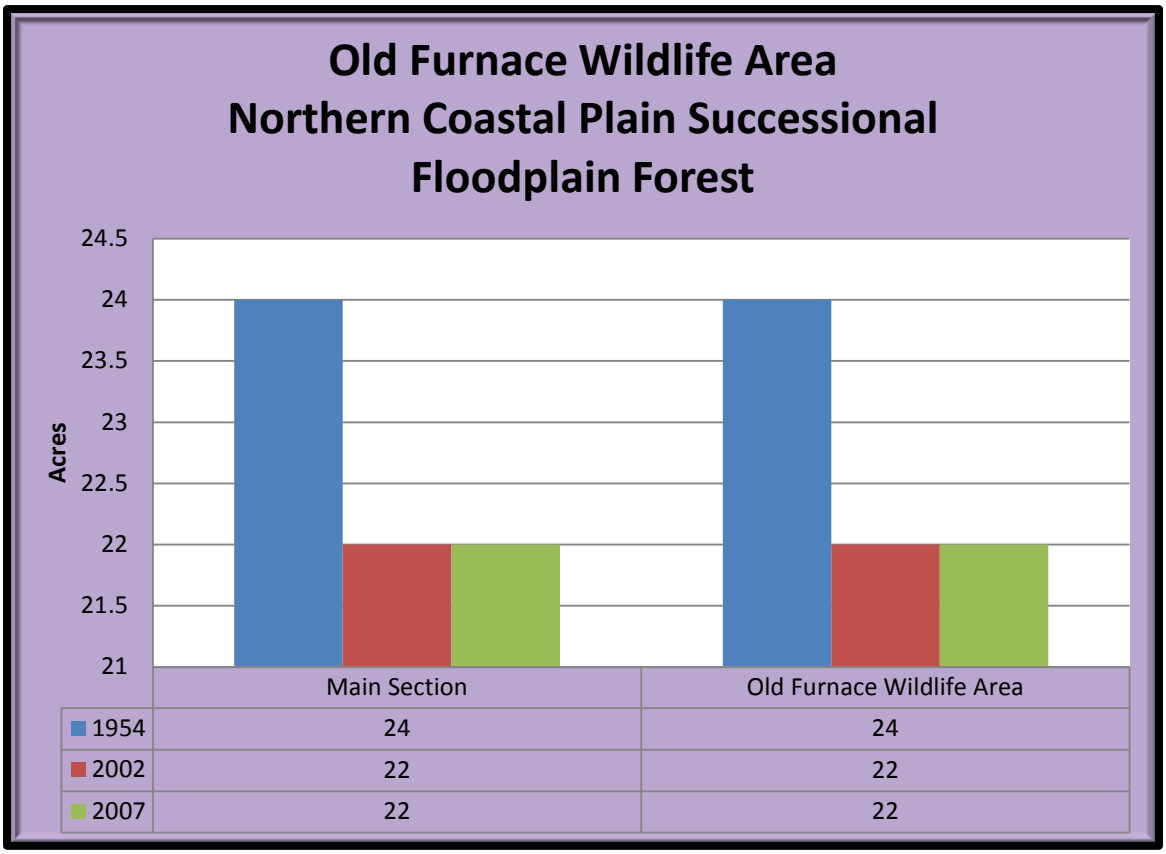


Figure 5.15. Northern Coastal Plain Successional Floodplain Forest at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.23)

Capital in Northern Coastal Plain Successional Floodplain Forest has decreased with the development of the Powerline R-O-W and an increase in water. The powerline has caused an overall decrease in capital to the wildlife area.

Table 5.23. Natural Capital of Northern Coastal Plain Successional Floodplain Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$294,996/year
2002	$270,413/year
2007	$270,413/year

***Pond Pine Woodland* [27 acres (Figures 5.16-5.17, Tables 5.24-5.25)] G? S1**

DEWAP: Isolated Forested Wetlands
NHC: Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest

Description

Pond Pine Woodland is present in the Lang Tract and represents the third major population of this community in the state. Pond pine (*Pinus serotina*) dominates the canopy and is associated by loblolly pine (*Pinus taeda*), sweetgum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*). The understory is composed of American holly (*Ilex opaca*), water oak (*Quercus nigra*), white oak (*Quercus alba*), and Virginia pine (*Pinus virginiana*). The shrub and vine layer contains common greenbrier (*Smilax rotundifolia*) and highbush blueberry (*Vaccinium corymbosum*). No herbs were noted in this community.

Figure 5.16. Pond Pine Woodland (Northeast Section)

This community is of a fairly young age compared with some of the others when looking at the historical imagery. I estimate it to be mid to late successional. Some of the pines are quite large, approaching 3 feet in diameter. Most trees however range from 1 foot to 1.5 feet in diameter.

Analysis of Condition at Old Furnace Wildlife Area

Pond Pine Woodland was not present in 1954 and has since grown into a former clear-cut (19 acres) and converted 8 acres of Chesapeake Bay Non-riverine Wet Hardwood Forest (Table 5.24).

Table 5.24. Pond Pine Woodland has migrated into X or remained since 1954	
X	**Acreage**
Clear-cut	19 acres
Chesapeake Bay Non-riverine Wet Hardwood Forest	8 acres

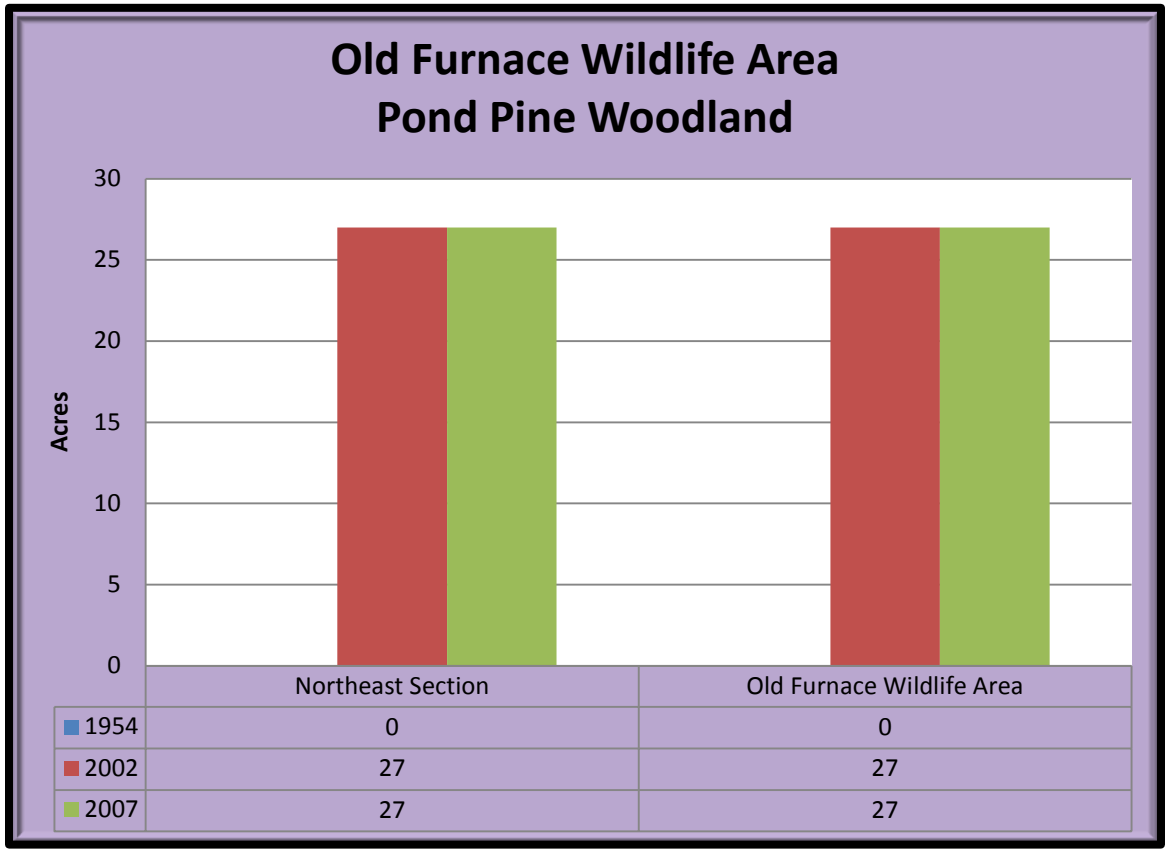


Figure 5.17. Pond Pine Woodland at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.25)

Pond Pine Woodland was not present in 1954 and has since made an overall gain in capital for the wildlife area.

Table 5.25. Natural Capital of Pond Pine Woodland	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$331,870/year
2007	$331,870/year

Southern Red Maple-Blackgum Swamp **[113 acres (Figures 5.18-5.19, Tables 5.26.5.28)] G3? S3**

DEWAP: Coastal Plain Floodplain Forest and Riparian Swamps
NHC: Northern Atlantic Coastal Plain Stream and River

Description

This community found along the major watercourses in the wildlife area, including Deep Creek and Tyndall Branch. Red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), blackgum (*Nyssa sylvatica*), green ash (*Fraxinus pennsylvanica*), loblolly pine (*Pinus taeda*) and a few pond pine (*Pinus serotina*) compose the canopy. The understory contains smaller members of the canopy plus American holly (*Ilex opaca*), sweetbay (*Magnolia virginiana*), and American hornbeam (*Carpinus caroliniana*). The shrub and vine layer is composed of common greenbrier (*Smilax rotundifolia*), laurel-leaf greenbrier (*Smilax laurifolia*), sweet pepperbush (*Clethra alnifolia*), strawberry-bush (*Euonymus americanus*), highbush blueberry (*Vaccinium corymbosum*), creeping raspberry (*Rubus hispidus*), and a few multiflora rose (*Rosa multiflora*). Common herbs include Atlantic sedge (*Carex atlantica*), thicket sedge (*Carex abscondita*), partridge-berry (*Mitchella repens*), and netted chainfern (*Woodwardia areolata*).

Figure 5.18. Southern Red Maple-Blackgum Swamp (Main Section)

Going by the imagery, this community is at least 60 years old. I estimate it to be late successional with diameters of trees ranging around 1.5 feet. The understory is thick in places.

Analysis of Condition at Old Furnace Wildlife Area

About 91 acres of the original 92 acres present in 1954 were still extant in 2007. The remaining acre has become 0.4 acres of impoundment, 0.4 acres of Mid to Late Successional Loblolly Pine-Sweetgum Forest, and 0.1 acres of Cultivated Lawn (Table 5.26).

Since 1954, this community has only migrated into 0.1 acres of agricultural field resulting in a near straight loss of acreage (Table 5.27).

Table 5.26. What was once Southern Red Maple-Blackgum Swamp in 1954 has become X or remained in 2007	
X	**Acreage**
Southern Red Maple-Blackgum Swamp	91 acres
Impoundment	0.4 acres
Mid to Late Successional Loblolly Pine-Sweetgum Forest	0.4 acres
Cultivated Lawn	0.1 acres

Table 5.27. Southern Red Maple-Blackgum Swamp has migrated into X or remained since 1954	
X	**Acreage**
Southern Red Maple-Blackgum Swamp	91 acres
Agricultural Field	0.1 acres

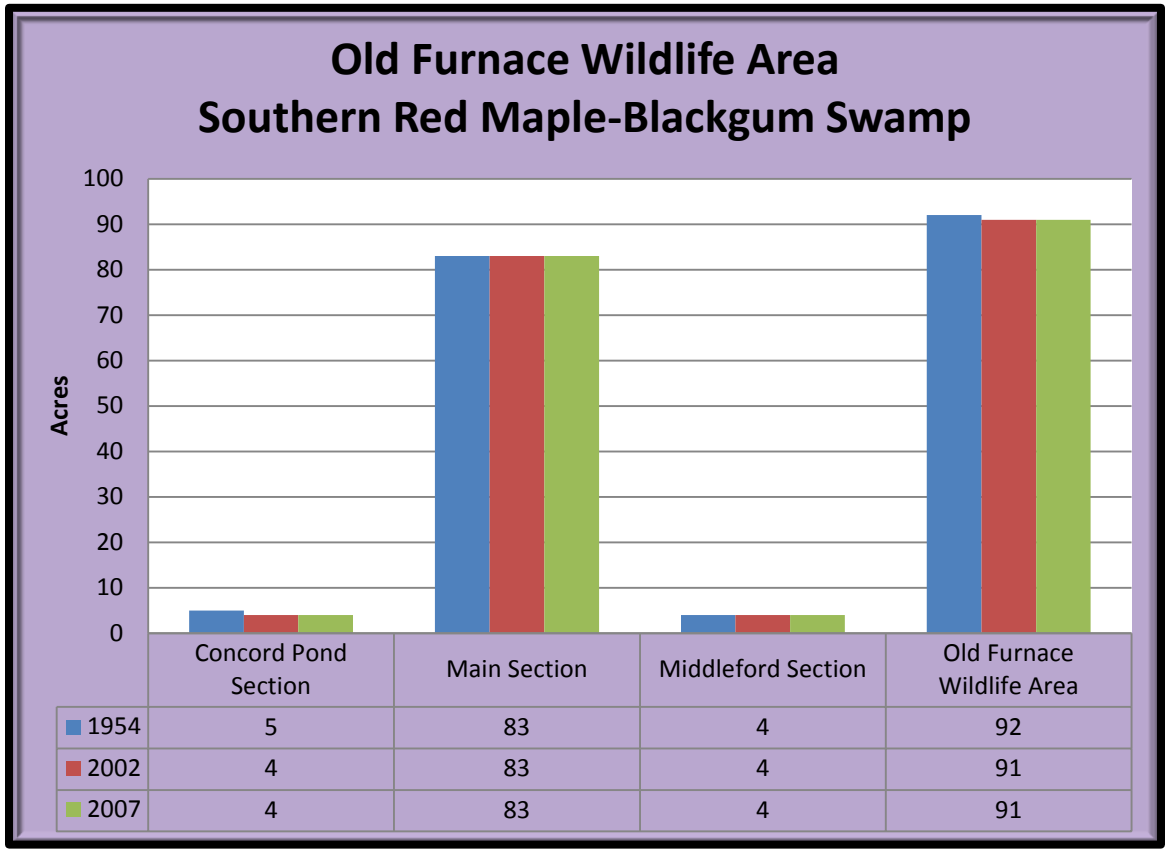


Figure 5.19. Southern Red Maple-Blackgum Swamp at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.28)

Capital in Southern Red Maple-Blackgum Swamp has decreased owing to the loss of an acre.

Table 5.28. Natural Capital of Southern Red Maple-Blackgum Swamp	
Year	**Natural Capital (in 2012 dollars)**
1954	$1,130,818/year
2002	$1,118,527/year
2007	$1,118,527/year

Southern Red Oak/Heath Forest **[40 acres (Figures 5.20-5.21, Tables 5.29-5.31)] G4G5 S5**

DEWAP: Coastal Plain Upland Forest
NHC: Northern Atlantic Coastal Plain Hardwood Forest

Description

A cutover and stunted example of a Southern Red Oak/Heath Forest is located in the center of the largest tract of Old Furnace Wildlife Area. Southern red oak (*Quercus falcata*) is associated by white oak (*Quercus alba*), red maple (*Acer rubrum*), Virginia pine (*Pinus virginiana*), and loblolly pine (*Pinus taeda*). The understory is composed of smaller canopy members plus American holly (*Ilex opaca*), wild black cherry (*Prunus serotina*), eastern red cedar (*Juniperus virginiana*), sand hickory (*Carya pallida*), and mockernut hickory (*Carya alba*). The shrub and vine layer includes lowbush blueberry (*Vaccinium pallidum*), blackberry (*Rubus* sp.), highbush blueberry (*Vaccinium corymbosum*), and a few mountain laurel (*Kalmia latifolia*) and summer grape (*Vitis aestivalis*). The herb layer is composed of broom-sedge (*Andropogon virginicus*) and speargrass (*Chasmanthium laxum*).

Figure 5.20. Southern Red Oak/Heath Forest (Main Section)

This community is of a young age and appears to have grown up from a clear-cut. Most trees are less than 1 foot in diameter and the understory and canopy are close in height.

Analysis of Condition at Old Furnace Wildlife Area

None of the acreage present in 1954 was present in 2007. All of the former Southern Red Oak/Heath Forest has become 2 acres of Northeastern Successional Shrubland, 0.1 acres of agricultural field, and 0.1 acres of cultivated lawn (Table 5.29). Since 1954, 31 acres of Early to Mid-Successional Loblolly Pine Forest and 3 acres of Mid to Late Successional Loblolly Pine-Sweetgum Forest have matured to this community (Table 5.30).

Table 5.29. What was once Southern Red Oak/Heath Forest in 1954 has become X or remained in 2007	
X	**Acreage**
Northeastern Successional Shrubland	2 acres
Agricultural Field	0.1 acres
Cultivated Lawn	0.1 acres

Table 5.30. Southern Red Oak/Heath Forest has migrated into X or remained since 1954	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	31 acres
Mid to Late Successional Loblolly Pine-Sweetgum Forest	3 acres

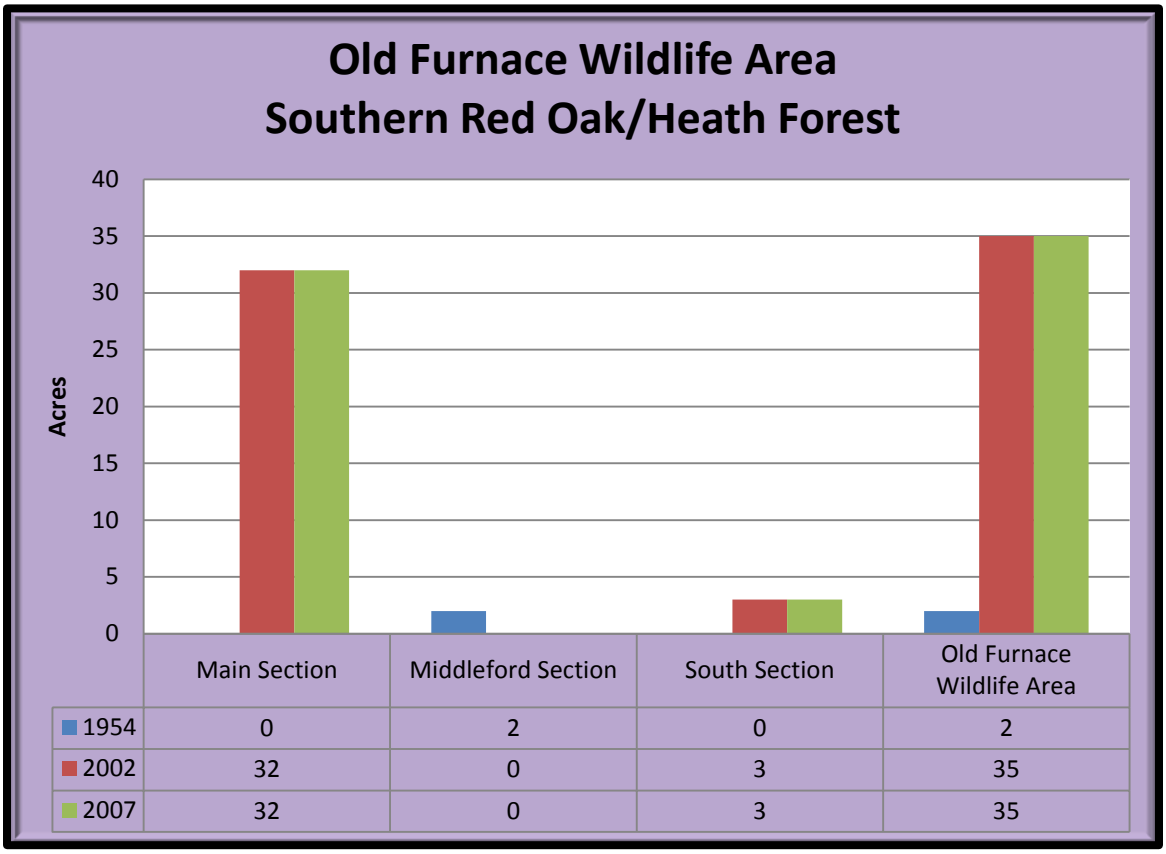


Figure 5.21. Southern Red Oak/Heath Forest at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 5.31)

Southern Red Oak/Heath Forest has increased in acreage since 1954, giving gains to its capital value.

Table 5.31. Natural Capital of Southern Red Oak/Heath Forest	
Year	**Natural Capital (in 2012 dollars)**
1954	$378/year
2002	$6,619/year
2007	$6,619/year

CHAPTER 6: 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 it effects can also be seen in the impoundments.

The land covers include:

1. Agricultural Field—211 acres
2. Farm Pond/Artificial Pond—0.1 acres
3. Impervious Surface—0.1 acres
4. Impoundment—1 acre
5. Modified Land—1 acre
6. Powerline R-O-W—23 acres
7. Water—2 acres

Agricultural Field **[211 acres, (Figure 6.1, Tables 6.1-6.3)]**

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

Description

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

Analysis of Condition at Old Furnace Wildlife Area

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.

About 182 acres of the agricultural fields present in 1954 were still present in 2007. The remainder had become 4 acres of Early to Mid-Successional Loblolly Pine Forest, 3 acres of Northeastern Old Field, 1 acre of Loblolly Pine Plantation, and 0.3 acres of Modified Land.

Since 1954, agricultural field has been developed in 17 acres of Early to Mid-Successional Loblolly Pine Forest and 8 acres of Loblolly Pine Plantation, 4 acres of Mid to Late Successional Loblolly Pine-Sweetgum Forest, and 0.1 acres of Cultivated Lawn.

Table 6.1. What was once Agricultural Field in 1954 has become X or remained in 2007

X	**Acreage**
Agricultural Field	182 acres
Early to Mid-Successional Loblolly Pine Forest	4 acres
Northeastern Old Field	3 acres
Loblolly Pine Plantation	1 acre
Modified Land	0.3 acres
Other communities/land covers	1 acre

Table 6.2. Agricultural Field has migrated into X or remained since 1954	
X	**Acreage**
Agricultural Field	182 acres
Early to Mid-Successional Loblolly Pine Forest	17 acres
Loblolly Pine Plantation	8 acres
Mid to Late Successional Loblolly Pine-Sweetgum Forest	4 acres
Cultivated Lawn	0.1 acres
Other communities/land covers	0.1 acres

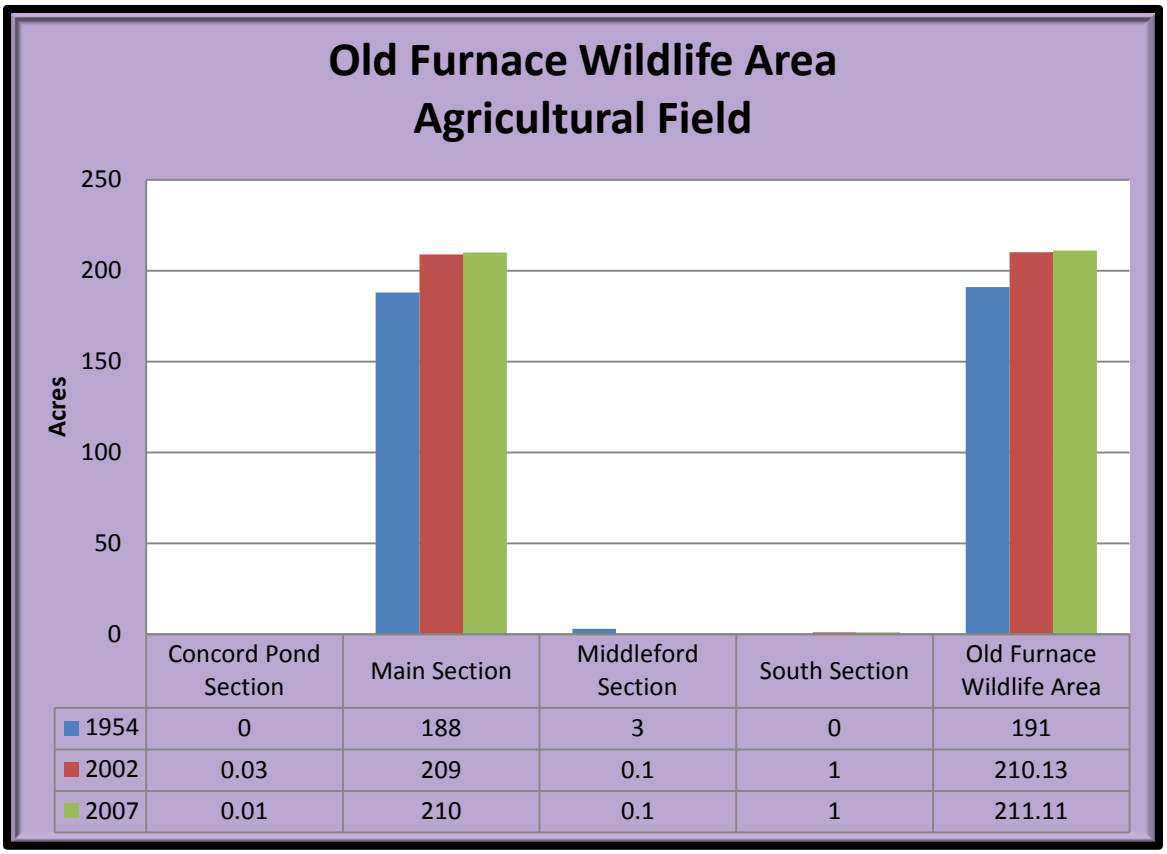


Figure 6.1. Agriculture Field at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 6.3)

Agricultural field acreage has been going up along with the capital of the fields.

Table 6.3. Natural Capital of Agricultural Field	
Year	**Natural Capital (in 2012 dollars)**
1954	$10,954/year
2002	$12,051/year
2007	$12,107/year

Farm Pond/Artificial Pond **[0.1 acres, (Figure 6.2, Table 6.4)]**

DEWAP: Impoundment
NHC: No Equivalent Classification

Description

Farm Pond/Artificial Pond includes water bodies that are less than 5 acres in size.

Analysis of Condition at Old Furnace Wildlife Area

The one farm pond that is present in the wildlife area was developed out of 0.02 acres of agricultural field.

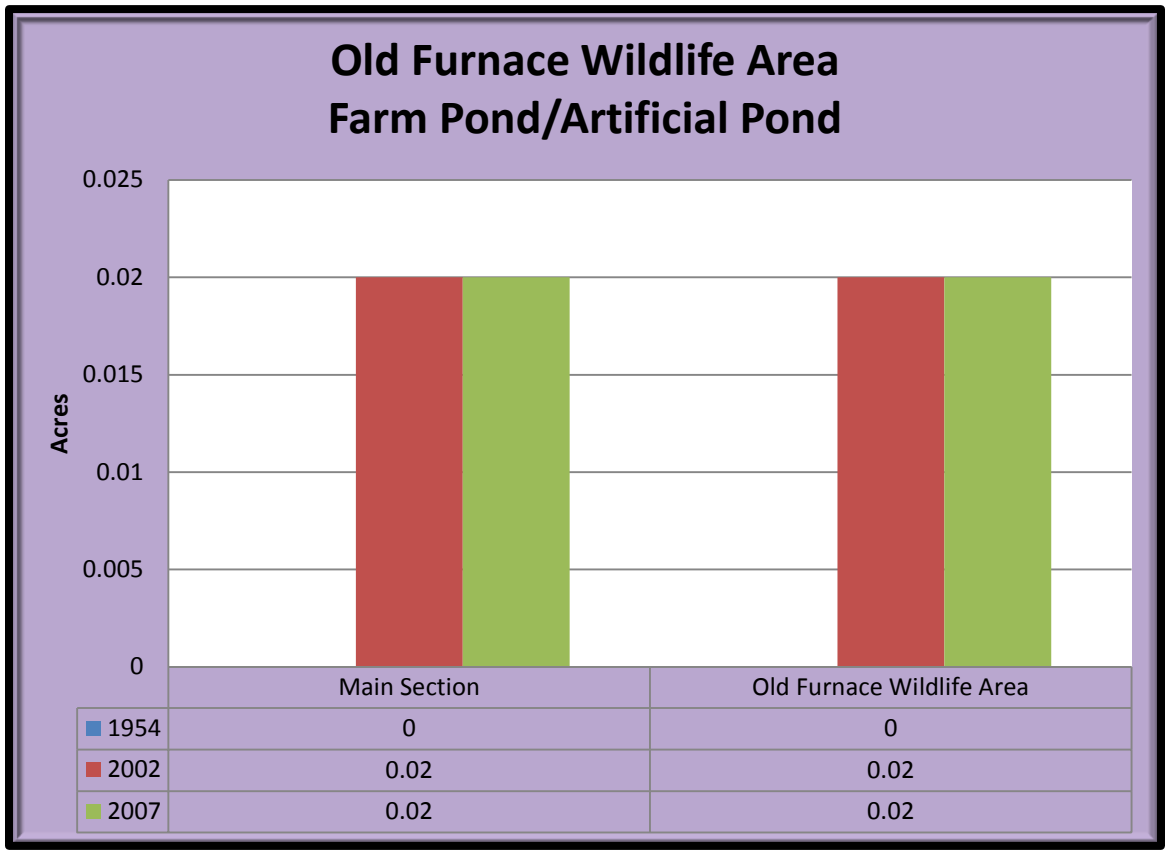


Figure 6.2. Farm Pond/Artificial Pond at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital (Table 6.3)

The Farm Pond/Artificial Pond that is present in the wildlife area was developed after 1954 and accounts for $107.00 in capital.

Table 6.3. Natural Capital of Farm Pond/Artificial Pond	
Year	**Natural Capital (in 2012 dollars)**
1954	$0/year (not present)
2002	$107/year
2007	$107/year

Impervious Surface **[0.1 acres, (Table 4.2)]**

Description

Impervious surfaces are those areas that are impermeable to the passage of water including roads, buildings, and driveways.

Analysis of Condition at Old Furnace Wildlife Area

Impervious surface was not present in 1954, but has since been developed in 0.1 acres of Mid to Late Successional Loblolly Pine-Sweetgum Forest and 0.02 acres of Agricultural Field (Table 6.4).

Table 6.4. Impervious Surface has migrated into X or remained since 1954	
X	**Acreage**
Mid to Late Successional Loblolly Pine-Sweetgum Forest	0.1 acres
Agricultural Field	0.02 acres

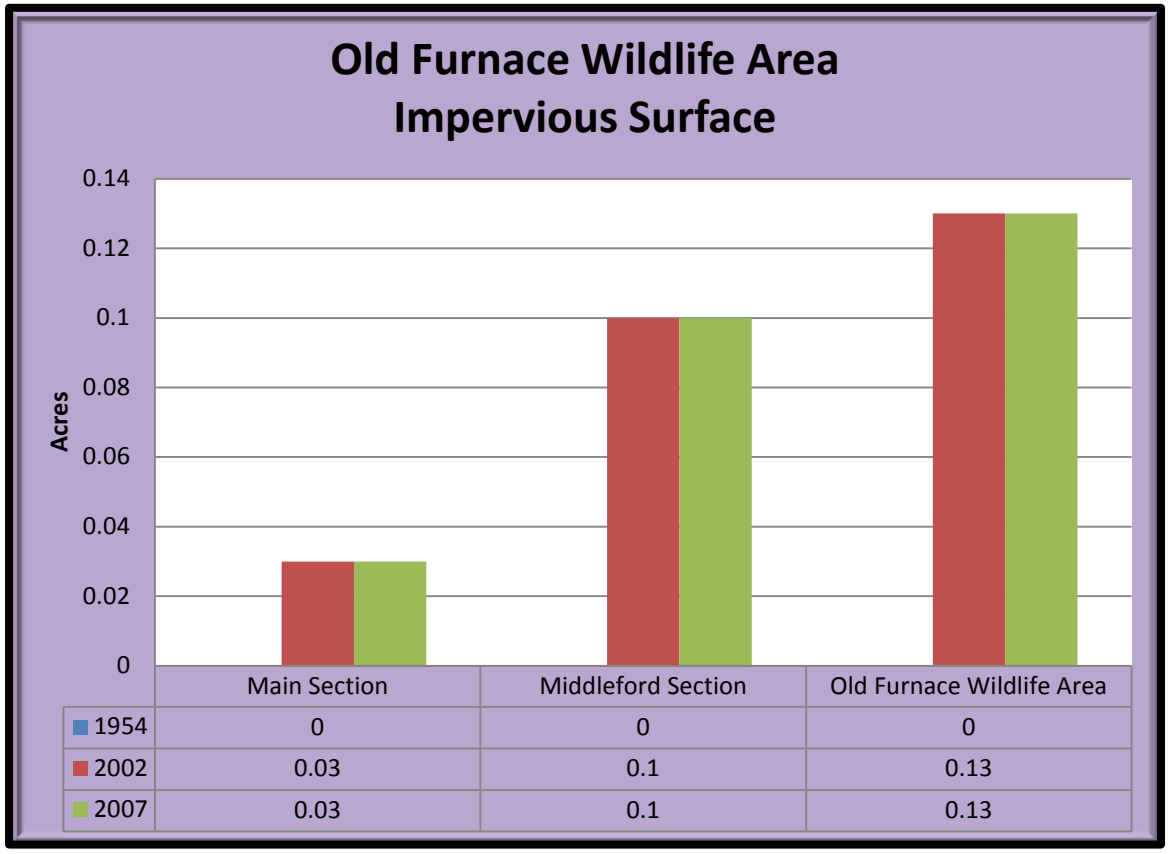


Figure 6.3. Impervious Surface at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital

Impervious surface does not have any natural capital value.

***Impoundment* [1 acre, (Figure 6.4, Tables 6.5-6.7)]**

DEWAP: Impoundment
NHC: No Equivalent Classification

Description

Impoundment includes those water bodies that are larger than 5 acres in size. This cover type includes Fleetwood Pond at Old Furnace Wildlife Area.

Analysis of Condition at Old Furnace Wildlife Area

All of the impoundment from 1954 is still present in 2007. However, about 0.4 acres of Southern Red Maple-Blackgum Swamp has been converted to impoundment since 1954.

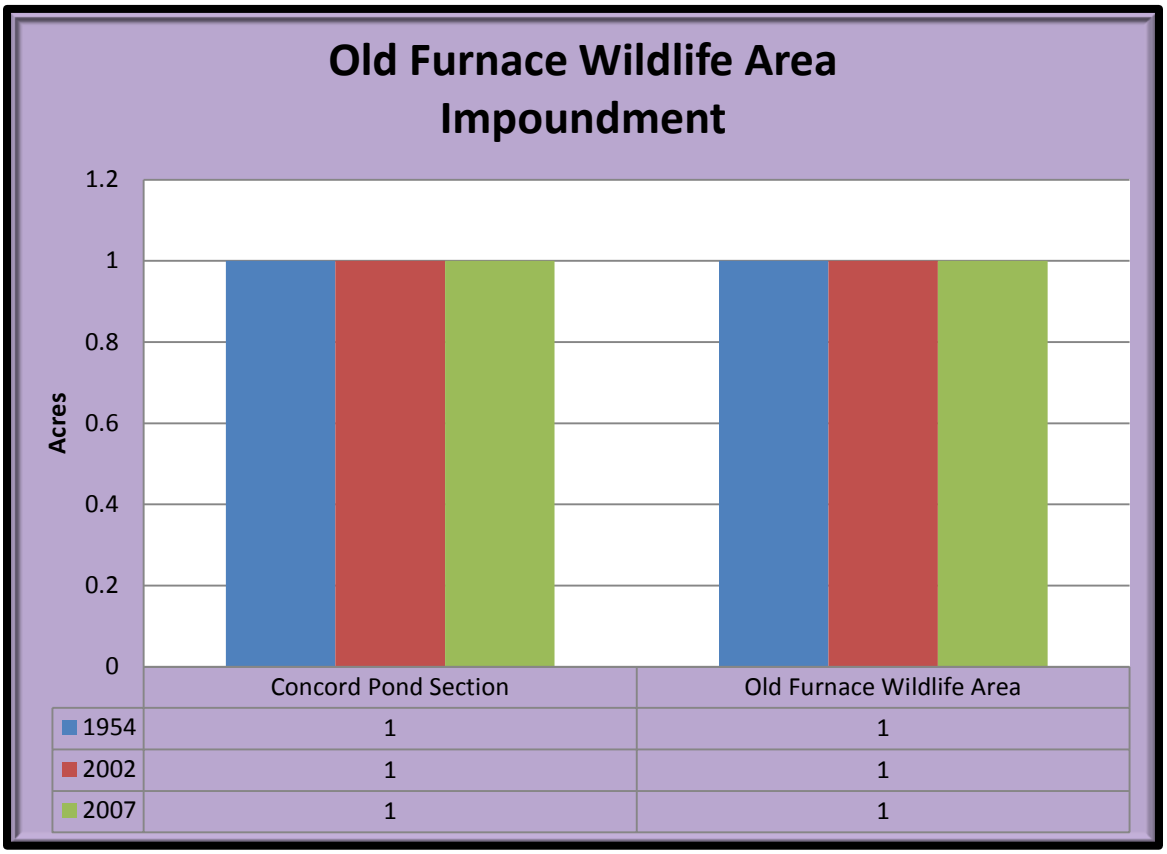


Figure 6.4. Impoundment at Old Furnace Wildlife Area (1954, 2002, and 2007)

Modified Land **[1 acre, (Figure 6.5, Table 6.5)]**

Description

Modified Lands include those areas that contain bare soil or have been disturbed containing little vegetation if any.

Analysis of Condition at Old Furnace Wildlife Area

Modified land has appeared in the wildlife area since 1954 in 1 acre of Early to Mid-Successional Loblolly Pine Forest and 0.3 acres of agricultural field (Table 6.5) and has been stable in the recent period (2002-2007).

Table 6.5. Modified Land has migrated into X or remained since 1954	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	1 acre
Agricultural Field	0.3 acres

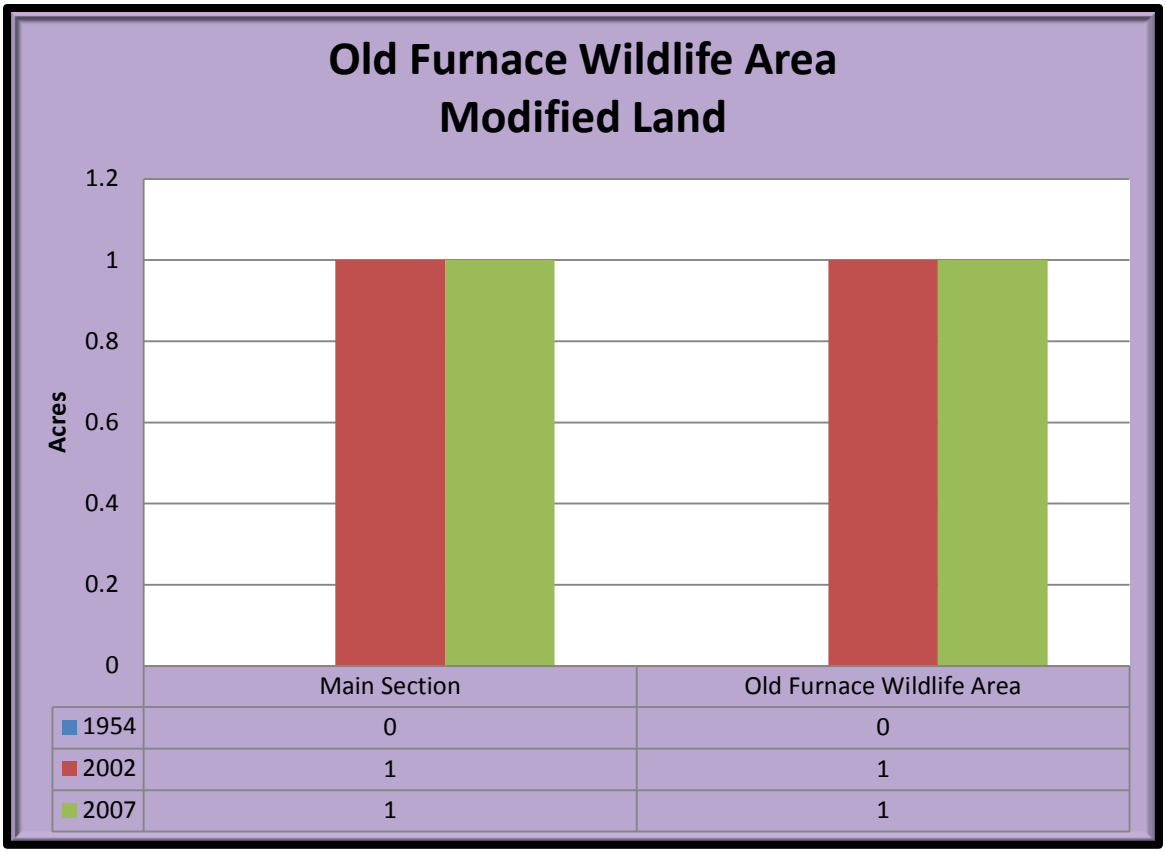


Figure 6.5. Modified Land at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital

Modified Land does not have any natural capital value.

Powerline R-O-W **[23 acres, (Figure 6.6, Table 6.6)]**

Description

Powerline R-O-W includes the area underneath high tension powerlines. These areas are similar to Northeastern Old Fields in vegetation composition.

Analysis of Condition at Old Furnace Wildlife Area

Since 1954, a powerline R-O-W has been developed across the Main Section of the wildlife area. This powerline converted 19 acres of Early to Mid-Successional Loblolly Pine Forest, and 1 acre each of Northern Coastal Plain Successional Floodplain Forest, Loblolly Pine Plantation, Mid-Atlantic Mesic Mixed Hardwood Forest, and Mid to Late Successional Loblolly Pine-Sweetgum Forest (Table 6.6).

Table 6.6. Powerline R-O-W has been developed in X	
X	**Acreage**
Early to Mid-Successional Loblolly Pine Forest	19 acres
Northern Coastal Plain Successional Floodplain Forest	1 acre
Loblolly Pine Plantation	1 acre
Mid-Atlantic Mesic Mixed Hardwood Forest	1 acre
Mid to Late Successional Loblolly Pine-Sweetgum Forest	1 acre
Other communities/land covers	0.1 acres

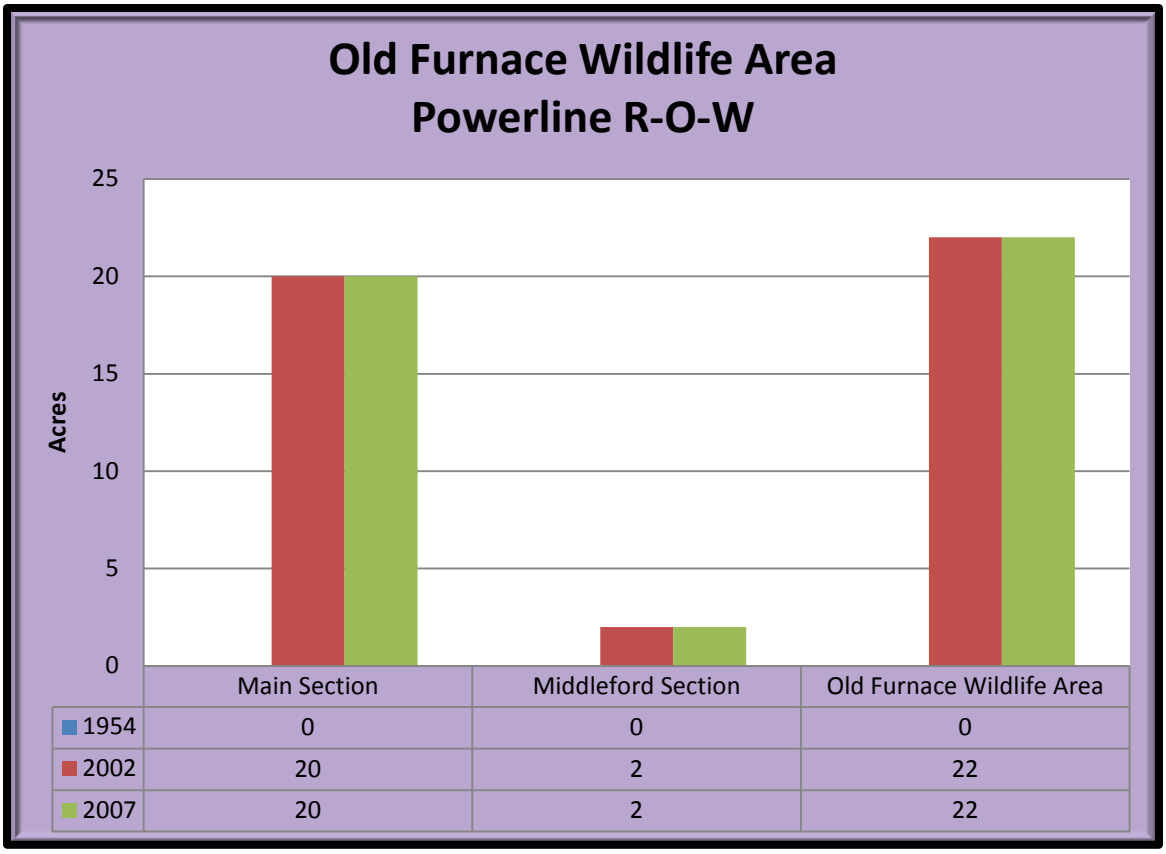


Figure 6.6. Powerline R-O-W at Old Furnace Wildlife Area (1954, 2002, and 2007)

Natural Capital

Powerline R-O-W does not have any natural capital value.

***Water* [2 acres, (Figure 6.7, Table 6.7)]**

Description

Water includes places that are not associated with a water body such as an impoundment or farm pond. In the case of Old Furnace Wildlife Area this includes Deep Creek and Tyndall Branch.

Analysis of Condition at Old Furnace Wildlife Area

All of the water present in 1954 was still present in 2007. Since 1954 the amount of water has increased and has gained acreage from 0.5 acres of Early to Mid-Successional Loblolly Pine Forest, 0.3 acres of Northern Coastal Plain Successional Floodplain Forest, and 0.1 acres of Mid to Late Successional Loblolly Pine-Sweetgum Forest (Table 6.7).

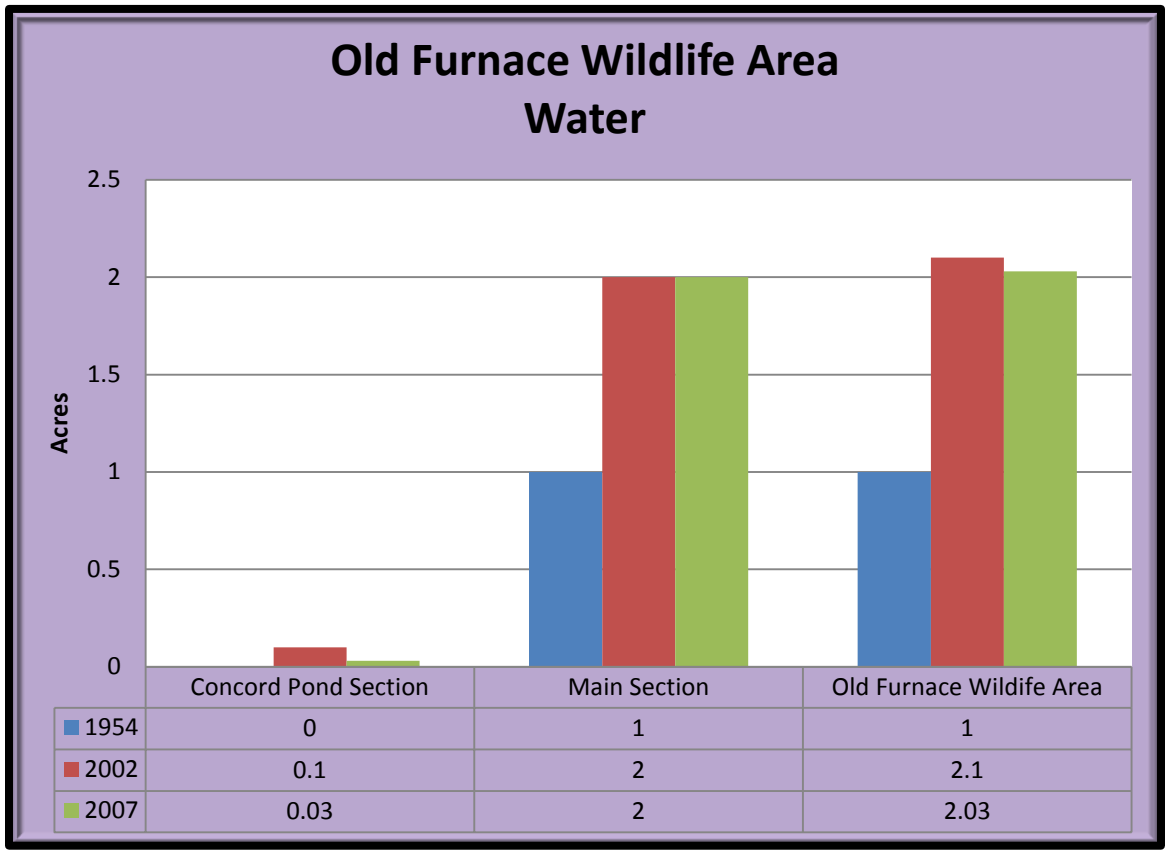


Figure 6.7. Water at Old Furnace Wildlife Area (1954, 2002, and 2007)

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 SPECIES EXPECTED FOR KEY WILDLIFE HABITATS

SGCN Species expected in Early Successional Upland Habitats			
Species	**Common Name**	**Class**	**Tier**
Nicrophorus americanus	American burying beetle	Insect	1
Callophrys irus	frosted elfin	Insect	1
Papaipema maritima	maritime sunflower borer moth	Insect	1
Terrapene carolina	Eastern box turtle	Reptile	1
Lampropeltis triangulum	milk snake	Reptile	1
Branta canadensis	Canada goose (migratory)	Bird	1
Circus cyaneus	Northern harrier	Bird	1
Bartramia longicauda	upland sandpiper	Bird	1
Scolopax minor	American woodcock	Bird	1
Asio flammeus	short-eared Owl	Bird	1
Chordeiles minor	common nighthawk	Bird	1
Lanius ludovicianus	loggerhead shrike	Bird	1
Dendroica discolor	prairie warbler	Bird	1
Ammodramus henslowii	Henslow's sparrow	Bird	1
Cincindela scutellaris	festive tiger beetle	Insect	2
Atrytonopsis hianna	dusted skipper	Insect	2
Satyrium liparops	striped hairstreak	Insect	2
Satyrium liparops strigosum	stiped hairstreak	Insect	2
Callophrys gryneus	juniper hairstreak	Insect	2
Speyeria aphrodite	aphrodite fritillary	Insect	2
Speyeria idalia	regal fritillary	Insect	2
Boloria bellona	meadow fritillary	Insect	2
Paratrea plebeja	trumpet vine sphinx	Insect	2
Calyptra canadensis	Canadian owlet	Insect	2
Acronicta rubricoma	a dagger moth	Insect	2
Papaipema rigida	rigid sunflower borer moth	Insect	2
Cirrhophanus triangulifer	a noctuid moth	Insect	2
Schina septentrionalis	a noctuid moth	Insect	2
Plegadis falcinellus	glossy ibis	Bird	2
Cygnus columbianus	tundra swan	Bird	2
Coragyps atratus	black vulture	Bird	2
Colinus virginianus	Northern bobwhite	Bird	2
Pluvialis squatarola	black-bellied plover	Bird	2
Coccyzus erythropthalmus	black-billed cuckoo	Bird	2
Chaetura pelagica	chimney swift	Bird	2
Colaptes auratus	Northern flicker	Bird	2
Empidonax minimus	least flycatcher	Bird	2
Tyrannus tyrannus	Eastern kingbird	Bird	2
Toxostoma rufum	Brown thrasher	Bird	2
Dendroica pensylvanica	Chestnut-sided warbler	Bird	2
Icteria virens	Yellow-breasted chat	Bird	2
Piplio erythrophthalmus	Eastern towhee	Bird	2
Spizella pusilla	field sparrow	Bird	2

Pooecetes gramineus	vesper sparrow	Bird	2
Passerculus sandwichensis	savannah sparrow	Bird	2
Ammodramus savannarum	grasshopper sparrow	Bird	2
Dolichonyx oryzivorus	bobolink	Bird	2
Cryptotis parva	least shrew	Bird	2

SGCN Species expected in Coastal Plain Upland Forest			
Species	**Common Name**	**Class**	**Tier**
Cicindela patruela consentanea	Northern barrens tiger beetle	Insect	1
Callophrys irus	frosted elfin	Insect	1
Catocala antinympha	sweetfern underwing	Insect	1
Catocala lacrymosa	tearful underwing	Insect	1
Terrapene carolina	Eastern box turtle	Reptile	1
Eumeces laticeps	broadhead skink	Reptile	1
Cemophora coccinea	scarlet snake	Reptile	1
Elaphe guttata	corn snake	Reptile	1
Lampropeltis triangulum	milk snake	Reptile	1
Haliaeetus leucocephalus	Bald eagle	Bird	1
Accipiter cooperii	Cooper's Hawk	Bird	1
Buteo platypterus	broad-winged hawk	Bird	1
Asio otus	long-eared owl	Bird	1
Melanerpes erythrocephalus	red-headed woodpecker	Bird	1
Certhia americana	brown creeper	Bird	1
Hylocichla mustelina	wood thrush	Bird	1
Wilsonia citrina	hooded warbler	Bird	1
Sciurus niger cinereus	Delmarva fox squirrel	Mammal	1
Discus catskillensis	angular disc	Gastropod	2
Cicindela patruela	Northern barrens tiger beetle	Insect	2
Cicindela unipunctata	one-spotted tiger beetle	Insect	2
Photuris frontalis	a firefly	Insect	2
Erynnis martialis	mottled duskywing	Insect	2
Erynnis baptisiae	wild indigo duskywing	Insect	2
Battus philenor	pipevine swallowtail	Insect	2
Polygonia progone	gray comma	Insect	2
Caripeta aretaria	a geometer moth	Insect	2
Tolype notialis	a lasiocampid moth	Insect	2
Hemileuca maia maia	the buckmoth	Insect	2
Cisthene kentuckiensis	Kentucky lichen moth	Insect	2
Cisthene tenuifascia	a lichen moth	Insect	2
Grammia phyllira	phyllira tiger moth	Insect	2
Zale metata	a noctuid moth	Insect	2
Catocala flebilis	mournful underwing	Insect	2
Catocala residua	residua underwing	Insect	2
Catocala cerogama	Yellow banded underwing	Insect	2
Acronicta exilis	Exiled dagger moth	Insect	2
Acronicta lithospila	Streaked dagger moth	Insect	2

Papaipema araliae	Aralia shoot borer moth	Insect	2
Papaipema baptisiae	Wild indigo borer moth	Insect	2
Lepipolys perscripta	A noctuid moth	Insect	2
Scincella lateralis	Ground skink	Reptile	2
Heterodon platirhinos	Eastern hognose snake	Reptile	2
Lampropeltis getula	Common kingsnake	Reptile	2
Storeria occipitomaculata	Redbelly snake	Reptile	2
Virginia valeriae	Smooth earth snake	Reptile	2
Agkistrodon contortix	Copperhead	Reptile	2
Coragyps atratus	Black vulture	Bird	2
Strix varia	Barred owl	Bird	2
Caprimulgus vociferus	whip-poor-will	Bird	2
Colaptes auratus	Northern flicker	Bird	2
Myiarchus crinitus	Great crested flycatcher	Bird	2
Sitta pusilla	Brown-headed nuthatch	Bird	2
Vireo flavifrons	Yellow-throated vireo	Bird	2
Dendroica dominca	Yellow-throated warbler	Bird	2
Mniotilta varia	Black-and-white warbler	Bird	2
Seiurus motacilla	Louisiana waterthrush	Bird	2
Oporornis formosus	Kentucky warbler	Bird	2
Piranga olivacea	Scarlet tanager	Bird	2
Piplio erythrophthalmus	Eastern towhee	Bird	2
Icterus galbula	Baltimora oriole	Bird	2
Lasionycteris noctivagans	Silver-haired bat	Mammal	2
Lasiurus borealis	Eastern red bat	Mammal	2
Lasiurus cinereus	Hoary bat	Mammal	2
Canis latrans	coyote	Mammal	2