New Jersey

Statewide Forest Resource Assessment & Strategies

2010

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Statewide Forest Resource Assessment

and

Resource Strategies

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In cooperation with:

The New Jersey Forest Stewardship Coordinating Committee
US Forest Service, State and Private Forestry
US Forest Service, Forest Inventory and Analysis (FIA)
NJ Forest Fire Service
NJ State Park Service
The Richard Stockton College of New Jersey

Introduction

As Congress worked to re-authorize the Farm Bill in 2008 they re-evaluated the importance of stewardship on the nation's non-Federal forest resources and coordinating federal and state efforts toward the proper stewardship of these resources. Congress inserted amendments in the Bill that require states to conduct an assessment of their forest resources and to formulate strategies for their protection and management. The Statewide Assessment of New Jersey's forest resources and the forest resource strategies presented herein have been prepared pursuant to this Farm Bill's mandate.

The intent and scale of the Assessment is not necessarily developed to pinpoint on the ground activities as in our annual work plans but to give an overview of the state's forest resources and to provide a practical and measurable approach for management opportunities.

Members from the NJ Forest Stewardship Coordinating Committee provided input and discussion regarding issues and concerns that needed to be addressed in the Statewide Assessment. Committee members were from the following organizations; The NJ Forest Service, NJ Department of Agriculture, US Forest Service, NJ State Technical Committee (NRCS), The Nature Conservancy, NJ Fish & Wildlife Service, Consultant Forester, NJ Forestry   Association, Forest Legacy Program, NJ Farm Services   Agency, Rutgers University, Natural Heritage Program, Commission,. Input was also provided by the US Army and the US Navy forestry personnel for the forest lands covering the Joint Base (Fort Dix, McGuire and Lakehurst Military facilities).
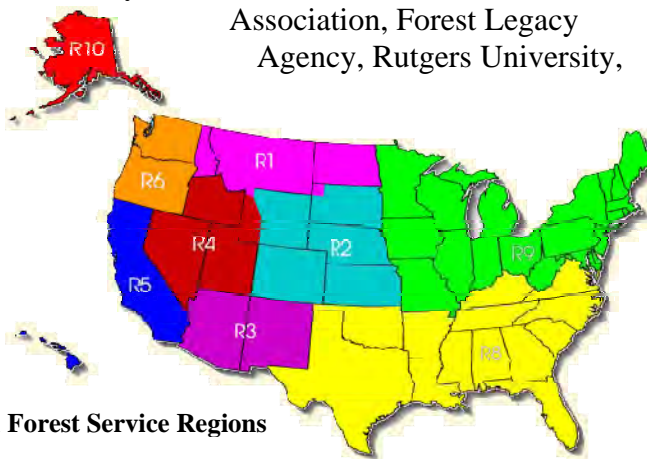
USDA Forest Service Regions

The Assessment will require an update every fives years thereby addressing what has changed during its implementation in consideration to the resources and success and evolution of strategies. The Assessment includes all forestry services program areas; Forest Stewardship, Forest Health, Urban and Community Forestry, and Forest Fire. Forest Legacy is also included which is formally administered by the Green Acres Program. No longer will individual strategic plans, assessment of need or program guidelines be submitted individually every five years. Core funding for programs will remain in place but an increase in competitive grants involving multi agency and multi-states for regional priority areas (Highlands, Legacy and Pinelands) defined by the Northeastern Forest Resource Planners Association.

This report is presented in two parts. Part I is a Statewide Assessment of forest resources. It provides an analysis of the forest conditions and trends in the state and describes rural and urban, public and private forest landscape areas. Part II is the Strategies Section that sets forth proposed state-wide forest resource strategies. It provides long-term strategies for investing state, federal, and private resources to manage the priority landscapes identified in the assessment, and thereby will focus investments where it can most effectively stimulate or leverage desired action and engage multiple partners.

Data used to generate the State Assessment & Resource Strategies were derived from various sources such as the United States Forest Service Forest Inventory & Analysis (FIA), NJ ECOMAP 1 & 2, NJ Forest Health Program, Forest Stewardship Program, and the Spatial Analysis Project (SAP). The data is presented using an outline of the Criteria and Indicator (C&I) framework for forest sustainability.

These criteria are the result of the 1995 Montreal Process (MP) that have been accepted and endorsed by the 20 Northeastern Area (NA) states, USDA Forest Service, NA Association of State Foresters and the Northeastern Forest Resource Planners Association. Included with the Assessment and Resource Strategies, the National Themes of Conserve and Manage

USDA Forest Service Northeastern Area

Working Forest Lands, Protect Forests from Threat and Enhance Public Benefits from Trees and Forests will be incorporated throughout all C&Is particularly the Strategies section due to the inter-relationships of natural resources and corresponding management.

These criteria are broad but provide information the State can utilize for long-term efforts in managing our forest resources sustainably. Any data gaps encountered in the framework will provide guidance for future data collection needs.

Statewide Assessment

Historical View

The earliest records of man's activities in northwest New Jersey date back to the Minisink Branch of the Lenni Lenape Indians who were referred to as the Delaware Indians by the early white settlers. This tribe used the fertile areas along the Delaware and its tributaries to grow crops of maize (corn), beans, squashes, and tobacco in small gardens. The mountainous areas which eventually became Stokes State Forest and High Point State Park were used by them for hunting and for gathering fruits and nuts. During the 1700's, people of English and Dutch extraction settled throughout the area. They cleared the forests for agriculture and for lumber, eventually forcing the Lenni Lenape out.

The lands that were to become the State of New Jersey were dominated by forests in the sixteenth and seventeenth centuries, when European settlers were first arriving (Matlack 1997) Native Americans had cleared some limited areas, generally by burning, for cultivation but for the most part the lands contained old growth forests.

In the two centuries that followed the early Europeans settled significant amounts of New Jersey forestlands and cleared, sometimes deliberately for timber, firewood or

agriculture, sometimes accidentally through forest fire (MacDonalda and Rudelb 2005). Whether caused by lightning, sparks from train engine boilers, or other sources, during the late 1800's, it was common in the Pine Barrens region of the State for 70,000 to 100,000 acres to burn annually (NJ Forest Fire Service 2006). By 1900 only about 2.2 million of New Jersey's 4.7 million acres (i.e., 46 percent) remained as forest land, and much of that in poor condition due to over cutting and burning.

The colonial iron industry which started in the mid 1700's made heavy demands upon the forest resources of northern New Jersey. Charcoal was the primary energy source for the early blast furnaces and was obtained by burning hardwood timber from the forests of the area. During the mid 1800's the demand for charcoal by the iron industry reached its peak and in 1855 when 63,000 cords of hardwood timber from 6,500 acres of forest land were required to provide this charcoal. In addition to providing charcoal, the forests of the area were also timbered during this period to maintain a flourishing lumber industry. Products such as railroad ties, hoop poles, fencing, mine timbers, domestic fuel and others were manufactured from the timber logged in the Stokes State Forest and the High Point State Park areas of the State. Land cleared in the middle 1800's to provide timber for charcoal and for lumber was then used for farming but most of the ridge top areas utilized as such were soon abandoned for lack of productivity. Subsistence farming of

this nature, however, persisted to some degree even into the early 1900's. The advent of the canals, followed by the railroads in the mid and late 1800's made the rich anthracite coal fields in eastern Pennsylvania accessible, resulting in the decline of the charcoal industry. The lumbering industry joined in this decline in the late 1800's following the depletion of the timber resource in North Jersey.

This decline of New Jersey's forests began to be reversed in the mid-nineteenth century due to a confluence of conditions. At that time small farmers began to abandon agriculture and move to towns and cities leaving some fields to lie fallow and self-regenerate. The demand for wood as a fuel declined as coal became for plentifully available. By the beginning of the 20th century recognition of the need for attending to its forests had gained acceptance. Following the European example of managing forest reserves by applying scientific forestry practices, the New Jersey legislature took steps that led to appointment of the first State Firewarden (1906) and the first State Forester, Alfred Gaskill (1907). These actions over a century ago are the origin of today's professional State Forestry Services in New Jersey.

Today in New Jersey forests continue to cover 42 percent of the lands in the state. Given that 8.7 million people live in the state, making New Jersey the most densely populated state in the United States, it is a testament to the measures that have been taken that this much forestland has been maintained. About two-thirds of New Jersey's forest lands are in private ownership.
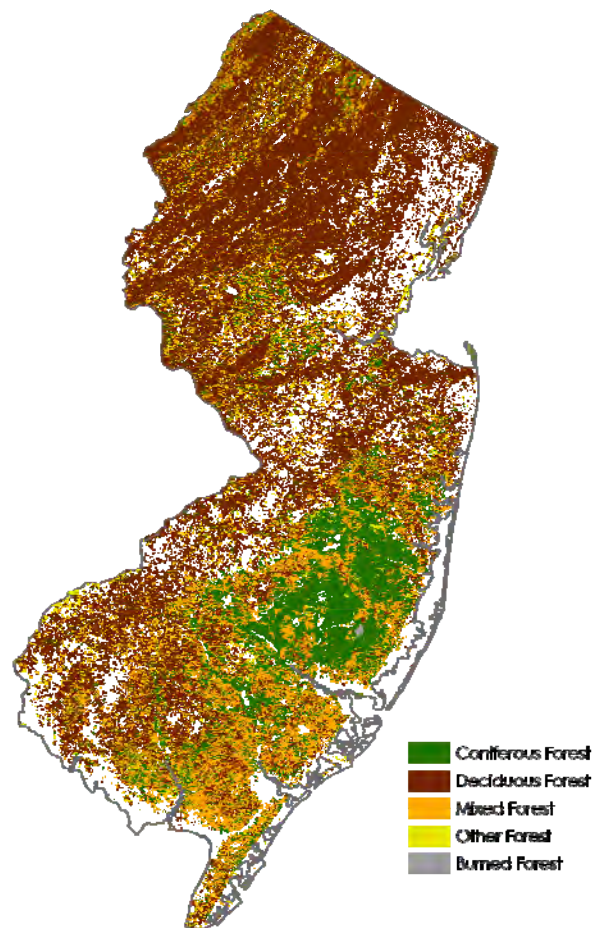
Forested Lands

Forest Conditions and Trends

Criterion 1. Conservation of Biological Diversity

1. Area of Forest Land relative to total land area and area of reserved forest land.

This is an indicator of how much land is forested within in the state and how much of that land is considered reserved. The variety of forest types occurring provides an ecological impression on how important the resources are to diversity. It is also a broad indication of society's interest in preserving forest ecosystems (USDA Forest Service, et al. 2003).

Drastic changes in forested land cover can affect the amount of overall habitat available for plant and animal species as well as the ability for various forest species to interact with each other.

Forests provide many benefits to the public such as recreational areas, natural water filtration / purification, removal of carbon dioxide, habitat for wildlife, a source of renewable energy and economic development. In an urban state such as NJ it is critical to maintain forested areas and to manage them properly. New Jerseys forests cover approximately 42 percent of total land area. Forest land has remained relatively stable.

Fish and Wildlife
Parks and Forestry
Natural Lands Trust

Military
USFWS
Other

Land Ownership

Classified Land-cover Characteristics

New Jersey's land cover is dominated by forestland, the characteristics as a percent of the total land area in New Jersey are (Nowak and Greenfield 2009):

Classified Land Cover Characteristics by Acres
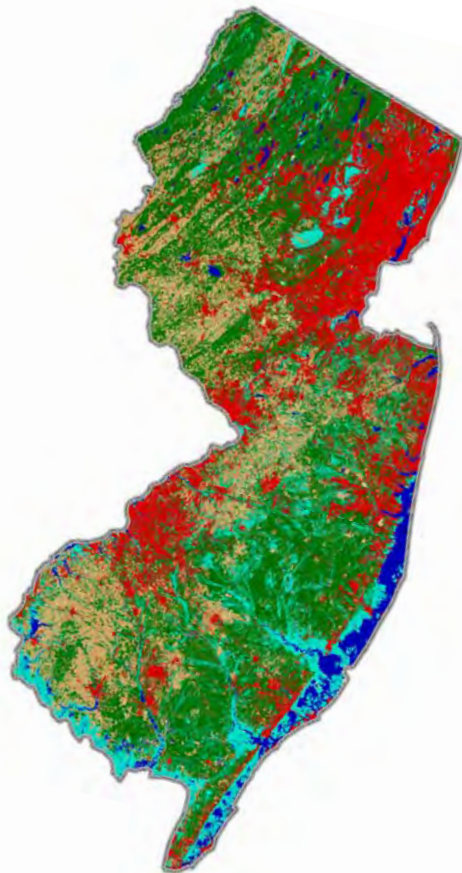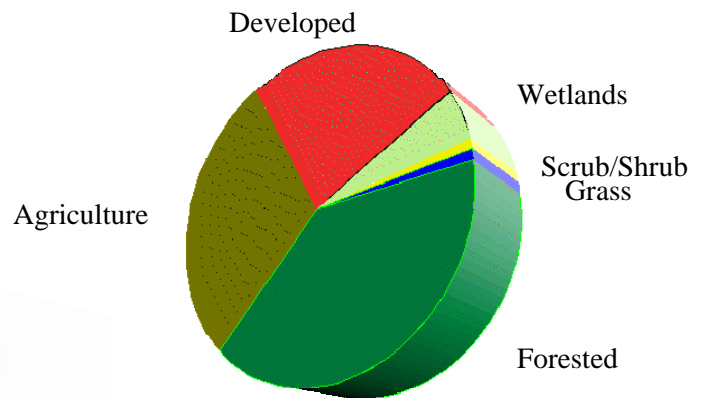
Land Use Land Cover

Protected land in held as state property through a few program areas. The Division of Parks and Forestry maintain approximately 38 parks and 11 forests, 4 designated recreational areas, 1 Forest Resource Education Center (FREC) and State Forest Tree Nursery and 43 Natural areas. These parcels total 436,527 acres. The Division of Fish and Wildlife have approximately 123 Wildlife Management Areas totaling 325, 900 acres. Of this acreage, many parcels are tidal areas that will not support forest or timber land. In 2006, the US Forest Service, FIA Program estimated 597,543 acres of state owned land to be forested.

The Forest Legacy Program also provides protection of forest land through either the establishment of easements on private property or the purchase of properties through the Green Acres Program.

Tree Canopy Cover Characteristics

Statewide tree canopy cover in New Jersey averages 43.6% with 91.7% total green space, 47.5% canopy green space, and 994.1 m^2 of canopy cover per capita. Average tree cover in urban areas of New Jersey was 34.8%, with 80.8% total green space, 43.1% canopy green space, ad 3,168 m^2 of canopy cover per capita. Within community lands in New Jersey, average tree cover was 37.3%, with 79.7% total green space, 46.9% canopy green space, and 315.6 m^2 of canopy cover per capita. Tree canopy cover, canopy green space, and tree cover per capita varies among communities, county subdivisions, and counties (Nowak and Greenfield 2009).
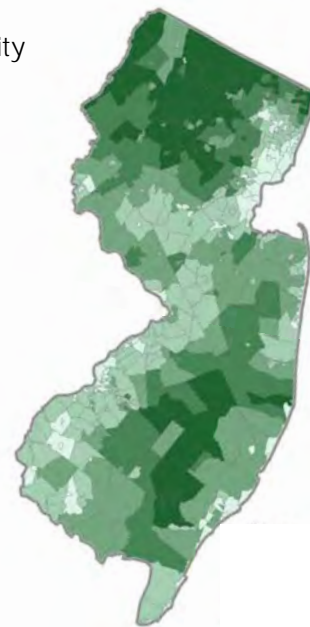
Percent tree cover by municipality

	0% – 15%
	15.1% – 30.6%
	30.7% – 45.9%
	46% – 61.8%
	61.9% – 87.6%
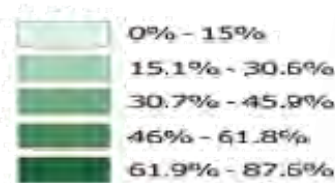
Relative Comparisons of Tree Cover

Out of the 566 county subdivisions (commonly called municipalities), 27 had a rating of excellent and 181 were rated poor; and out of 21 counties, four were rated excellent while four were given a rating of poor. Variability of assessment scores is a product of the difference in land-cover distributions and the percentages of canopy cover within the population density classes and mapping zones (Nowak and Greenfield 2009).

The NJFS report, "Trees in Crisis" of December 2000 (NJ-TIC2000) is based on field data collected from street trees in 432 plots in 1994 and 1999. These plots are in 108

municipalities of the ten different population Density Classes scattered across all 21 counties.

Seven population density classes were used for the relative comparison of tree cover:

Density Class	People per Square Mile
1	0 to 99.9
2	100 to249.9
3	250 to 499.9
4	500 to 749.9
5	750 to 999.9
6	1,000 to 4,999.9
7	5,000 or greater

The standardized score was calculated as equal to "tree canopy percent of mapping unit minus minimum tree canopy percentage in class" divided by "range of tree canopy percent in class." Then the county subdivisions and counties were assigned to one of the following categories based on that standardized score:

- Excellent – Standardized score of 0.9 to 1.0
- Very Good – 0.7 to 0.89
- Good – 0.5 to 0.69
- Fair – 0.3 to 0.49
- Poor – 0 to 0.29

Impervious surface in NJ is clustered around the urban areas and averages aprroximately 20 % by municipaility. Impervious surface alters hydrology and can adversely impact wildlife migration patterns (Nowak and Greenfield 2009).

Percent impervious surface by municipality

- 0.1% - 8.7%
- 8.8% - 19.9%
- 20% - 33.6%
- 33.7% - 52.2%
- 52.3% - 82.9%
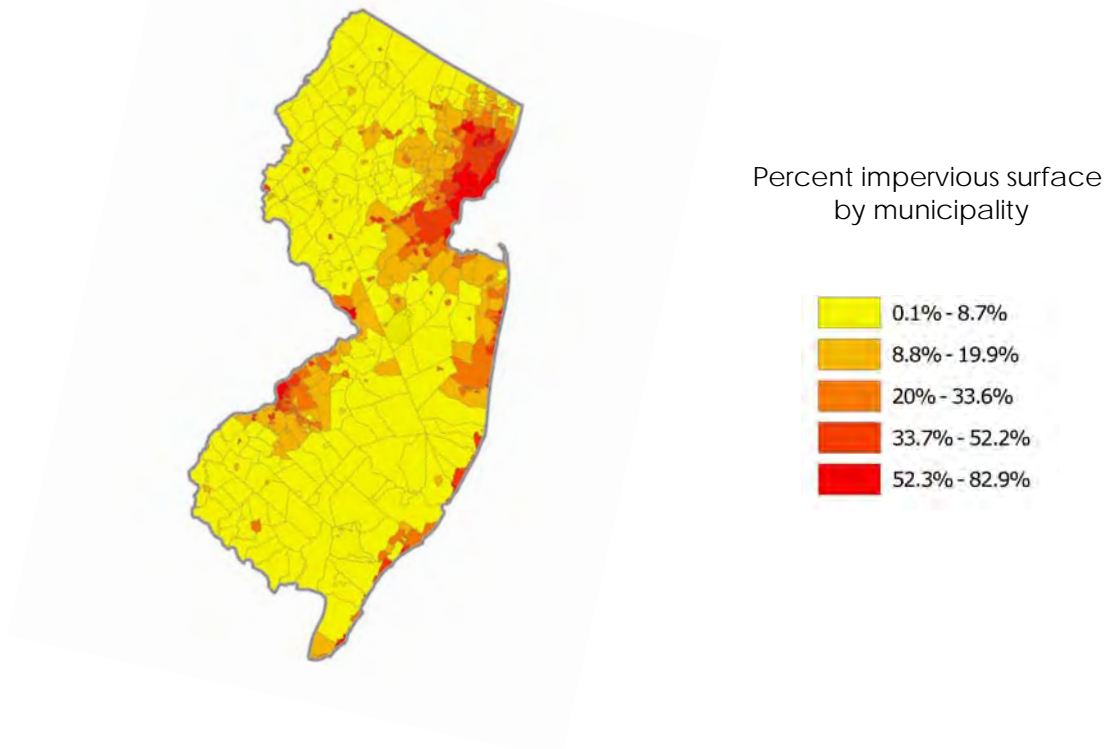
2. The extent of area by forest type and by size class, age-class and successional change.

This is an indicator that describes the variability of forest resources within the State. The number of successional stages gives an indication of the diversity of species that can be supported. A balance of forest types and successional stages provides a resource that is capable of being utilized sustain ably for traditional and nontraditional forest products (USDA Forest Service, et al. 2003).
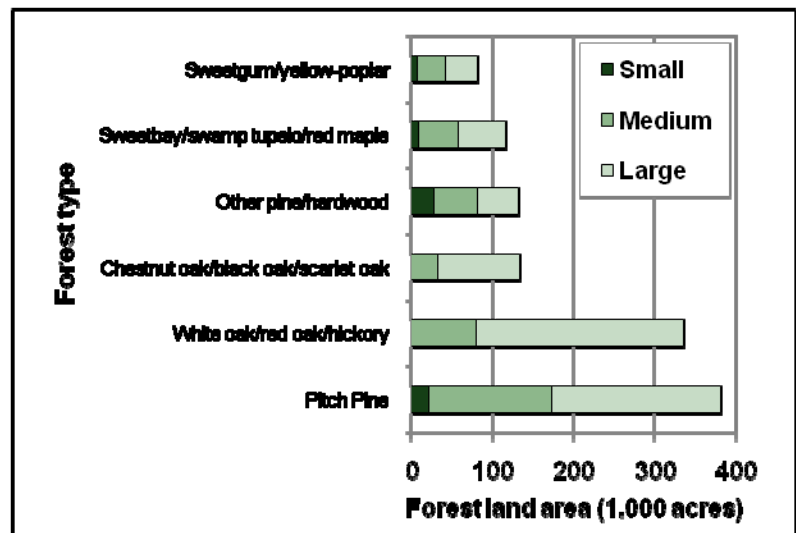
Area of forest land by top six forest types and stand-size class, (USDA Forest Service, FIA 2007)

New Jersey's forests vary greatly from north to south. In the north, northern hardwoods, white pine, Eastern hemlock, mixed oak and a variety of other species including isolated stands of red spruce are part of the forest composition. In the south, southern yellow pines such as pitch and shortleaf and to a lesser extent Virginia and loblolly are present. Various oak species such as southern red, scarlet, chestnut and white are prevalent.

Under the US Forest Service the Forest Inventory and Analysis (FIA) program conducts periodic inventories of forest resources throughout the US. This information is made available to the public in several different forms. The NJ Forest Service summarized portions of these data sets for the purpose of this assessment. The chart titled "Area of forest land by top six forest types and stand-size class, (USDA Forest Service, FIA) 2007," shows the area of forest land among NJ's 6 most widespread forest types.

The size classes roughly correspond to small being sapling- seedling size, medium being pole timber, and large being sawtimber. The FIA combines similar forest types into more generally defined forest type-groups. In the 2006 inventory, 77 different tree species were tallied and 38 forest types were identified in NJ. These types can be grouped into nine more broadly defined type-groups, six of which are widespread and were counted in all of the 1987, 1999, and 2006 inventories. The chart titled "Area of Timberland by Forest Type-group" shows the distribution of these six type-groups across NJ timberlands.

The oak/hickory type-group is and has been over the three survey periods in the chart, the most common type group in NJ. This group makes up nearly half of NJ's forested area. It includes tree species such as white oak, northern red oak, hickory species, white ash, walnut, yellow poplar, and red maple (Widmann 2005). This type-group contains many mast producing species that provide important forage for wildlife. The loblolly/shortleaf pine group which includes the pitch pine type, grows in the NJ Pinelands in the southern part of the state and is the second most widespread type-group. The oak/pine group may also include pitch pine as a species. Together, the oak/hickory group and the loblolly/shortleaf group comprise over 70% of NJ's forested lands. Due to their widespread nature, these types are particularly important regarding the character of NJ's forests and the protection of statewide biodiversity and resilience in the face of global climate change.

Area of Timberland by Forest Type-group
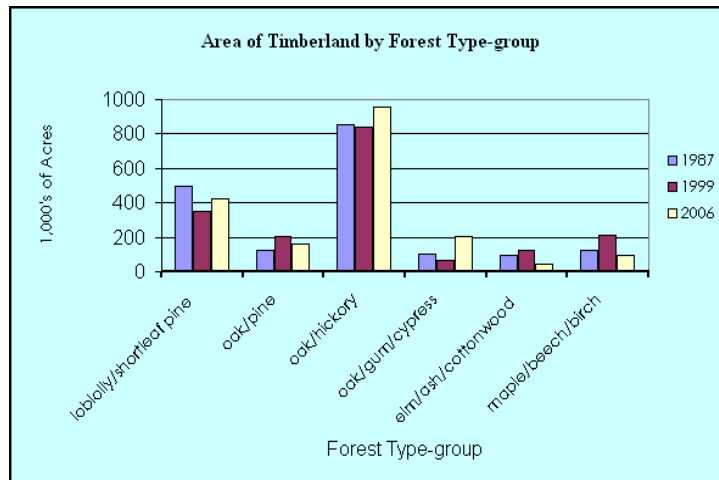
It should also be noted that the oak/gum/cypress group includes Atlantic white-cedar stands. Using data from the 1999 inventory, Widmann revealed approximately 32,000 acres of Atlantic white-cedar stands statewide (Widmann 2005). Pre-European presence of this species has been estimated at approximately 115,000 acres statewide (NJ Forest Service 1997). Atlantic white-cedar is of particular importance to biodiversity because it provides benefits to a wide range of plant and animal species, including several threatened and endangered species (Mylecraine and Zimmerman 2003). In southern NJ, stands of this species may also act as natural firebreaks (Little 1964) further contributing to landscape level dynamics of the NJ forest resource.

Many of the changes occurring in NJ's forests can be attributed to their age and overall pattern of maturation. The chart titled "Size Class Distribution of NJ's Timberlands" shows that the trees in NJ's forests are getting larger. The average diameter has increased statewide from 8.6 inches in 1987 to 9.3 inches in 2006. The chart titled "Age Class Distribution of NJ's Forested Lands"

Size Class Distribution for NJ Forested Lands
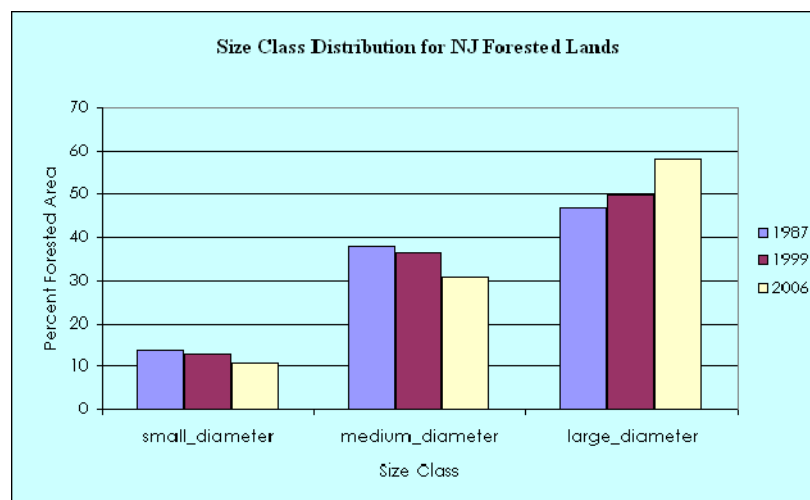
indicates that overall, NJ's forests are also relatively even-aged with a mean age somewhere in the 60-79 year-old age class. In 2005, Widmann attributed this trend to the fact that many acres of forest land in the state are abandoned farmlands that reverted to forest since the 1940's. Fewer acres are in the process of reverting back to forest today. Therefore, acreage in young stands will decrease over time as supported by the nearly "bell-shaped" distribution of age classes for 2006 centered around the 60-79 year age class. According to the FIA, the number of trees per acre of live trees 5 inches in diameter and above has been steadily increasing, just as forest size class and average diameter have increased, while the number of live trees per acre between 1 inch and 5 inches in diameter has decreased. The changes in NJ's forests have been accompanied by the recovery and return of many woodland species during the last century. Population increases have been noted for beaver, black bear, white-tailed deer, and wild turkeys. High densities of white-tailed deer also contribute to forest regeneration problems because they browse seedlings and saplings. These are important trends to track, because maintaining forests that are well distributed across age classes enhances the biodiversity of the landscape and reduces susceptibility of the forested landscape, as a whole, to catastrophic damage (Widmann 2005).
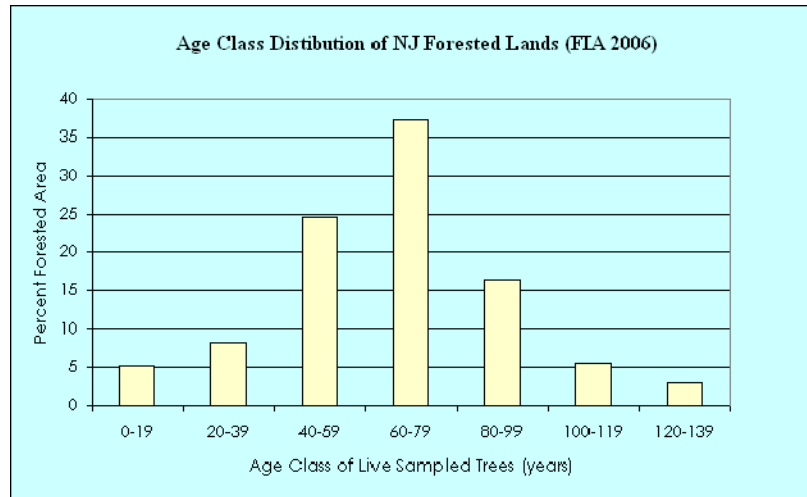
Shrubs
Understory vegetation is an important component of forested habitats because it provides both food and cover for wildlife. Huckleberry and blueberry are the most common shrub species in New Jersey. Barberry, a nonnative plant that invades natural plant communities, is the eleventh most common shrub growing in the State's forests. High deer populations contribute to the spread of barberry because it is browsed infrequently (Widmann 2005). NJ Forest Service conducts periodic inventory of state owned forest lands. The collection of better understory data is of key importance in these inventories because of its importance in understanding forest biodiversity, forest health, and succession.

Table provided by the USFS, FIA lists the top twelve shrub species in the State in 1999.

Top 12 shrub species in New Jersey
(Millions of stems)

Huckleberry	24,323
Blueberry	12,802
Sweet pepperbush	4,550
Sheep laurel	2,055
Rose	1,087
Briers/Brambles	930
Common spicebush	894
Mountain laurel	736
Maple-leaf viburnum	573
Maleberry / Staggerbush	506
Barberry	443
Fetterbush	277

3. Degree of forest land conversion, fragmentation and parcelization.

This indicator provides data on how much land is being converted from one use to another such as forest to non-forest, which is almost always permanent. Fragmentation and parcelization is the breaking up of larger contiguous tracts for forested areas into smaller noncontiguous blocks that can result in a reduction of interior forest animal species, invasive species along the forest edge and more landowners per given area. These types of change bring forth additional challenges to forest resource management (USDA Forest Service, et al. 2003).

When a large portion of a forest is lost to new residential and urban development, the remaining forest land often is broken up into smaller tracts or noncontiguous patches.

Average Forest Patch Size

Sussex 81 ac. — Passaic Bergen Essex Hudson Union 33 ac.
Warren 50 ac. Morris 61 ac.
Hunterdon 33 ac. — Somerset Middlesex Mercer 25 ac
Monmouth 30 ac.
31 ac. — Camden Gloucester — Burlington 55 ac. — Ocean 64 ac.
Salem 27 ac.
Cumberland 38 ac. — Atlantic Cape May 53 ac.

(Widmann 2005)

Known as forest fragmentation, this phenomenon is of growing concern to land managers and planners throughout the Northeastern United States. The fragmentation of forests,
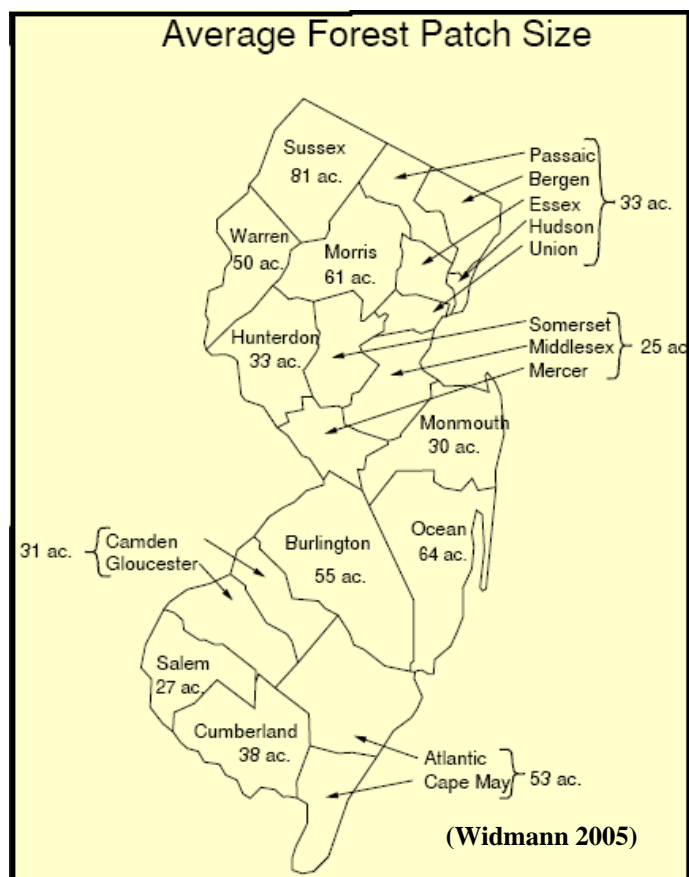
particularly by urban uses, degrades watersheds, reduces wildlife habitat, increases site disturbances, and favors invasion by exotic plant species. Many wildlife biologists believe that fragmentation is a contributing factor in the decline of some bird and wildlife species, though fragmentation favors species such as raccoons, squirrels, and white-tailed deer. These species are habitat generalists that have become acclimated to living near humans. Fragmentation also changes the character of rural areas because unlike owners of large tracts, owners of small parcels are less likely to manage their forests and/or allow access to their land for activities such as fishing and hunting (Widmann 2005). As NJ's population increases and the land becomes subdivided for housing, urban, and suburban areas, contiguous forested patch size decreases. The NJ Wildlife Action Plan (WAP) sites forest fragmentation and habitat loss as threats to wildlife. Intense fragmentation can also preclude the migration of genetic material from one forest population to another. In order to protect landscape level biodiversity, forest patch size is considered and weighted in the resource ranking for the Forest Stewardship Program in order to protect both interior and forest edge loving species.

The table, "Land-use Change (SCORP)" represents the changes in the major land-use types in NJ from 1995 to 2002.

Land-use change (SCORP)

Land-use	1995 Acres	2002 Acres	Change in Acreage
Agriculture	652,335	596,805	-55,530
Barren Land	56,698	59,668	2,970
Forest	1,616,522	1,575,219	-41,303
Urban Land	1,334,542	1,440,404	105,862
Water	301,987	302,883	897
Wetlands	1,022,253	1,009,357	-12,896

4. Status of forest / woodland communities and species of concern

This Indicator references species and communities that part of the biodiversity of the overall health of the State's ecosystem. Certain assemblages of plants and animals occur in various patterns dependent upon where they are located in a landscape. ECOPMAP's ecological land-types, as referenced, have provided an overview of what should be expected in undisturbed areas. These communities also assemble in response to human activity and disturbance. Having a variety of plant communities result in a variety of animal populations both threatened, endangered and common (USDA Forest Service, et al. 2003).

At Risk Species**:** (NJ Division of Fish and Wildlife, 2008)

The greatest threats to New Jersey's natural resources include habitat loss, destruction, alteration, and fragmentation. This has been a recurring theme within the State for years

as it is the most densely populated state in the union with an increasing population requiring additional homes, roads, commercial buildings, schools, etc. Furthermore, threats to our natural resources not only arise from the continued pressures of development, but also in the form of invasive species (flora and fauna, aquatic and terrestrial), insects and disease, pollution, and unsustainable land management practices. It's essential that we take steps to make certain that remaining areas of natural significance be conserved for their resource potential whether it be educational, exploratory use, aesthetic, or cultural values. The protection of the State's natural heritage can be balanced with societal needs as long as planning accompanies growth.

The State currently has 821 records of rare or endangered plant species and an additional 30 threatened and 47 endangered wildlife species. With a large number of imperiled species and vast development pressures in New Jersey, a Natural Heritage Database was developed to aid resource planner's conservation of these rare and endangered species.

The Natural Heritage Database contains more than 11,000 records of locations for rare plants, animals, and ecological communities and is a dynamic inventory of rare plants and animal species and representative ecological communities in New Jersey. It is the state's most inclusive source of information on rare plants, animals, and natural communities. The database includes officially listed endangered species from the Federal Endangered Species Act, the State Endangered Species Act, the State Endangered Plant Species List Act, the State Endangered and Non-game Wildlife Act. The database is a compilation of information from a broad range of sources including museum and herbarium collection records, publications, knowledgeable experts, and fieldwork. It contains information collected by the Office of Natural Lands Management on rare plants, animals, and ecological communities as well as data on rare animals provided by the Endangered and Non-game Species Program. The Database is continuously updated and improved as new data is obtained. Information from this database is available to assist individuals in the conservation of habitat for rare species and ecological communities.

The Database can be employed to facilitate:

- The preparation of environmental impact assessments

- Identifying the highest quality areas for natural diversity and those areas in most need of protection

- Supplementing field surveys conducted to assess project impacts on natural diversity

- Planning government, commercial, and residential development

- Anticipating potential problems related to development

- Reducing adverse impacts on the environment

- Avoiding unnecessary conflicts and costs

In the past, the lack of this type of information severely hindered decision making. By offering a scientific overview of New Jersey's natural assets, the Natural Heritage Database makes it possible to chart the course of development intelligently, as the best decisions are made when the most information is available.

The NJ Division of Fish and Wildlife staff, along with input from the general public, the state's conservation groups and other stakeholders, formed a blueprint for the future conservation of our State's wildlife species of greatest conservation need. This blueprint is called the Wildlife Action Plan (WAP) (New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered and Non-game Species Program. 2006. Wildlife Action Plan.) developed primarily to qualify for federal funding under the State Wildlife Grants program. The Plan lays the foundation for better coordination of wildlife research and management among programs within the Division of Fish and Wildlife, state and federal agencies and the many partners in the conservation community. The foundation of the WAP is eight principal elements which continue to be refined as the WAP is considered a dynamic or living document.
http://www.njfishandwildlife.com/ensp/wap/pdf/wap_draft.pdf

Eight (8) principal elements of the wildlife action plan are:
1. Information on the distribution and abundance of species of wildlife.
2. Descriptions of locations and relative condition of key habitats and community types.
3. Descriptions of problems and priority research and survey efforts.
4. Descriptions of conservation actions.
5. Proposed plans for monitoring.
6. Descriptions of procedures to review the strategy.
7. Coordinating the development, implementation, review and revision of the plan with Federal, State, and local agencies and Native American tribes.
8. Broad public participation.

With these principal elements in mind, the NJ WAP provides a common comprehensive conservation vision with guidance and specific actions for both long and short-term management efforts that can be implemented by government and non-government agencies, conservation organizations, land stewards, and private landowners. The WAP can guide partners in conservation in a cooperative effort to minimize the threats and improve habitat quality for NJ's wildlife. Some of the suggested conservation actions in the WAP include:

1. A full recovery of rare species populations through habitat restoration, land acquisition, and landowner incentives;
2. Public education and outreach programs regarding wildlife, critical habitats, and the deleterious effects of invasive species and other threats;
3. The development of effective conservation partnerships among organizations representing diverse interests in wildlife conservation;
4. Continued research and monitoring of species of greatest conservation need to inform biological databases and NJ's Landscape critical habitat mapping, and direct local and statewide conservation efforts.

The WAP provides a variety of actions at various stages focusing on the conservation of our species of greatest need.

New Jersey's wildlife species of greatest conservation need that depend upon forests.

BIRDS

Endangered		Threatened	
Bittern, American	*Botaurus lentiginosos* **BR**		
Eagle, bald	*Haliaeetus leucocephalus* **BR**	Eagle, bald	*Haliaeetus leucocephalus* **NB**
Falcon, peregrine	*Falco peregrinus*	Hawk, Cooper's	*Accipiter cooperii*
Goshawk, northern	*Accipiter gentilis* **BR**	Hawk, red-shouldered	*Buteo lineatus* **NB**
Grebe, pied-billed	*Podilymbus podiceps*	Night-heron, black-crowned	*Nycticorax nycticorax* **BR**
Harrier, northern	*Circus cyaneus* **BR**	Night-heron, yellow-crowned	*Nyctanassa violaceus*
Hawk, red-shouldered	*Buteo lineatus* **BR**	Osprey	*Pandion haliaetus* **BR**
Owl, short-eared	*Asio flammeus* **BR**	Owl, barred	*Strix varia*
Shrike, loggerhead	*Lanius ludovicianus*	Owl, long-eared	*Asio otus*
		Woodpecker, red-headed	*Melanerpes erythrocephalus*

**Federally endangered or threatened

BR - Breeding population only; NB - non-breeding population only

REPTILES

Endangered		Threatened	
Rattlesnake, timber	*Crotalus h. horridus*	Snake, northern pine	*Pituophis m. melanoleucus*
Snake, corn	*Elaphe g. guttata*	Turtle, wood	*Clemmys insculpta*
Snake, queen	*Regina septemvittata*		
Turtle, bog	*Clemmys muhlenbergii***		

**Federally endangered or threatened

AMPHIBIANS

Endangered		Threatened	
Salamander, blue-spotted	*Ambystoma laterale*	Salamander, eastern mud	*Pseudotriton montanus*
Salamander, eastern tiger	*Ambystoma tigrinum*	Salamander, long-tailed	*Eurycea longicauda*
Treefrog, southern gray	*Hyla chrysocelis*	Treefrog, pine barrens	*Hyla andersonii*

INVERTEBRATES

Endangered		Threatened	
Beetle, American burying	*Nicrophorus mericanus***	Elfin, frosted (butterfly)	*Callophrys irus*
Copper, bronze	*Lycaena hyllus*	Floater, triangle (mussel)	*Alasmidonta undulata*
Floater, green (mussel)	*Lasmigona subviridis*	Fritillary, silver-bordered (butterfly)	*Bolaria selene myrina*
Satyr, Mitchell's (butterfly)	*Neonympha m. mitchellii***	Lampmussel, eastern (mussel)	*Lampsilis radiata*
Skipper, arogos (butterfly)	*Atrytone arogos arogos*	Lampmussel, yellow (mussel)	*Lampsilis cariosa*
Skipper, Appalachian grizzled (butterfly)	*Pyrgus wyandot*	Mucket, tidewater (mussel)	*Leptodea ochracea*
		Pondmussel, eastern (mussel)	*Ligumia nasuta*
Wedgemussel, dwarf	*Alasmidonta heterodon***	White, checkered (butterfly)	*Pontia protodice*

**Federally endangered or threatened

MAMMALS Endangered

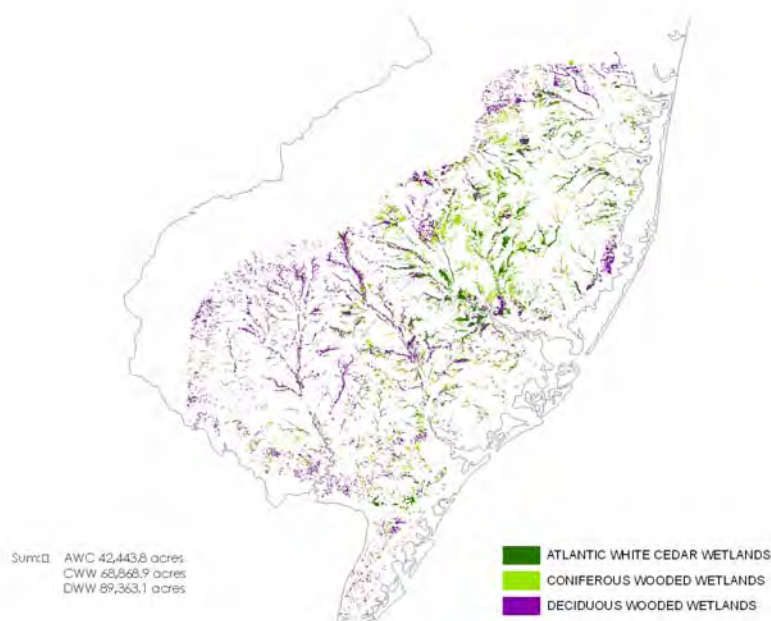|	
Bat, Indiana	*Myotis sodalis***
Bobcat	*Lynx rufus*
Woodrat, Allegheny	*Neotoma floridana magister*

**Federally Endangered

The application of information regarding threatened and endangered (T&E) species into development and land use decisions along with forest management planning has long been a top priority in New Jersey. The Forest Stewardship program incorporates T&E concerns into private lands forest management as well as several other state laws regarding wetlands and flood hazard areas. Land Managers within the NJ Department of Environmental Protection (NJDEP) are subject to Natural Heritage Review (NHR) by an interdisciplinary team of experts. Cooperation between agencies with varied interests and expertise has lead to some truly innovative land management strategies where T&E habitat improvement was possible while achieving many other forest management objectives.

In particular, the improvement of habitat for red-headed woodpecker has been facilitated by several multi-stakeholder developed projects between the NJ Forest Service, NJ Fish and Wildlife, NJ Forest Fire Service, and the NJ Audubon Society. These projects utilized commercial firewood harvesting through local woodcutters, restoring habitat for red-headed woodpeckers. The prescriptions created snags, open conditions and a mix of tree species favored by the woodpecker, as well as the reintroduction of prescribed fire in the project sites. The result was re-colonization of the site by red-headed woodpeckers.

Similarly, the NJ Forest Service, NJ State Tree Nursery, NJ Forest Fire Service Research and Development, NJ Fish and Wildlife, NJ State Park Service, and the Conserve Wildlife Foundation of NJ have coordinated in order to restore Atlantic white-cedar to former stands of this species that had been impacted adversely by a variety of factors over the last two centuries as mentioned in Mylecraine and Zimmerman 2003. The cooperative cedar restoration projects facilitated improvement of eastern timber rattlesnake basking areas, which were confirmed as being used by the snakes after project completion as well as habitat improvement for a number of other T&E plants and animals. At the same time new techniques for Atlantic white-cedar restoration were developed and evaluated that continue to improve the rate of success with these types of projects.

Atlantic white-cedar (AWC) is of special concern and is found in freshwater wetlands along the coast of southern Maine to northern

Sum:□ AWC 42,443.8 acres
CWW 68,868.9 acres
DWW 89,363.1 acres

■ ATLANTIC WHITE CEDAR WETLANDS
■ CONIFEROUS WOODED WETLANDS
■ DECIDUOUS WOODED WETLANDS

Potential Atlantic White-Cedar of Southern NJ

Florida. Atlantic white-cedar was once widely distributed across the state, with major stands in the Pine Barrens, the Hackensack Meadowlands, and Sandy Hook. Presently in New Jersey white-cedar forests are located principally in the Pinelands region in Atlantic, Burlington, Cape May, Monmouth and Ocean counties. New Jersey's white-cedar stands commonly occur in swamps, flood plains, stream headwaters, tidal wetland borders, drainage ways and bogs. Atlantic white-cedar typically forms pure stands with thousands of trees per acre, nearly all the same age. Other associated tree species are pitch pine, red maple, blackgum and sweetbay magnolia. Young cedar seedlings, intolerant of shade, require strong sunlight to grow. Stands will develop only in the presence of disturbance or after an area has been cleared and if sufficient seed source exists (Mylecraine and Zimmerman 2003).

Atlantic white-cedar population has steady declined from its historical average of about 115,000 acres to an area of approximately 32,000 acres (Widmann 2005). Lack of proper management, loss of wetland habitat, theft and illegal harvesting, wildfire, deer browsing, salt water intrusion, beaver, and conversion to agriculture have contributed to its steady decline.

Additional projects recently initiated by the Division of Parks and Forestry, such as the Berkley Triangle and Belleplain State Forest plan integrate the WAP into the management strategies of these projects. The Berkley triangle, a landscape scale project, with the focus of cooperatively managing public and adjacent private lands of multiple ownerships. This project utilizes the State's multi-disciplinary staffing resources in conjunction with the non-profit conservation group's (NJ Audubon Society, NJ Conservation Foundation) staff. With the continued collaboration between state agencies and stakeholders the WAP will continue to provide direction for the conservation of State's wildlife species of greatest conservation need. During the implementation of the Statewide Assessment and Resource Strategies these projects will be incorporated into the US Forest Service, Stewardship Project.

Criterion 2: Maintenance of Productive Capacity of Forest Ecosystems

5. Area of Timberland

This Indicator measures how much land is available for the harvesting of timber products as compared to the total forested area for the benefit of society. It is important to know what area is available for existing and future generation's sustainable extraction of renewable resources (USDA Forest Service, et al. 2003).

Forest resources are prioritized by the NJ Forest Stewardship Coordinating Committee into high, medium and low categories of potential stewardship planning. The amount of timberland available for management is contained in these areas.
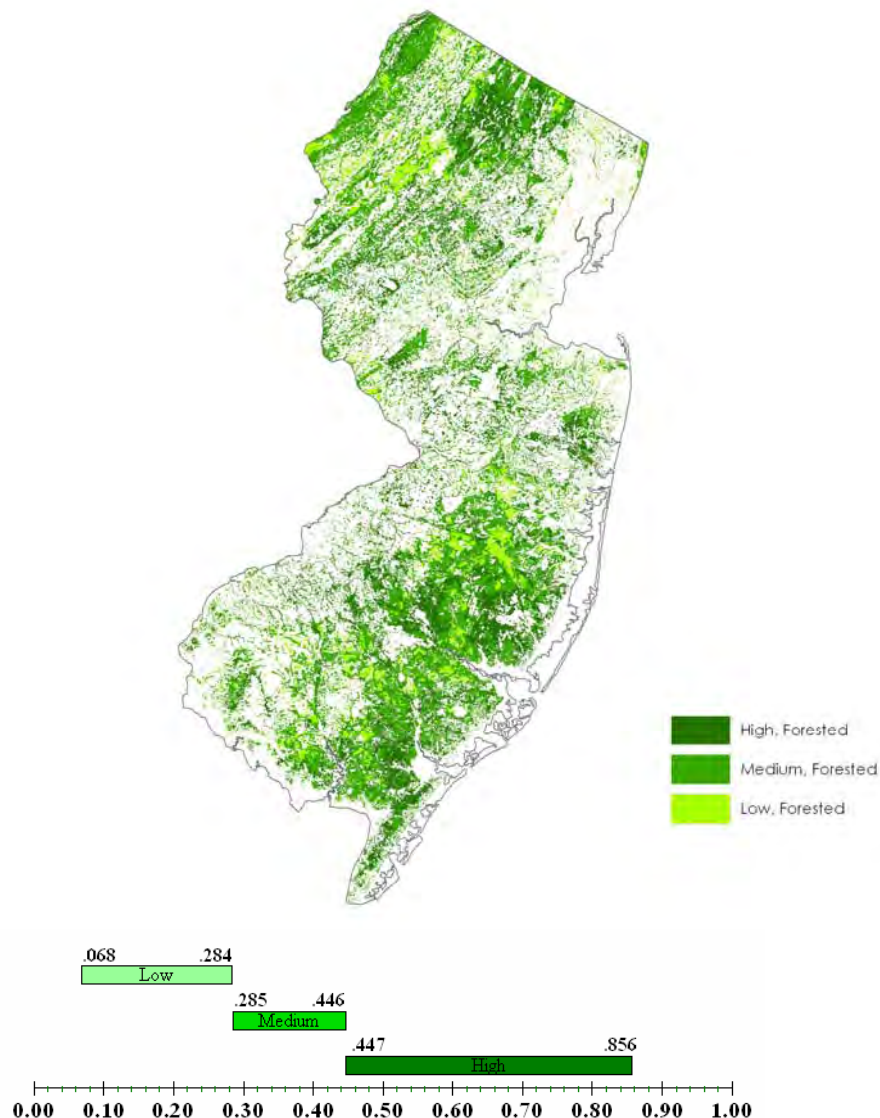
Forest Resource Potential (Spatial Analysis Project 2009)

Forest land is classified by the US Forest Service as timberland or "other" forest land. Timberland is categorized as forest land with potentially available resources for commercial use. The majority of NJ's forest land is historically considered to be
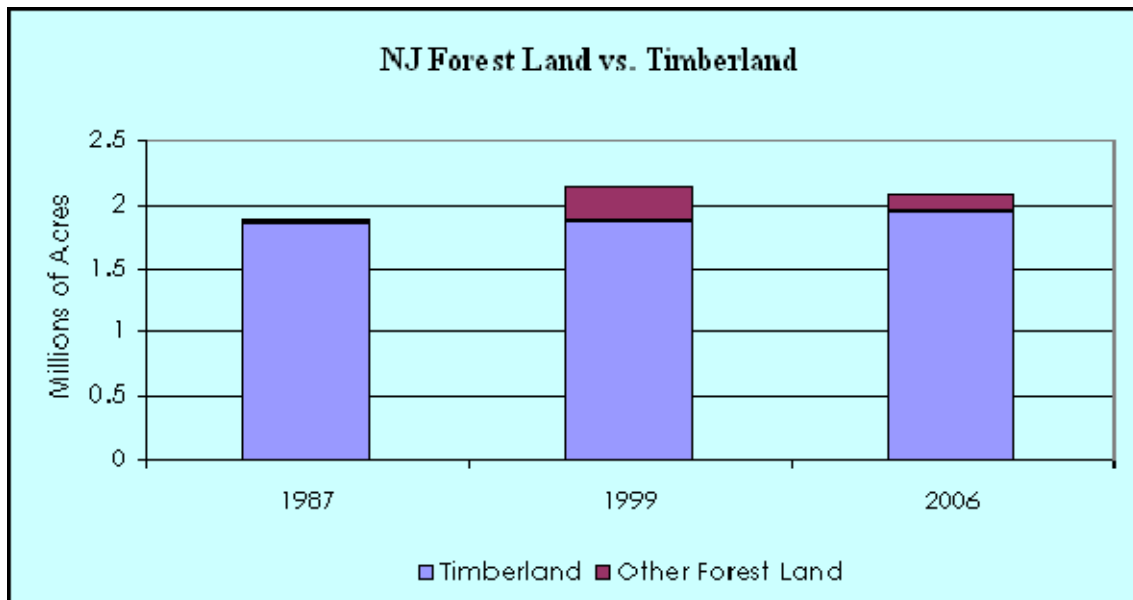
timberland. In the 2006 FIA inventory, 93% of NJ's forest land was classified as timberland. The amount of timberland in NJ has not changed substantially from 1987 to 2006.

According to the 2006 FIA inventory, the State of New Jersey owns approximately 597,543 acres of forested open space. Of this area, 579,922 acres are considered timberland. These parcels include the previously mentioned parks, forests and wildlife management areas that are located throughout the state in all ecological provinces.

The Forest Stewardship Spatial Analysis Project ranking method reflects the program's resource priorities and identifies high, medium, and low priority forested and non-forested areas on private lands. Of the total amount of forest land in the State, private forest lands represent a significant amount of acreage. The table shows a comparison of potential stewardship acreage. Significant amounts of the losses shown in forest acreage can be attributed to land-use change. The remainder is attributed to forest land being purchased by acquisition. Of the acreage represented approximately 115,000 acres are currently enrolled in the NJ Forest Stewardship Program.

	SAP acres 1997	SAP acres 2002	Gain / Loss
High Forested	520,830	469,207.00	-51,623.00
Medium Forested	853,453	698,753.14	-154,699.86
Low Forested	111,767	162,109.62	50,342.62
High Non-Forested	15,589	83,601.25	68,012.25
Medium Non-Forested	287,850	344,115.23	56,265.23
Low Non-Forested	732,033	698,753.14	-33,279.86
Total Forested	1,486,050	1,330,069.76	-155,980.24
Total Non-Forested	1,035,472	1,126,469.62	90,997.62

6. Annual removal of merchantable wood volume compared to net growth

This indicator compares removals from the forest to net growth of the forest. To meet sustainability goals the net growth must equal or exceed removals. Each area of the of the forests throughout the State have species and soil characteristics that determine how much net growth (cubic feet per acre) can be expected from a given stand, forest or property. From these values sustainable harvest levels can be measured (USDA Forest Service, et al. 2003).

FIA growth data from inventories taken later than the 1999 inventory was not available at the time of the development of this assessment. Hardwood growth statewide is more than double softwood growth. This is because hardwood forest type-groups (such as oak/hickory) cover the majority of NJ's forested area. In 1999 estimated growth on NJ's timberland was 55.3 million cubic feet annually.

The average volume in cubic feet harvested on private lands from 2001 to 2009 is 1.4 million cubic feet. An approximate, additional 652,800 cubic feet of wood are harvested on state lands

Cordwood Volume Harvested and Sold on Private Lands
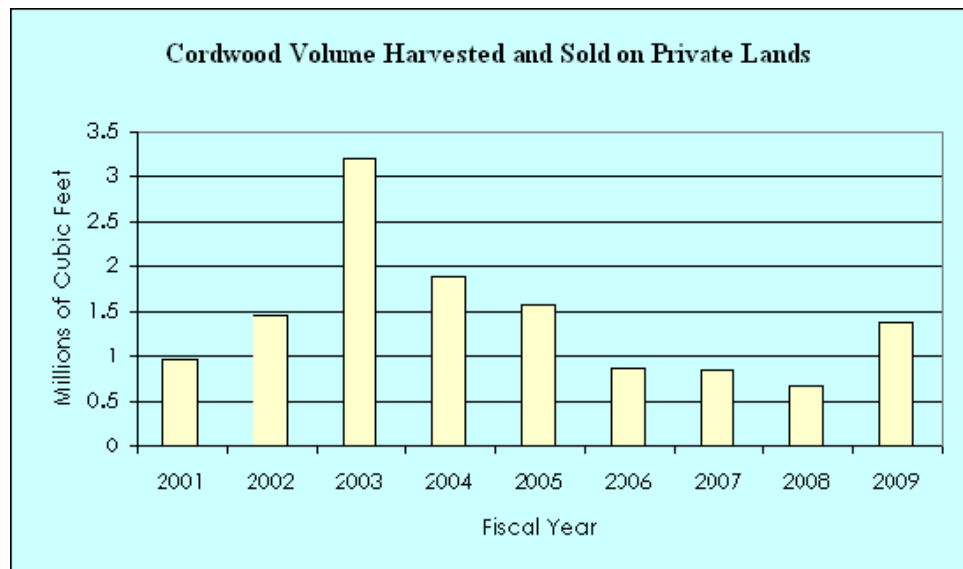
annually for a total of approximately 2.1 million cubic feet harvested for commercial forestry annually. This is less than 4% of annual growth. Indicating that NJ's timber resource is largely underutilized.

As NJ's forests mature and smaller trees grow into the larger size classes, the amount of sawtimber available on timberlands statewide is increasing as well.

Net Cubic Foot Volume of Growing Stock Trees on Timberland
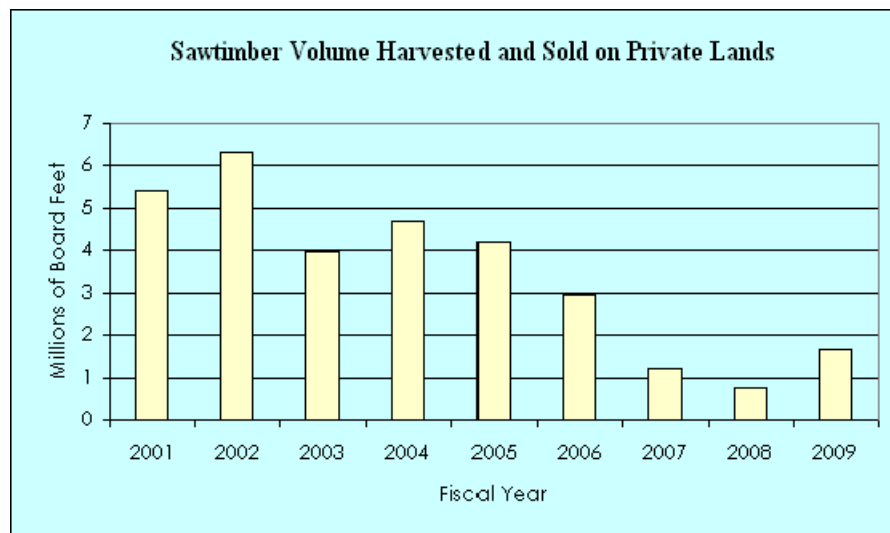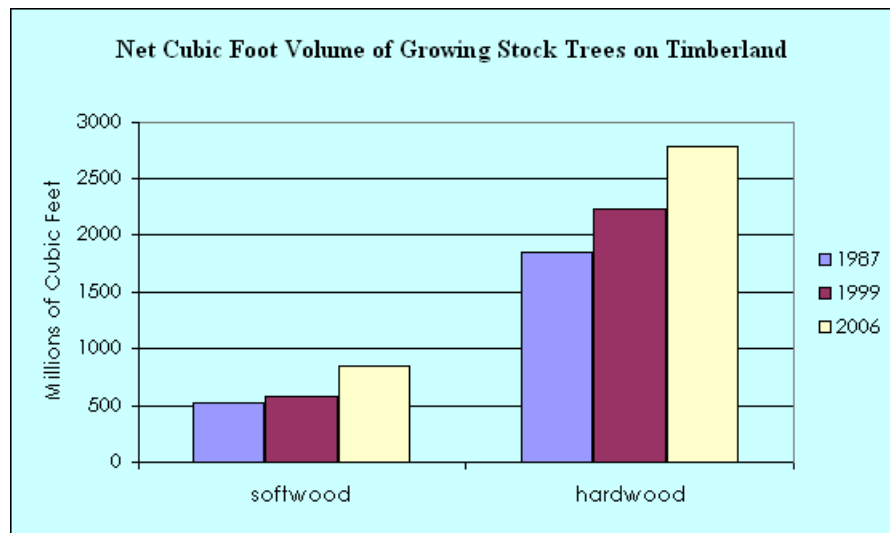
Harvests on State lands over the past ten years have provided products including, hardwood sawtimber, commercial firewood, Atlantic white-cedar salvage and pine pulplwood, and Homeowner Firewood supply according to the following summary:

- Sawtimber products including mixed hardwood and Atlantic white-cedar totaled approximately 590,000 BF yielding approximately $ 104,960 in cash receipts and barter-received lumber products.
- Commercial firewood sales total of 2,000 cords, yielding $ 55,302 in cash receipts and yarded cordwood.
- Homeowner Firewood program firewood sales producing 3,100 cords of firewood yielding $52,500 in cash receipts.
- Pine pulpwood harvests producing 3,168 cords of pulpwood at value of $ 31,700.

Criterion 3: Maintenance of Forest Health and Vitality

7. Area and percent of forest land affected by potentially damaging agents

This Indicator identifies and monitors the forested areas impacted by a variety of damage causing agents (DCAs) that have the potential to cause decline and mortality of vegetation in forested areas. The causal agents can be natural or manmade, native or exotic and occur in all types of environments i.e., rural, suburban and urban areas. Many causal agents exist naturally in the ecosystem at endemic levels. However, when they reach epidemic proportions suppression, if practical, may be necessary (USDA Forest Service, et al. 2003). Wildfire, although a natural force that is critical in shaping forests over time, is a causal agent that mandates immediate suppression in New Jersey.

Gypsy Moth Mortality

The New Jersey Forest Service, Forest Health Program is responsible for monitoring and surveying for Damage Causing Agents that have the potential to cause harm to our State's Forest Resource. Depending on the time of year, the Forest Service initiates both aerial and ground surveys for causal agents such as gypsy moth, southern pine beetle, bacterial leaf scorch, and various non-native insects and diseases. Also monitored are abiotic causal agents such as drought, flooding and wildfire.

By monitoring and surveying the level of activity at which these casual agents are occurring, the Forest Service can gain a better understanding of the status of our forest resources for the current year and also measure the cumulative damage over time. This assists with management decisions regarding what suppression techniques if any, may be necessary. By knowing the changes that are occurring in the forested environment, the future conditions can be determined. This can be a corresponding colonization of other tree species (as one dies), shrubs or invasive plants. Wildlife habitats and recreational opportunities can change depending on the severity of damage.

While there are hundreds of possible damage causing agents to survey and monitor, in New Jersey many do not necessarily need suppression. However, the following damage causing agents have been the most active over the past 5 or more years that have caused a need for suppression and / or a concentrated effort on detailed yearly monitoring efforts.

Mortality data for FIA inventories later than 1999 was not available at the time of this assessment. Mortality data for 1987 was only available for growing stock trees on timberland. Since the majority of NJ's forest land is classified as timberland by the federal government, these estimates may be used to gain insight into patterns on statewide forested lands as a whole. Mortality appears to be on the rise for both hardwood and softwood species. Consequently, the number of dead trees per acre has also increased
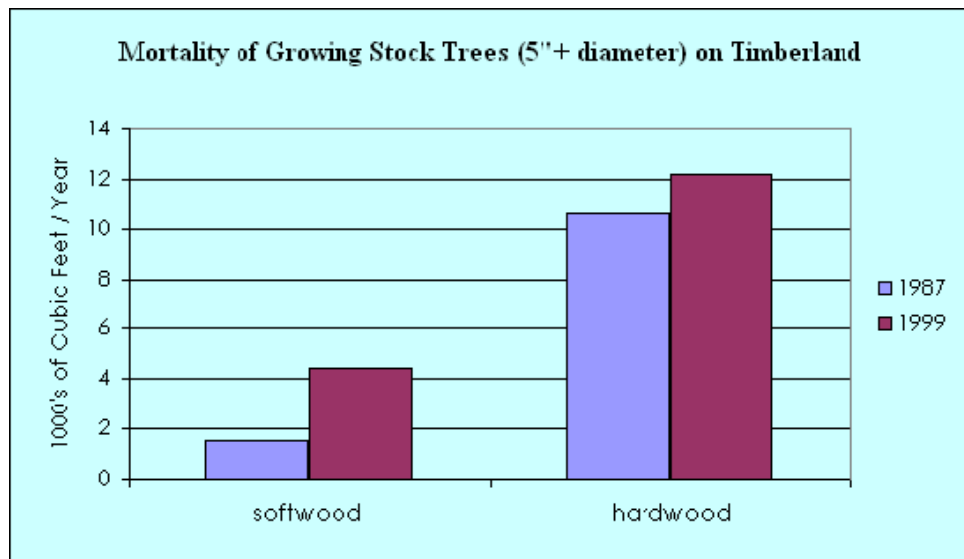
Mortality of Growing Stock Trees (5"+ diameter) on Timberland

Y-axis: 1000's of Cubic Feet / Year (0 to 14)

Legend: 1987, 1999

Categories: softwood, hardwood
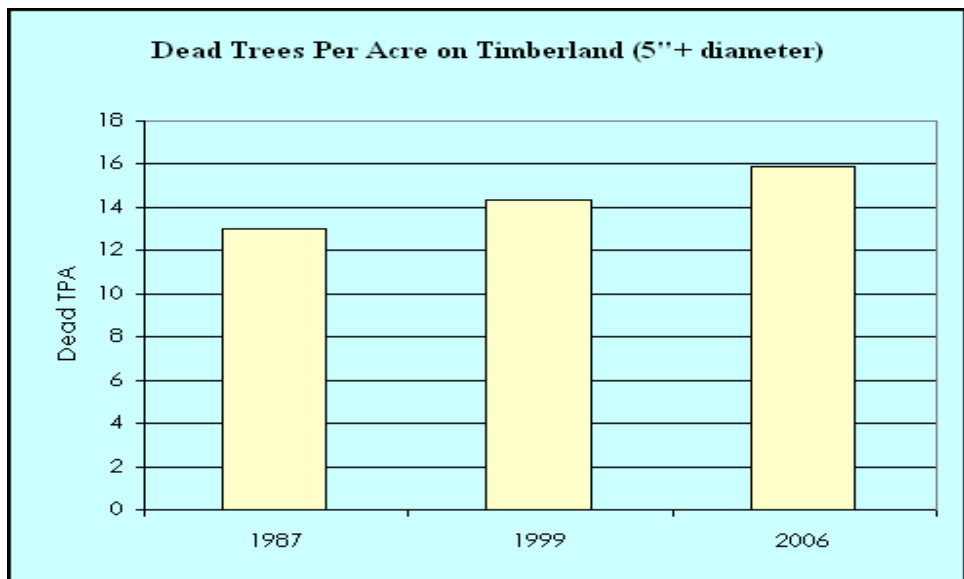
An increase in dead trees is a normal sign for a maturing forest and can even be important for biodiversity and providing structure for wildlife habitat. However, mortality should be closely monitored in NJ

Dead Trees Per Acre on Timberland (5"+ diameter)

Y-axis: Dead TPA (0 to 18)

Categories: 1987, 1999, 2006

because of the relative homogeneity of the forest statewide in terms of forest type-groups and age class distribution. Coupled with these factors insects and pathogens could lead to widespread, rapid changes that would be detrimental to biodiversity, social, and economic values of the resource.

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Forest Risk: Damage Causing Agents

Gypsy moth (*Lymantria dispar*)
Gypsy moth has existed in the northeastern states since 1869. In New Jersey the first defoliations linked to this insect were identified as early as 1919 with sporadic pockets of activity continually occurring through the early 1930's. After a peak 1955 outbreak an aggressive control program was thought to have eradicated this insect. However, small pockets of infestations were again found to be evident through the 1960's and then by 1974 over 254,000 acres received some degree of defoliation.

Initially, suppression programs focused on eradicating the insect was found to exist but soon the program was shifted to focus on attempting to limit defoliation and tree mortality in high-use recreational and residential areas. Subsequently in many forested areas around the state no controls were implemented and expanses of forests were being subjected to repeated defoliations and as a result extensive tree mortality occurred.

Surveys conducted from the late 1960's through the 1970's in our State's north central region, where oak/hickory forest type-group dominates, indicated 60-70% oak mortality after repeated defoliations. Economic losses to woodland owners as well as aesthetic, wildlife habitat, watershed protection and wildfire hazards resulted in considerable public reaction.

As the 1970's progressed statewide defoliation acreage followed a cyclical pattern of highs and lows. In 1981, defoliation peaked at approximately 800,000 acres with 75,000 acres of suppression activity.

Gypsy moth even targeted non-preferred species such as flowering dogwood (*Cornus florida*) in Brendan T. Byrne State Forest.

One particularly hard hit area along the Kittatinny Ridge and Valley section of northwestern New Jersey was Stokes State Forest. While standing at an overlook in Stokes State Forest's eastern boundary, a person could view an expanse of approximately 50,000 acres of forestland to the north, west and south. In June of 1980 the expanse looked like a forest in the dead of winter due to severe defoliation. These heavy defoliations in the late 1970's and early 1980's killed many thousands of acres of trees.

The NJ Forest Service in cooperation with the NJ Department of Agriculture conducts aerial surveys in June and early July each year to determine the extent of defoliation. This survey provides a basis on where to conduct egg mass surveys for the following fall.

Historical Gypsy Moth Defoliation Trends
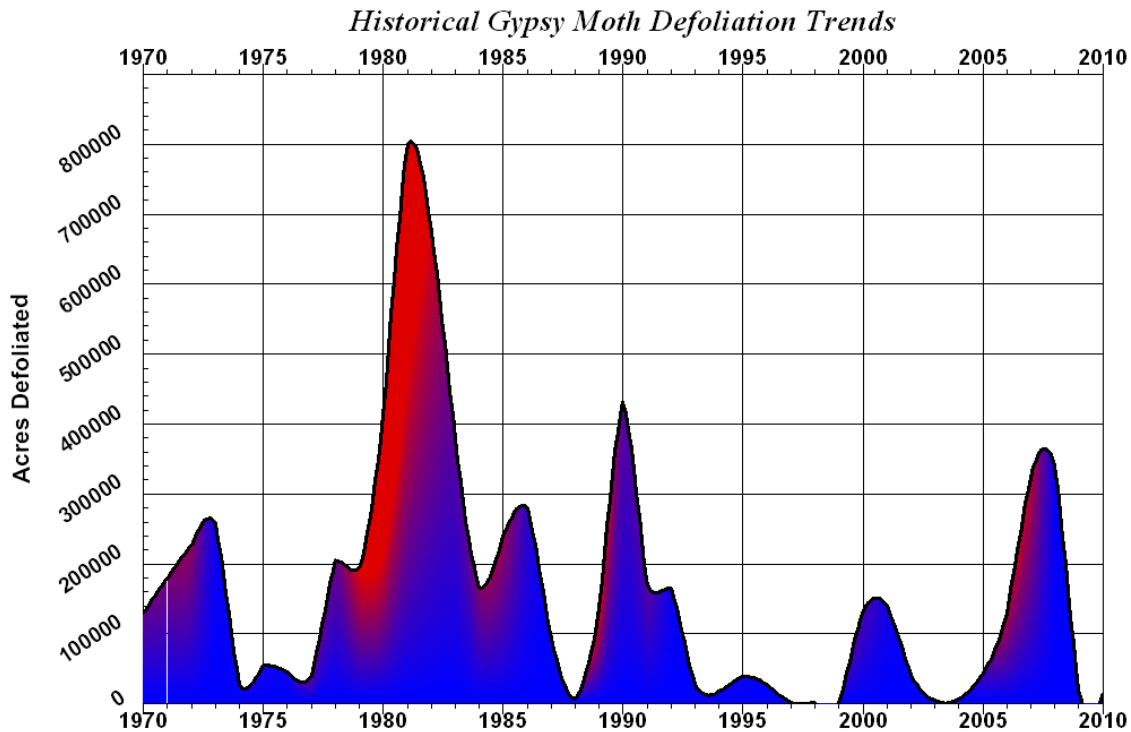
It is of little surprise that insect and pathogens affecting oak species have been on the rise in NJ during the last decade when considering that more than half of state's forested area is covered by forest types containing oak and forests across the state have been gradually aging together with little recruitment of younger trees. Compounding the problem, oak seedlings are preferred browse by white-tailed deer making reestablishment of oak species difficult in the forest.

Bacterial leaf scorch (*Xylella fastidiosa*)
Bacterial Leaf Scorch (BLS), caused by the bacterium *Xylella fastidiosa*, clogs the xylem, (the cells that transport water between the roots and the leaves of a tree) and causes the leaves to scorch, leading to branch dieback. The overall decline of an affected tree can last for several years, but the tree will eventually die.

BLS symptoms in New Jersey oaks are only visible for a few weeks in mid-summer and early fall. Although many of the symptomatic leaves remain on the tree until normal leaf fall, some will fall to the ground early, which indicates BLS. However, BLS symptoms can be similar to those caused by drought stress and normal autumn changes.

In leaves affected by BLS, the outer edges will turn brown, with the discoloration moving toward the center of the leaf in an irregular pattern. Perhaps the most distinguishing visible characteristic of BLS is that the affected leaf will present a "water-soaked" region, sometimes a red band, and sometimes a yellow halo at the transitional area between the browning portion and the healthy green portion of the leaf.

BLS may affect only one area of the tree before spreading, or may exhibit symptoms throughout the crown. A tree can harbor a BLS infection and refoliate for several years, but eventually the stress of the disease and the resulting branch dieback will make the tree more susceptible to other pathogens and insects which will speed the tree's decline.

BLS is believed to be spread by xylem feeding insects, such as leafhoppers, treehoppers and spittle bugs. These insects pick up the BLS bacteria by feeding on the xylem fluid of an infected plant and then inject the bacteria into the healthy plant leaves while they feed. BLS is most common in the red oak subgenus.

Gouty oak gall (*Callirhytis quercus punctata*)
Galls created by the Cynipid wasp generally do not cause mortality. Their damage historically has been an aesthetic problem that can be remedied by selective pruning. However, in 2006 southern New Jersey experienced heavy infestations that caused significant decline and mortality over 20,000 acres.

Tree species affected are scarlet, black, chestnut, and southern red oak. Symptoms ranged from a few galls to entire branches and crowns covered in galls.

In some cases trees were heavily infested yet showed no decreased canopy transparency. Overall mortality is wide spread occurring on state, private and federal lands. Damage is also present in campground areas causing hazardous conditions to recreationalists. What exacerbates the condition is that the gall is occurring in regions affected by other damage causing agents such as gypsy moth and orangestriped oakworm (*Anisota senatoria*).

Bass River State Forest

Sudden Oak Death (*Phytophthora ramorum*)
Sudden oak death (SOD) is a disease caused by the pathogen *Phytophthora ramorum* and was first reported in central coastal California in 1995 (USDA Forest Service 2002). Once infected, certain oak tree species can die within a few months to a few years. California nurseries that had contaminated stock or the potential for contamination were quarantined

so as not to distribute material to other parts of the country. However, prior to quarantine, plant material particularly Camellia (Camellia spp.) was shipped to NJ garden centers and nurseries in 2003. As a result of host plant material entering NJ, the NJ Forest Service applied for and received federal grants from 2004-06 in order to perform a survey of the recipient nursery's respective woodland perimeter(s) for symptoms related to *P. ramorum*. The survey was performed in June through early July 2004 and proceeded from Cape May to Bergen County. Suspect samples were collected and shipped in coolers to laboratories via overnight delivery. This process would maintain sample integrity for diagnostic analysis. All samples submitted tested negative for *P. ramorum*. Woodland areas selected were based on the presence of an enoculum factory consisting of host understory species and the presence of oak in the overstory. In 2007-08 the survey shifted to stream baiting downstream from the trace forward nurseries in order to detect if *P. ramorum* was dispersed within the local watershed. Those samples also tested negative.

SOD poses a serious threat to the Nation's oak and New Jersey's forest types, urban forests and horticultural industries. "In California, it has affected ecosystem functions, increased fire and safety hazards, and reduced property values in developed areas" (USDA Forest Service 2004). The advanced stages of SOD result in high levels of mortality of tanoak, coast live oak, California black oak in woodlands or within the wildland-urban interface (Garbelotto, Rizzo, Davidson, Frankel 2002). To date, tens of thousands of trees have died on the west coast and management operations to "slow-the-spread" are underway. Currently cutting and burning of host plants has shown to eradicate the disease. At this time, only oaks in the black and red oak groups are known to be susceptible to *P. ramorum.* Tree Species in NJ at risk are Northern red oak (*Quercus rubra)*, which is the NJ State Tree, Southern red oak (*Q. falcata),* black oak (*Q. velutina*) and scarlet oak (*Q. coccinea*).

Northern red oak is a significant component within hardwood forest types across northern NJ including the Highlands, Piedmont and Hudson Ridge and Valley Regions. Southern red and scarlet oaks are common components of forest stands along the Delaware basin and southern coastal plain. USFS Forest Inventory and Analysis (FIA), 2006 data indicates that Northern and Southern red oak, scarlet oak and black oak occur in approximately 45 percent of the total forested land area in NJ. Common understory species including mountain laurel and *Viburnum* spp. are also at high risk.

Asian longhorned beetle (*Anoplophora glabripennis*)
The Asian Longhorned Beetle (ALB) is native to Asia was introduced to North America via wood packing material from China. This invasive species was first discovered in Brooklyn, NY in 1996. ALB appeared in New Jersey for the first time in 2002 in Jersey City.

The preferred hosts of the ALB are maple trees, but it will also attack willows, poplars, ask, horsechestnuts, and buckeye trees. Maple trees comprise over thirty percent of the street tree population in New Jersey. An infestation could jeopardize nearly half the trees that line our streets, highways and also severely impact the non-urban forests of the Pinelands, Highlands, outer coastal plain and other areas where host species are part of the ecosystem.

Adult Asian longhorned beetle.
(Photo Courtesy: USDA)

ALB larvae tunnel into the tree, damaging the vascular system and ultimately causing mortality. Larvae mature into adults in the heartwood and tunnel out. A tree infested with ALB will have perfectly round exit holes in the bark about the width of a pencil. The beetles also leave behind frass, a mixture of sawdust and waste. The branches of an infested tree may also exhibit yellowing leaves and dying limbs. The adults can be seen outside the tree from May to October.

All infested trees are removed, chipped in place, burned and the stumps of infested trees are ground to below the soil level. All potential host trees within a one-eighth to one-quarter mile radius of infested trees are removed to stop the spread of ALB.

In order to mitigate the impact of the removal of infested trees, the New Jersey Forest Service has planted over 6,500 trees in Carteret, Linden, Rahway and Woodbridge. Tree planting has been on both public property (streets, parks, schools and other community centers) and private.
.
Numerous replacement shade trees have been planted in residential areas impacted by ALB sanitation efforts and are providing their benefits to these communities. The NJ Forest Service works with each municipality to find appropriate street tree planting locations. Both private property owners and the municipalities agree to care for and water the trees. Cities and towns across the United States are monitoring for ALB. The ALB has mainly caused destruction in Chicago, New York City, New Jersey, and most recently in Massachusetts in August of 2008.

Emerald ash borer (*Agrilus planipennis*)

Emerald ash borer, native to Asia, was introduced in North America in the 1990s and was first reported causing widespread decline and mortality in trees of the ash genus (*Fraxinus*) in Detroit, Michigan in 2002. It was then reported in the states' of Ohio, Indiana, Illinois, Maryland, Missouri, Pennsylvania, Virginia, West Virginia, and, Wisconsin. The distribution of EAB is due to unknowingly transporting infested ash nursery stock and forest products such as firewood and unprocessed logs (USDA Forest Service 2002).

The adult beetles are less than a penny in size and are bronze, golden, or reddish green with darker metallic emerald green wing covers. EAB feeds on ash foliage for a few weeks and has a 1-year life cycle. Peak activity occurs in from mid-June and early July with most activity occurring throughout the day. Eggs are deposited individually in bark crevices or under bark flap of trunks or branches. After 7-10 days the larva hatch they chew through the bark and into the phloem and cambial layer where they feed and overwinter. Pupation occurs in late April or May. The adults then exit the tree and form a characteristic D-shaped exit hole 3-4 mm in diameter (USDA Forest Service, 2002).

Adult EAB.   Exit hole: Photos: USFS Pest Alert

The Emerald ash borer is responsible for killing and heavily infesting tens of millions of trees in urban, rural and forested environments. In North America EAB has only attacked ash species and appears to prefer green ash (*F. pennsylvanica*) and black ash (*F. nigra*) over white ash (*F. americana*) and blue ash (*F. quadrangulata*). Even with this preference all North American species of ash are at risk. Outward appearing symptoms are wilting foliage, dead branches and an increasingly thin crown (USDA Forest Service 2002).

Approximately 9 percent of the State's total forested area is at risk to this pest. This area contains significant numbers of trees that could be devastated by EAB. Ash is an important resource for forested wetlands and associated communities (USDA FIA 2006).

EAB may have already entered New Jersey but not yet discovered. The NJ Forest Service has received correspondence regarding sites where ash trees are in decline or killed and have performed on-site inspections to determine the cause. It was determined that the symptoms were not related to EAB activity. These inspections were performed in cooperation with the NJ Department of Agriculture and the US Forest Service.

European woodwasp (*Sirex noctilio*)
Sirex woodwasp is native to Eurasia and northern Africa where it is considered a secondary pest. It is the most common species of exotic woodwasp detected in the United States ports-of-entry where solid wood packing materials are common. In its native range Sirex predominantly attacks Scotch (*Pinus sylvestris*), Austrian (*P. nigra*) and maritime (*P. pinaster*) pines. It has also devastated exotic pine plantations in the southern hemisphere such as New Zealand, Chile, and South Africa where it was unintentionally introduced. These plantations are composed of species of North American pine such as Monterey (*P. radiata*) and loblolly (*P. taeda*) (USDA Forest Service 2005).

The woodwasp is approximately 1.0 – 1.5 inches, dark metallic blue or black with middle sections of the abdomen orange. Adults have a spear-shaped plate at the end of the tail. This tail feature gives the woodwasp a nickname of 'horntails'. Larvae are white and legless with a distinguishable dark spine and the rear. It is suspected to have one generation per year (USDA Forest Service 2005).

Sirex Woodwasp
USDA APHIS PPQ,

An interesting characteristic of the 'horntail' is that it attacks living pines as opposed to native woodwasp attack only dead and dying trees. A tree crown will progress from green to light green, to yellow and finally red occurring over 3-6 months (USDA Forest Service 2005).

The NJ Forest Service is coordinating monitoring efforts with the NJ Department of Agriculture, Division of Plant Disease and the USDA Animal and Plant Health Inspection Service, Plant Protection and Quarantine (APHIS PPQ) in order to strategically deploy traps throughout the State to cover as many preferred host species as possible. Trapping for early detection is an important part of the monitoring process.

Traps are located throughout the State in red, white, pitch and shortleaf pine and mixed pine - hardwood stands. At this time it is not known how potential *Sirex* impacts will be to the southern yellow pine group. The trapping for Sirex occurs over a 20 week period from the end of June through November of each year. This coincides with the woodwasp emergence pattern. Traps are collected by NJFS personnel and forwarded to the US Forest Service for identification. Initially trapping was conducted using the double girdle method. However, in small red pine stands we have shifted from the double girdle to a pheromone lure in order to reduce tree mortality.

Biological control has proved successful in managing the Sirex. The parasitic nematode *Deladenus siricidicola*, infects the larva which sterilizes the adult females. The infected females lay infertile eggs that are filled with nematodes spreading the *D. siricidacola* to population, assisting in naturally regulating the Sirex. The nematode can also be mass-reared in laboratories and introduced into the environment via tree injection (USDA Forest Service 2005). This biocontrol and be integrated with mechanical control for integrated pest management (IPM).

Southern pine beetle (*Dendroctonus frontalis*)
In December 2001, it was thought that the first occurrence of southern pine beetle (*Dendroctonus frontalis* Zimm.) was discovered and reported in New Jersey. However, through much research, historic records were found indicating that in 1939 a previous SPB event did occur. No other information as to the location, population, and duration of that event has been found.

The SPB is the most destructive forest insect pest in the southern and the southeastern United States. Since SPB migration to southern NJ it has attacked all pine species growing in the Pinelands region. Theses species include pitch, shortleaf, loblolly, white, and red. The infestations are occurring in pure pine stands, pine-hardwood, hardwood-pine, pitch pine lowlands, and Atlantic white-cedar swamps. Ornamental plantings of Norway spruce have also been infested. Stands with the greatest risk of attack have one or more of the following characteristics: biologically mature to overmature, high stand densities, stresses from drought, and storm damage. However, even apparently healthy stands were (and are) being mass attacked.

Initial on-site investigations revealed scattered dead and vacated trees with signs of SPB activity. As a result, in 2002 the Forest Service initiated the first spring *Billings* Trap Survey. This was performed in cooperation with US Forest Service entomologists, who then predicted a low to declining SPB populations for 2002 based on the number of SPB to checkered beetles (*Thanasimus dubius* Fabricius) collected in the traps. The checkered beetle is a known predator of SPB. However, SPB infestations expanded very rapidly throughout the summer 2002. Aerial surveys in late summer detected approximately 264 outbreaks ranging from single trees to 250 acres in size. Infested acreage was estimated to be 1,270 acres. The winter of 2001-2002 was mild in New Jersey and at that time, NJ was experiencing the worst recorded drought in state history. This was thought to contribute to the stress on trees thereby making them more susceptible to attack. Increases in SPB infestations since 2002 similar have the potential to significantly impact species composition, wildlife habitat, outdoor recreation, private forests, prescribed burning (RxB), and wildfire suppression in Southern New Jersey. SPB monitoring has been ongoing since 2002 and continues to be refined.

The damage to trees caused by SPB activity is direct mortality. Depending on the time of year, number of SPB attacking, presence of blue-stain fungi and environmental factors, mortality may become noticeable within a few weeks to four months after an attack. Newly infested trees will begin to turn yellow progressing to red. This discoloration will also indicate the direction the infestation is spreading. Fresh reddish and yellowish-white pitch tubes can also help determine the direction of spread. Eventually the trees will turn brown and loose their needles. Many of the spots observed have had multiple heads moving in different directions. Some spots also merge together to form a larger contiguous infestations thereby resulting in large forest type changes.

Continued SPB activity could result in a loss of the pine component in the Pinelands region. Factors associated with climate change such as global warming, will most likely lead to continued infestations, continued migration north, shifting of forest types to non-pine thereby reducing favorable habitat of pine dependent wildlife species, increased wildfire risk, loss of revenue, and increased costs of removing hazard trees in recreational areas or around structures such as homes.

In New Jersey's Pinelands region there are three species of pine which are at risk, pitch (*P. rigida*), shortleaf (*P. echinata*) and loblolly (*P. taeda*). Pitch pine is the dominant pine species in the Pinelands. The current infestations and corresponding mortality by the southern pine beetle have the real potential of devastating this region.

Restore fire-adapted lands and reduce risk of wildfire impacts.

The NJ Forest Fire Service protects a primary response area of 3.25 million acres within the suburban and rural areas of the state. The goal of the Forest Fire Service is to limit the number of wildfires to less than 2,000 annually, and the acreage burned to less than one half of one percent (0.5%) of the area protected, or 15,750 acres. The Service accomplishes these goals by maintaining an aggressive fire management program that addresses the hazards and risks unique to each region of the state.

Pinelands Wildfire

Wildland fuels of New Jersey have been ranked to the hazard they pose and are presented in the "New Jersey Wildland Hazardous Fuels Map". The 2007 statewide "Land Cover/Land Type" dataset maintained by the NJ DEP was used as the base map, with each cover type ranked low to extreme. Where slope exceeds 30%, the rank was assigned the next higher step. With this image, a better understanding of the location of hazardous fuels can be found.

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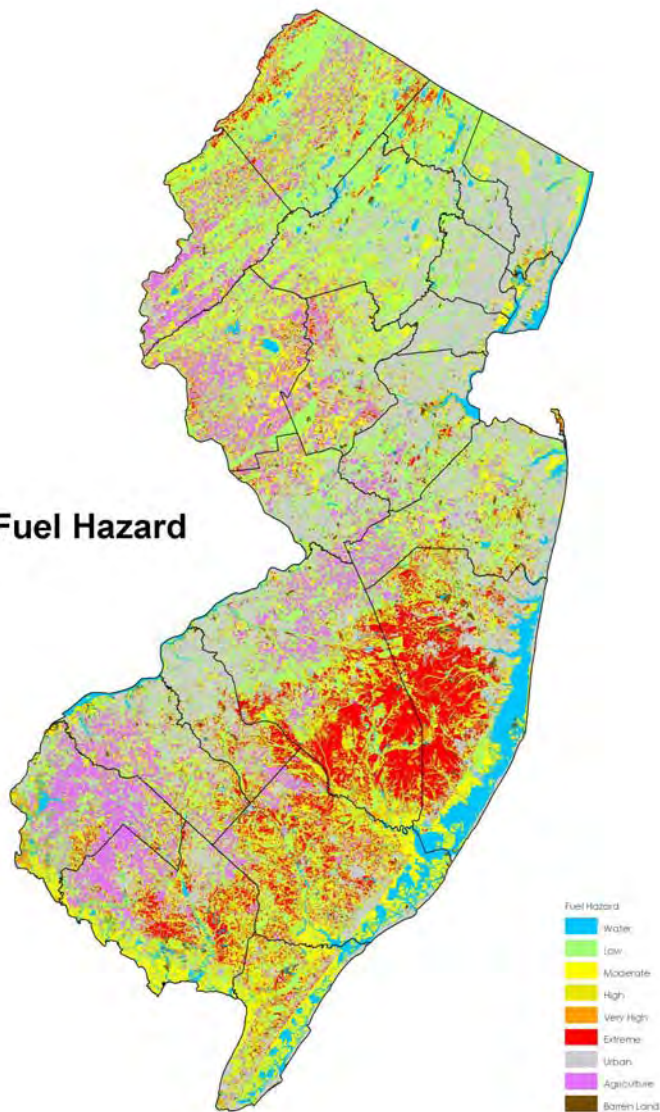
Hemlock Woolly Adelgid (*Adelges tsugae*)

The hemlock woolly adelgid (HWA) is native to Asia and was first reported in the Eastern United States in 1951. It attacks Eastern hemlock (*Tsuga canadensis*). Infestations occurring throughout New Jersey's hemlock stands have caused mortality to thousands of trees. Other stressors to hemlock such as drought, hemlock elongate scale (*Fiorinia external*) and borers accelerate the rate and extent of hemlock mortality (Mayer and Scudder, 2008). (Photo Courtesy USFS) shows the ovisacs (woolly mass) produced by HWA.

HWA is small (1/16-inch) long and reddish-brown to purplish-black in color. As it matures it produces a wool-like wax to protect it and their eggs from natural predators and is dormant during the summer. The HWA begin to feed at the base of hemlock needles when cooler temperatures arrive typically in October through the winter. The result after repeated infestations is a thinning of the crowns leading to decline and mortality (USDA Forest Service 2005).

Hemlock is an important forest resource for providing habitat for wildlife, maintaining water quality and regulating stream temperatures. Hemlock is also prevalent in recreational areas where mortality can also be costly for removing any trees classified as hazardous. Hemlock occurs over approximately 25,000 acres in the northern part of the State. The continual loss of hemlock to the forest will result in degrading of the ecological benefits previously mentioned.

Urban Forest Health
Street tree condition is a general evaluation of a species overall health. The USDA Forest Service designates four classes of tree condition and these were used by the NJFS in both studies. It should be noted here that the summer of 1998 experienced low rainfall followed by a severe drought in 1999. Although urban forest health is listed as a separate category, many of the causal agents referenced can and have targeted these areas of land use. Historically and currently the potential is high that these agents will continue to be gypsy moth, BLS and SPB. Exotic insect and disease potential also exists for ALB, EAB, SOD, *Sirex*, oak wilt, and others.

Tree Health Conditions (NJ-TIC2000)

1994 Study	1999 Study	Tree Conditions Classes
69%	34%	Good – A tree with a healthy, full crown that shows no visible signs of disease or damage.
21%	52%	Fair – A tree with thinning or unbalanced crow off-color foliage, or wounds.
8%	13%	Poor – A tree that is barely alive, and death or failure is imminent. It has many dead branches and is sparsely foliated.
2%	1%	Dead – A tree with no foliage; branches are brittle. It is a hazard in many locations.

White-tailed deer (*Odocoileus virginianus*)
High densities of white-tailed deer pose a significant threat to forest health and forest regeneration. New Jersey's progressive deer management strategy and the hunter's contribution through increased antler-less deer harvests have reduced the deer herd in many areas of the state. Damage from deer browse can severely impact some of New Jersey's remaining public and private natural lands. The unintended consequence is the destruction of some of our remaining natural lands. Deer directly damage wildlife habitat for other species and can eliminate rare plant communities. High numbers of deer find refuge in residential areas or on private land where hunting is not allowed. Over-browse by deer eliminates the native shrub layer, which deprives breeding habitat for many species, particularly shrub-nesting birds. Deer over-browse creates a favorable environment for invasive plants to germinate and crowd out native species. Deer selectively browse on native species, which allows non-native plants to become established and thrive (Wildlife Action Plan 2008).

Invasive plants (NJDEP 2006)
The control of invasive species, particularly plants, is a major stewardship issue in New Jersey. More than one thousand nonindigenous plants species have become established in New Jersey. Fortunately, not all of them have harmful or invasive qualities. But some of these species are very harmful and crowd out native plant species, altering the structure of natural plant communities, disrupting ecosystem functions and degrading recreational opportunities. While statewide eradication of invasive species is impossible, site specific removal and restoration is possible and is occurring throughout New Jersey.

Forest Health Risk and Host Species
In 2006, the NJ Forest Service participated in developing models for the National Insect and Disease Risk Map with the US Forest Service and other northeastern area state forest service personnel. This risk map was a modeling approach to provide information on what host tree species would be at risk of 25% mortality over a 15-year period.

These models are at a national scale and depict at risk species at a contiguous scale of 6,000 meters. The risk maps will aid in management and budgetary considerations in preparing Forest Health Monitoring decisions. These figures depicts where four; SPB, ALB, GM and ROD, damage causing agents have an impact on the mixed pine of southern NJ, mixed hardwood species and mixed oak species, respectively.

2006 National Insect and Disease Risk Map
http://www.fs.fed.us/foresthealth/technology/nidrm.shtml

% Tree Mortality Projected for 2006 – 2020:   ▢ 0 – 5   🟩 5 – 15   🟨 15 – 25   🟥 > 25

Southern Pine Beetle	Asian Longhorned Beetle	Gypsy Moth	Red Oak Decline
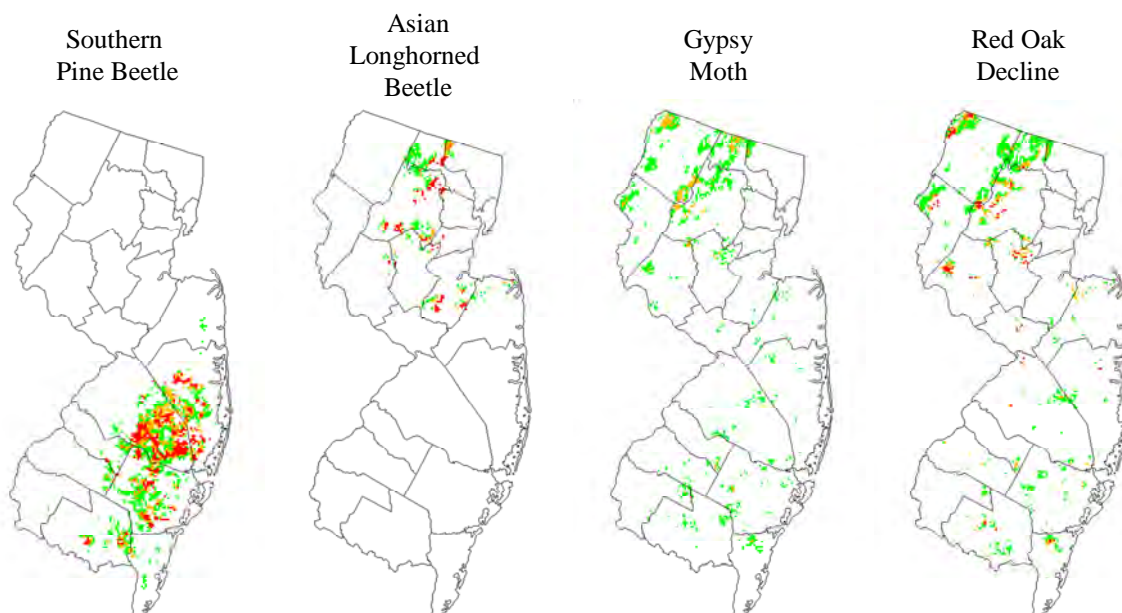
When analyzing the maps, it should be noted that only host species occurring over a contiguous acreage of 6,000 square meters are shown. While there are other areas of preferred host species within the state, they do not occur at that scale. Revised maps of 30 meters are being developed and the NJ Forest Service is part of the ground truthing effort to determine the accuracy of the higher resolution maps. These maps will depict additional areas of host species occurring at the revised scale.

Data from the US Forest Service FIA program also reveals some useful information regarding the extent of certain host species in NJ. It is possible to query the area of certain forest types known to widely consist of certain host species in order to get a feel for the extent of forested lands at risk to certain damage causing agents. This method only works for forest types known to contain the host species extensively, therefore it is not very effective for determining the area occupied by host species that occur in a "patchy" arrangement on the landscape (i.e. scattered eastern hemlock were tallied in the white oak/red oak/hickory type as well as the chestnut oak/black oak/scarlet oak type, both of which are part of the oak/hickory forest type-group, the most widespread group in NJ. The acreages of these types would not adequately reflect the extent of eastern hemlock in NJ. Ash species were abundant in 7 of NJ's 38 forest types reported by FIA in 2006. These types make up approximately 9% of NJ's total forested area. Most of these types are

categorized as portions of the oak/hickory forest type-group and the elm/ash/cottonwood type-group. Ash species are of special concern because they are the host species for emerald ash borer (*Agrilus planipennis*), which has been devastating in nearby states but not found in NJ to date. The NJ Forest Service is currently carefully monitoring for this pest.

As mentioned previously, the loblolly/shortleaf type-group, which includes the pitch pine type, is the second most widespread type-group in NJ occurring primarily in the southern part of the state. Southern yellow pine species group (pitch pine, shortleaf pine, Virginia pine, loblolly pine, and pond pine) are abundant in 4 of NJ's 38 forest types reported by FIA in 2006. These types make up approximately 29% of NJ's total forested area. Forest types where yellow pine species are abundant are included in both the loblolly/shortleaf and oak/pine type-groups. The yellow pines are of particular interest because they are host species for the southern pine beetle (*Dendroctonus frontalis*)**,** pitch pine looper (*Lambdina athasaria pellucidaria*), and the European woodwasp (*Sirex noctilio*)**.** Large contiguous blocks of forest containing these host species are spread throughout the NJ Pinelands in the southern part of the state.

Oak species are extremely widespread in NJ. Oak species are abundant in16 of NJ's 38 forest types reported by FIA in 2006, approximately 50% of NJ's total forested land area. These types are categorized within the oak/hickory type-group as well as the oak/pine type-group. As mentioned previously, the oak/hickory type-group is by far, the most widespread type-group in NJ. As the forests of NJ age, it is no surprise that insect and disease problems start to present themselves more frequently in such widespread forest types. Oak species are host to many different insects and diseases such as gypsy moth (*Lymantria dispar*), bacterial leaf scorch (*Xylella fastidiosa*), sudden oak death (*Phytophthora ramorum*), orangestriped oakworm (*Anisota senatoria*) and gouty oak gall (*Callirhytis quercus punctata*).

Gypsy moth has long been a problem in NJ but as large contiguous tracts of oak forest mature, mortality from gypsy moth defoliation has risen. Bacterial leaf scorch (BLS) affects oaks that make up the red oak subgenus. It is fatal and incurable and has been found in NJ. According to the FIA 2006 data, forest types containing significant presence of this subgenus occur on approximately 45% of NJ's total forested land area. Sudden oak death (SOD) primarily affects the red oak subgenus as well and has been devastating in other states. It has spread via nursery stock, and has fortunately not been found in NJ's woodland environments. The NJ Forest Service in conjunction with the NJ Department of Agriculture has been monitoring for sudden oak death. As NJ's oak forests continue to mature together, native insect species are also starting to show increased presence as forest pests. Gouty oak gall and orangestriped oakworm are examples of such insects that have only recently presented themselves as pests, contributing to significant oak forest mortality. White-tailed deer (*Odocoileus virginianus*) browse oak seedlings extensively. High deer populations and the maturing oak forests in NJ are contributing to declining regeneration statewide, as mentioned previously
.

Criterion 4: Conservation and Maintenance of Soil Water Resources

8. Area and percent of forest land with diminished soil quality
Soil and water quality is an important part of all forest environments both urban and rural. All strata of the forest such as trees, shrubs and ground cover help to stabilize soil and transform nutrients. Watersheds with higher forest cover provide higher quality and quantity of water for multiple uses. It is important that riparian areas are forested to provide natural buffers for filtering pollution and sediments before reaching streams and other water bodies. Protecting soil quality is also part of the USFS's redesign with Protecting Forests from Harm and Enhancing Public Benefits from Trees and Forests.

Soil quality and stability is important for tree species that are under stress from damage causing agents such as HWA. As an example, the more stabile the soil the better chance of reducing stress on the trees thereby reducing risk associated with hemlock decline (USDA Forest Service et al. 2003)

Historic Large Fires:
1925 -2009

Repeated fires have an impact on the on the organic matter and soil characteristics. Depending on the severity of the wildfire entire organic matter can be rapidly released. For instance in some cedar stands where organic matter has greater than 1-foot have been burned directly to the mineral layers.

Fire Towers
Airfields
100 Acre or Greater Fires
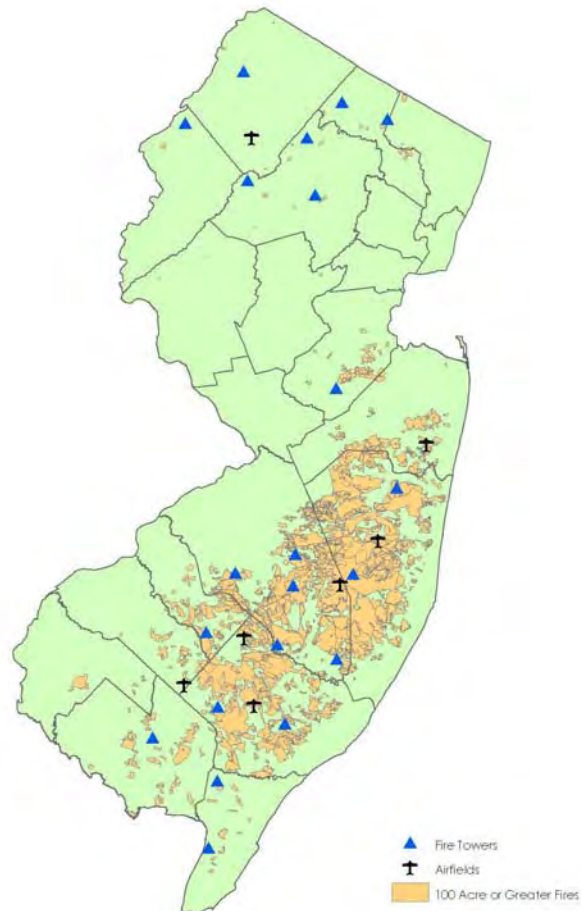
9. Area and percent of forest land adjacent to surface water and area of forest land by watershed

This Indicator relates to how forests are important in regulating surface and ground water flow and maintaining water quality. Forest in riparian areas slow the movement into bodies of water, regulate temperature and provide valuable food and habitat for wildlife. The amount of management of forests in these areas has an influence on the quantity and quality of water therefore it is important to follow best management practices to maintain the integrity of forests, streams, lakes and ground water. Forests are important in regulating water flow (surface and ground) and quality. Generally the greater the amount of forest cover the greater the opportunity provided for cleaner drinking water and recreational opportunities. Forests in riparian areas also regulate temperature and provide habitat and food for wildlife. The health of these forests and individual trees and associated plants is important in order to stabilize stream banks (USDA Forest Service et al. 2003).
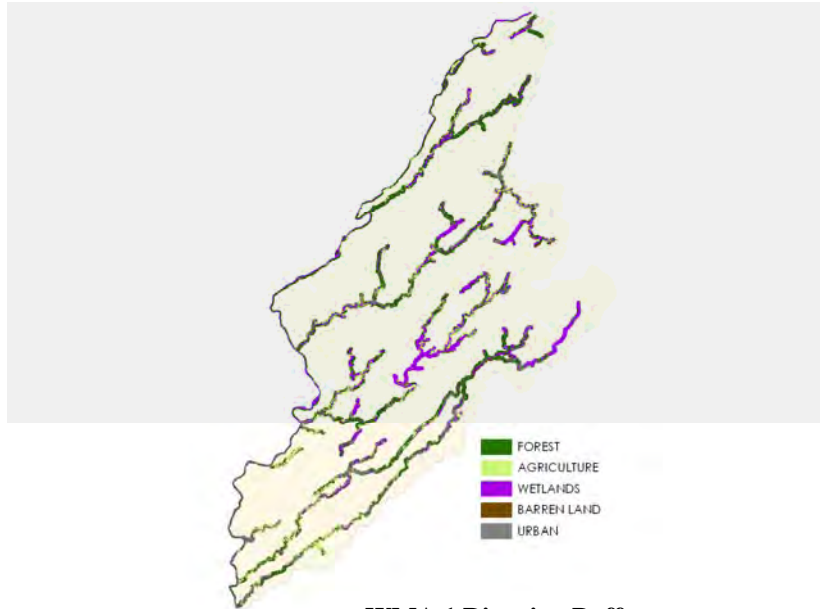
WMA 1 Riparian Buffers

Atlantic White Cedar

Within the Pinelands region and freshwater wetlands, white cedar swamps are essential storage areas for rainwater and water runoff, help maintain productivity of wetland communities, provide essential habitat for wildlife and plant life, including threatened and endangered species, cultural resource and the diversity and beauty of New Jersey's forest resource. For New Jersey cedar swamps provide habitat for 19 species of mammals, 14 herpetological species with declining populations, including the Pine Barrens tree frog, bog turtle, timber rattlesnake, northern pine snake, and several species of salamander. Unique plant species growing in Pine Barrens cedar bogs include the rare curly grass fern, several species of orchids, milkworts, sedges and cotton grasses, and the federally endangered swamp ink and bog asphodel (NJ Forest Service 1998).

10. Water quality in forest areas

Water resources are key to the productivity and health of many forest resources and include the physical features, habitat, and organisms of wetland areas, lakes and streams. Maintaining water quality in forested watershed processes are to sustaining ecological integrity of the environment. The State of New Jersey made water resources a priority due to the resources that depend upon a clean and plentiful supply. A Category of C1 Streams was created to protect water at key sources. Additionally, realizing water is important for all species within the State other rules and regulations were enacted to regulate activities within wetland areas and flood hazard areas. Drinking water, wildlife (aquatic and terrestrial), recreational activities such as fishing and swimming depend on a clean and abundant water supply (USDS Forest Service et al. 2003).

Forested wetlands are found throughout New Jersey and are considered one of the state's vital resources. They provide many benefits including: flood storage capacity; flood velocity reduction; groundwater recharge opportunities; nutrient and sediment control; wildlife habitat; recreational opportunities; and timber supply. Wetlands occur in depressions along rivers, lakes, streams and coastal waters subject to periodic flooding. They are frequently transition areas between a well-drained upland and the open waters of lakes, rivers, streams, and bays. Many wetlands develop in distinct depressions or basins that can be readily observed. Others may occur in almost imperceptible shallow depressions that cover many acres. They also may be associated with groundwater seeps. Water is a dominant factor in determining the nature of the soil development and the types of plant and animal communities living in the soil and on its surface. Water creates severe physiological constraints for all plants and animals except those that are adapted for life in water or in saturated soil.

Numerous factors influence the wetness of an area, including precipitation, stratigraphy, topography, soil permeability and plant cover. All wetlands usually have at least a seasonal abundance of water. This water may come from seasonal fluctuation in groundwater level, direct precipitation, overbank flooding, surface water runoff from rain, snow melt or from tidal flooding. The duration and frequency of inundation and soil saturation vary from permanent flooding or saturation, to irregular flooding or saturation. Wetlands are defined by, and process the following three essential characteristics or parameters:

Wetland hydrology
Wetland vegetation
Hydric soils

Of the three technical criteria for wetland identification, wetland hydrology is often the least exact and most difficult to establish in the field, largely due to annual, seasonal and daily fluctuations.

Criterion 5: Maintenance of Forest Contribution to Global Carbon Cycles

11. Forest ecosystem biomass and forest ecosystem and forest products carbon pools
This indicator is related to the amount of biomass reserved in forest ecosystems. Forests and its soils are the largest reservoirs in biomass and carbon which is an important factor in regulating the amount of atmospheric carbon. Trends in the amount of carbon sequestered are important consideration in forest management as an avenue to help monitor and stabilize the global climate (USDA Forest Service et al. 2003).

Forests are one of the largest carbon sinks. As a result of increasing atmospheric carbon dioxide (CO_2) and the phenomena of the greenhouse effect it is important to keep our forests as forests and healthy to absorb as much carbon as possible (USDA Forest Service et al. 2003).

Carbon-containing gases in the atmosphere, the so-called "greenhouse" gases, are strongly implicated as a potential source of climate change. Carbon dioxide, methane, and nitrous oxide have changed the composition of the atmosphere. Carbon dioxide concentration alone increased since the 18th century and greenhouse gasses are expected to warm the earth by allowing sunlight to reach the earth's surface while blocking heat from escaping. Some of the gases also thin the ozone layer that shields the earth from harmful solar radiation (NAASF 2008).

Growing forests store carbon naturally in both the wood and soil in a process called carbon sequestration. Trees are about 50 percent carbon; wood products from harvested trees continue to store carbon throughout the life of the product. In general, forest activities such as tree planting increase carbon sequestration, while activities such as prescribed burning release carbon into the atmosphere. Increasing carbon stored in urban and rural trees is usually an inexpensive way to mitigate increasing atmospheric greenhouse gases. In addition to sequestration, planting and maintaining trees in communities and especially around buildings to provide shade or block prevailing winds can moderate temperatures and substantially reduce energy demands and related greenhouse gas emissions (NAASF 2008).

While scientific understanding of the role of forests in the global carbon cycle has increased in recent years, there is still a significant lack of information on selected forest components and specific geographic regions. Trees remove (or fix) carbon from the atmosphere during the process of photosynthesis and incorporate this carbon into their tissues (or biomass), thus effectively storing (or sequestering) this carbon for extended periods of time. Organic carbon stored in forests includes both aboveground and belowground components. Aboveground biomass can be partitioned into standing live trees, standing dead trees, shrub, and down dead wood (DDW). DDW includes coarse wood debris and fine wood debris. The belowground component includes roots and organic material incorporated into soils (Zhang et al. 2010). The US Forest Service FIA program data from 2008 estimates that NJ's forests store approximately 65.5 million short tons of carbon in trees $\geq$ 5 inches in

diameter at breast height, above and below ground. Of those 65.5 million short tons, 17.1 million short tons (roughly 26%) are stored on state owned, forested lands. The chart titled "Above and Below Ground Carbon (Short Tons) by Forest Type-group using FIA 2008 data" shows the breakdown of the six most prevalent forest-type groups in NJ regarding carbon storage.

Above and Below Ground Carbon (Short Tons) by forest Type-group. FIA 2008 Data
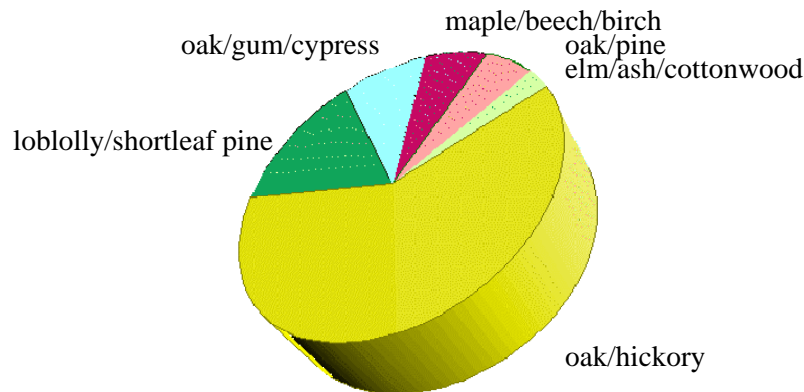
Knowing that the oak/hickory group accounts for the majority of NJ's forested area, it is no surprise to find that this type-group constitutes the largest component of the forest carbon reserve statewide. The loblolly/shortleaf group, which include the pitch pine type, makes up the second largest component of NJ's forest carbon reserves. For more specific breakdowns by unit area and information on NJ's forest carbon reserves see the "COLE 1605(b) Report for New Jersey" in an appendix at end of this assessment.

According to the FIA database for 2008 the total gross biomass of live trees at least 5 inches in diameter is approximately 102.1 million short tons on NJ's forested lands statewide, with roughly 25.9 million short tons (approximately 25%) of biomass falling on state owned forested lands. The distribution by NJ's six most prevalent forest type-groups is similar to that of statewide forested carbon reserves. The Oak/hickory group dominates in terms of biomass making up almost 60% of the total gross biomass statewide. The loblolly/shortleaf (including pitch pine) group contains the second most amount of biomass in a single type-group making up almost 14% of the total gross biomass statewide.

Urban Forest

Results from *Urban and Community Forests of the Southern Mid-Atlantic Regional* (Nowak and Greenfield 2009) Statewide, urban or community land in New Jersey has an estimated 152.7 million trees, which store about 29.1 million metric tons of carbon ($663.5 million), and annually remove about 961,000 metric tons of carbon ($21.9 million) and 30,070 metric tons of air pollution ($244.2 million).

Pollution Removal Benefits from Urban Trees:

The following forest attributes are estimates for the urban or community land in New Jersey. These are rough estimates of values. More localized data are needed for more precise estimates, but these values reveal first-order approximations.

152.7 million trees
29.1 million metric tons of C stored ($663.5 million value)
961,000 metric tons per year of C sequestered ($21.9 million value)
30,070 metric tons per year total pollution removal ($244.2 million value)
668 metric tons per year of CO removed $940,300 value)
6,234 metric tons per year NO_2 removed ($61.8 million value)
11,289 metric tons per year of O_3 removed ($111.8 million value)
2,114 metric tons per year of SO_2 removed ($5.1 million value)
9,760 metric tons per year of PM_{10} removed ($64.5 million value)

		Carbon		
	Metric Tons Stored	22,900,000	17,400,000	29,100,000
	Stored ($)	522,100,000	396,700,000	663,500,000
	Metric Tons/Year Sequestered	754,000	574,000	961,000
	Sequestered ($/Year)	17,191,000	13,087,000	21,911,000
		Pollution Removed/Year		
	Metric Tons of CO	525	399	668
	CO ($ value)	738,500	561,500	940,300
	Metric Tons of NO_2	4,896	3,723	6,234
	NO_2 ($ value)	48,501,300	36,878,500	61,756,600
Urban Tree Benefits	Metric Tons of Ozone (O_3)	8,866	6,742	11,289
2000	Ozone ($ value)	87,830,000	66,782,000	111,833,000
	Metric Tons of SO_2	1,660	1,262	2,114
	SO_2 ($ value)	4,026,000	3,061,200	5,126,300
	Metric Tons PM_{10}	7,665	5,828	9,760
	PM_{10} ($ value)	50,694,900	38,546,400	64,549,700
	Total Metric Tons	23,610	17,950	30,070
Total Pollution Removal ($/Year)		**191,800,000**	**145,800,000**	**244,200,000**

Criterion 6: Maintenance and Enhancement of Long-term Multiple Socio-economic Benefits to Meet the Needs of Societies

12. Value and volume of wood and wood products production, consumption, and trade

This Indicator measures the value, quantity and consumption of the variety of wood products harvested from forest lands. This reflects the importance forest resources have in supplying raw materials for utilization and consumption to an ever demanding population. It is important to harvest at sustainable levels while making investments in forest resource planning economically feasible for the Steward while adhering to rules and regulations (USDA Forest Service et al. 2003).

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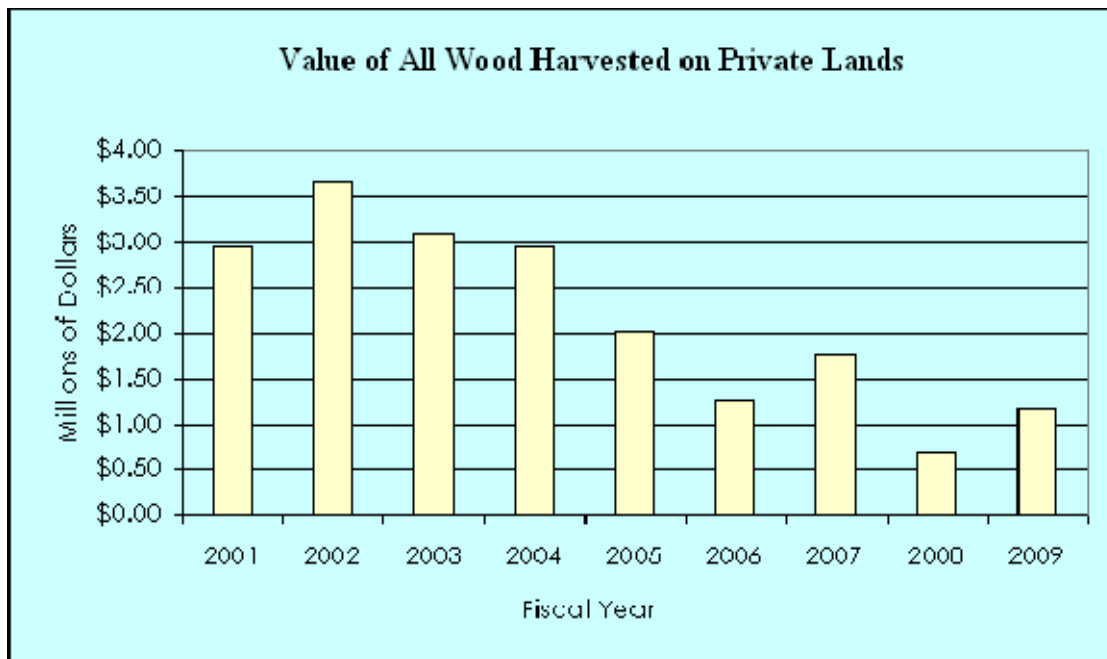
The NJ Forest Service requests an Accomplishment Report from consultant foresters twice a year. Each report asks for classifying the amount of wood removed in the form of sawtimber and roundwood (cordage). The products removed correspond to prescriptions conducted such as forest stand improvement, regeneration – natural or planted, insect or disease suppression, and wildlife habitat enhancement. The number of plans and acreage these activities are carried out in is also recorded.

Sawtimber Volume Harvested and Sold on Private Lands
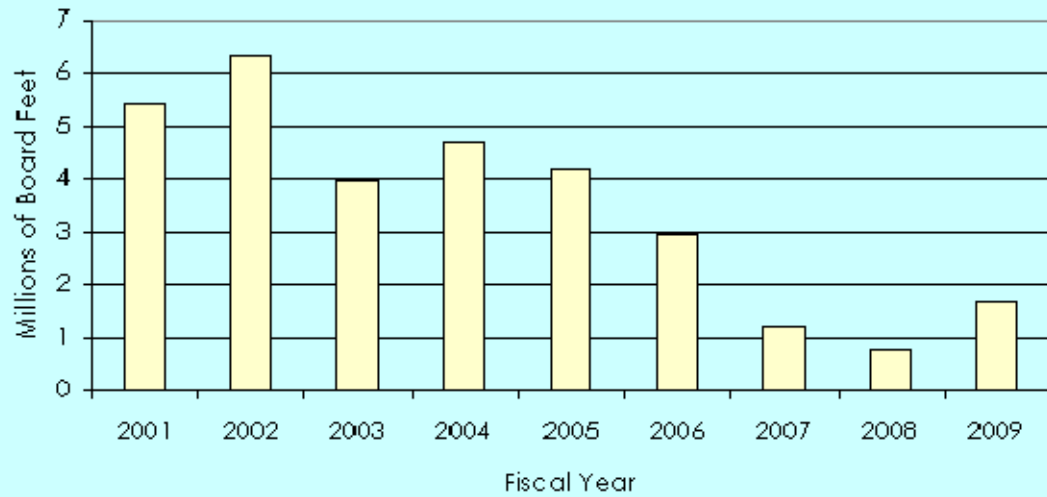
Cordwood Volume Harvested and Sold on Private Lands
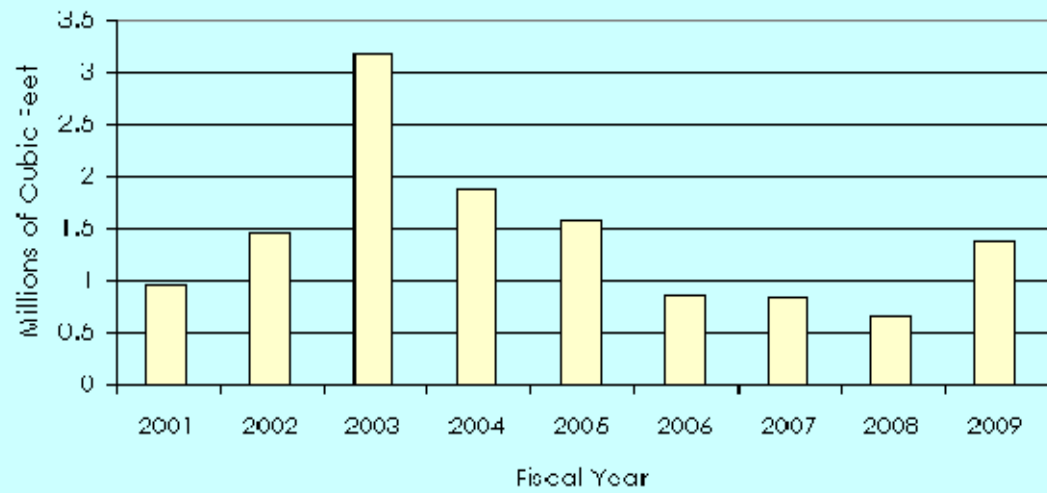
13. Outdoor recreational facilities and activities
This Indicator assesses the many demands of recreational opportunities placed upon the forest resource. Outdoor recreation has been a cultural part of the State's heritage. Also, in a time when society is promoting outdoor activity for health benefits the demands for a quality outdoor recreational experience have increased (USDA Forest Service et al. 2003).

New Jersey has over 1.2 million acres of preserved public open space representing 26% of the land area. Open space preservation is a tool of smart growth that provides many amenities including recreation, water resource protection, biodiversity, agriculture, and tourism.

The Policy Plan
Land preservation and recreation comprise one of the cornerstones of New Jersey's smart growth policy. Nine Green Acres bond issues totaling $1.4 billion together with funding from the Garden State Preservation Trust Act, which has the potential to provide $1.9 billion, represent a combined $3.3 billion public investment in open space preservation and recreation by the State since 1961. New Jerseyans have continually expressed their support for the State to carry out a comprehensive open space and recreation program. There is no stronger testament of this support than residents consistently voting for open space and recreation referendums not only at the State level, but at the local level as well. In 2007, 252 New Jersey local governments, all 21 counties and 231 municipalities, assessed a special tax for land preservation and recreation purposes. New Jersey is clearly a national leader in open space preservation.

The NJDEP documented the recreational and economic importance of New Jersey's wildlife resources through a 2007 study of the economic value of the State's natural resources.

Of the 1.2 million acres in preserved open space 436,570 acres is under the jurisdiction of the Division of Parks and Forestry. Parcels are designated as state park, forest, natural area, recreational, and conservation easements. The Division of Parks and Forestry has the stewardship responsibility of thirty-nine state parks (125,576 ac.) and eleven state forests (251,480 ac.). The largest state park is Wawayanda (39,198 ac.) located in the north central part of New Jersey and the largest parcel being Wharton State Forest (122,463) acres located in the Pinelands region in the southern part of the State.

Note: Total includes all areas and or historic sites that are assigned to the state park or forest.

Source: Fiscal Year 2006 Attendance Report, Division of Parks and Forestry. ***For the purposes of** the Assessment, attendance at marinas, lighthouses and beaches were not included.

Visitor Use by Fiscal Year
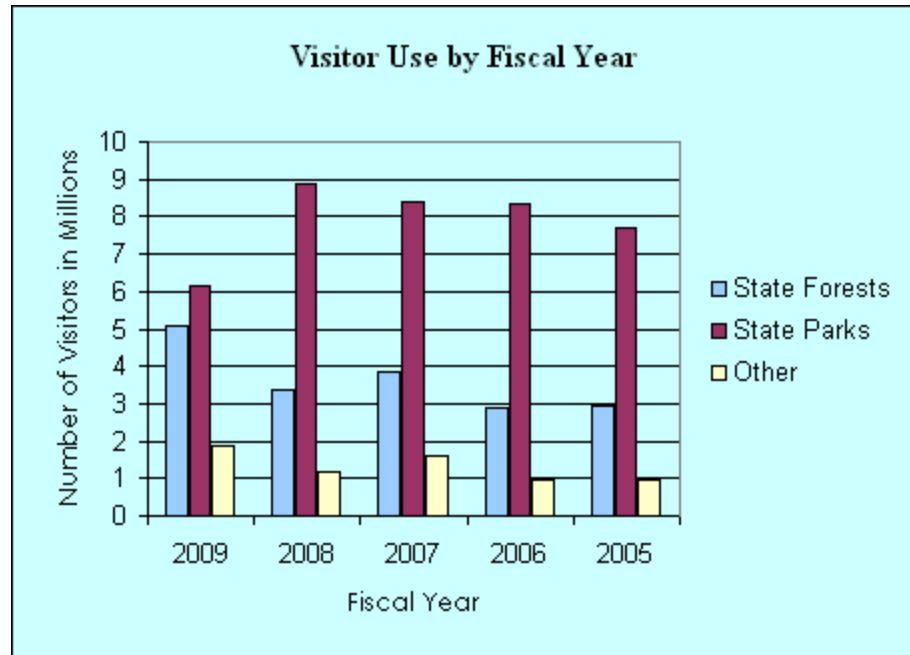
NJ Fish & Wildlife Service Website and NJDEP 2006.
The Division of Fish and Wildlife have approximately 120 Wildlife Management Areas totaling 326,000 acres.

Recreational activities include hunting, archery, shotgun ranges, bird watching, photography, hiking, horseback riding, and field trials (dog training). These areas also provide for the preservation of biodiversity. A NJDEP study documented that the recreational and economic importance of New Jersey's wildlife resources amounts to approximately $3.1 billion dollars and 37,000 jobs. Approximately 2.4 million people participate in some form of wildlife recreation in New Jersey. Fish and wildlife are a major capital asset that must be managed and protected. Open space preservation as pursued by New Jersey is one way in which wildlife resources can be protected.

Many of these areas are adjacent to designated parks and forests where management activities have been planned to blend into each other. More recently large landscape and regional planning are taking place in the northern Pinelands region where both public and private landowners are part of a regional plan.

Off-Highway Vehicles (NJDEP 2005)
The continued illegal use of off-highway vehicles (OHV) in New Jersey remains another serious stewardship concern. The state currently has a policy that prohibits OHV use on State public open space lands but damage to natural resources on these lands continues. The State acquired a 235 acre site in Gloucester County as a possible site for an OHV park. The State is currently in the planning and design phase to determine the site feasibility in more detail. The State is also working with a nonprofit group to establish an OHV park in Ocean County. The lack of a large parcel of land without environmental constraints and concerns of local officials and the public makes sitting such a facility

difficult. The State set a goal of having two OHV parks by 2005. Due to the complex issues associated with ORV use, this remains an on going goal to be achieved. The State continues to seek opportunities to provide OHV users with safe, legal places to ride in New Jersey. Besides providing recreational benefit, these sites will enable the NJDEP to implement stronger protections on land currently subject to illegal OHV use.

It is clear that the value our parks, forests and wildlife management areas have is both environmental and economical. The acquisition and preservation of New Jersey's open space to protect the natural resources for public enjoyment and biodiversity are high priorities.

14. Public and private investments in forest health, management, research, and wood processing
This Indicator reflects a commitment to the short and long-term health of our forests. Investments in forest health monitoring are necessary to build new knowledge through research and development to improve upon corresponding silvicultural activity necessary to protect, enhance and conserve our forest resources (USDA Forest Service et al. 2003).

The New Jersey Forest Service maintains a Cooperative Forest Health Monitoring and Survey and Technical Assistance Program. This program is part of the larger Mid-Atlantic regional area of concern. Each year the State prepares two federal grant narratives to the United States Forest Service for financial assistance to monitor and survey our State's forest resource both public and private. Other states involved are Delaware, Maryland, Pennsylvania, Ohio and West Virginia. The District of Columbia is also a participant in the Mid-Atlantic region.

The NJ Forest Service coordinates research activities with The Richard Stockton College of New Jersey on the best management practices for Atlantic white-cedar management and restoration. These coordinated efforts have been taking place for over 20-years. As a result the Atlantic white-cedar: Ecology and Best Management Practices Manual. This manual provides valuable guidelines for restoration of this valuable tree species. Additional efforts are underway for the developing improved silvicultural practices for other New Jersey forest types.

The NJDEP agencies coordinate management and research efforts as a part of an interdisciplinary review process. In addition to these interagency efforts, NJDEP also coordinates with federal and local governments, colleges and universities, non-profits, professional organizations, and stakeholder groups. Examples include habitat management techniques, biodiversity and tree provenance studies as well as ecological restoration efforts. New Jersey has also hosted the Atlantic white-cedar Steering Committee Symposium as was as participated in conferences hosted by other states and federal agencies.

The Cooperative Forest Health Program was authorized by the Cooperative Forestry Assistance Act of 1978 (PL 95-313) and amended by the 1990 Farm Bill (PL 101-624) and assists states in conducting forest health management activities on non-federal forest lands to achieve healthy sustainable forests. This provides states with federal funds to detect, monitor and evaluate forest health conditions on state and private lands. These federal funds enable states to collect forest health data in a standardized manner so that it is compatible with data from other states in the region. Standardization and compatibility ensures that the information collected by states and given to the US Forest Service is valid for regional reporting.

The goal of the Cooperative Forest Health Management program in NJ is to protect and promote the forest resources of New Jersey by providing timely insect and disease identification and other damage causing agent assessments thereby providing management advice for ecological services to state and private forest owners and managers. Through this Cooperative Agreement, the NJFS will conduct the FHM and CFHP programs to meet this goal.

Forestry Services Investments in Training
State lands C&I: 4.10 | 7.17
The Forest Service offers training to consultants regarding rules and regulations to the Department's Land Use Regulation Program pertaining to wetlands and flood hazard areas where Best Management Practices must be followed. This allows forestry practices to occur in regulated areas under and approved forest management plan.
Other training opportunities provided have been for invasive species management.

Conservation / Interpretation: Educational Programs
The Forest Resource Education Center (FREC) offers free education programs to groups of ten or more. Although school groups make up the majority of the programs, clubs, seniors, and professional organizations also come to the FREC for programs. Programs are usually two-hours in length and must be booked in advance.
The teacher receives a curriculum guide to prepare for their trip which includes correlations to NJ State Standards. On the day of the program, the staff introduces the group to the area and gives a safety orientation on poison ivy and ticks. Many of the FREC programs are hands-on and interactive.

Demonstration Forestry, Related Criteria & Indicator: 2 | 4.10 | 6.12-15
The FREC site shows examples through active forestry management practices, of the stewardship and conservation of New Jersey's natural and renewable resource. Forest management demonstrations include: prescribed burning, timber stand improvement, pine savanna, thinning, even and uneven aged plots, artificial and natural regeneration, water quality and habitat improvements, and maintaining riparian forested buffers to protect wetlands.

Visitation at the FREC:
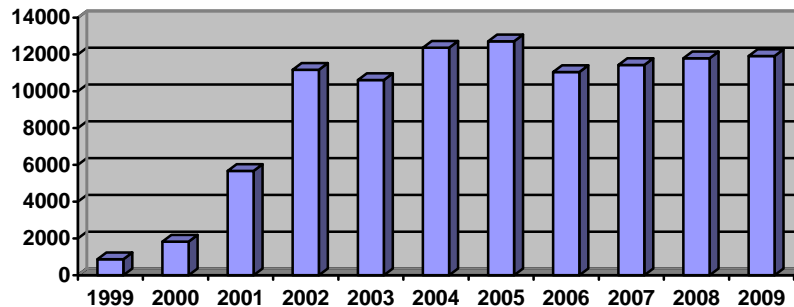
Trout in the Classroom C&I: 4.10 | 6.13
Since 2008, the FREC staff hosts the yearly Trout in the Classroom Field Day in cooperation with Freehold Area and Ocean County Soil Conservation Districts, Jersey Shore Trout Unlimited, and NJ Division of Fish and Wildlife.

Special Events
Fall Forestry Festival C&I: 6.13-14

For 15 years, the New Jersey Forest Service has hosted the Fall Forestry Festival on the first Saturday in October. The festival features over 40 exhibits, hikes, activities, and demonstrations on environmental topics. Scouts attend to fulfill badge requirements. In 2009, the Fall Forestry Festival had a record attendance of over 1,200 visitors.

Trail Exploration Day C&I: 6.13-14
On Trail Exploration Day, visitors take one-hour long guided hikes through the forest to learn about forests, wildlife and the inter-relationships.

Full Moon Hike C&I: 6.13-14
Every year in August, the FREC hosts the Full Moon Hike under the "Green Corn" full moon. FREC staff leads visitors along the trail, stopping to discuss native Pinelands plants and wildlife.

Carving Workshops C&I: 6.12-14
The FREC holds carving workshops led by Ray Nyman, NJ Forest Service Volunteer and Barnegat Bay carver. Past workshops include paddle-making, traditional Santa, ducks, and shorebirds.

Cooperatives C&I: 6.12-14
Ocean County Vocational Technical School Cabinet Shop
The FREC donates furniture-grade lumber yearly to the cabinet shop. The students use the lumber for various projects.

Project Learning Tree C&I: 4.10 | 6.12-14
The FREC hosts the New Jersey Project Learning Tree (PLT) program. The coordinator and facilitators give teacher training workshops on the nationally acclaimed curriculum guide.

AmeriCorps C&I: 4.10 | 6.12-14, 16
The FREC hosts the AmeriCorps program's Watershed Ambassador for the Barnegat Bay watershed. The ambassador helps with education programs and gives on-site school programs during their year of service. The FREC has hosted six Watershed Ambassadors since 2004.

Society of American Foresters C&I: 4.10 | 6.12-14
The New Jersey Division of the Alleghany Society of American Foresters (SAF) works with the FREC on various statewide forestry programs and rules and regulations.

Volunteers C&I: 6.12-14
The FREC provides volunteer opportunities for individuals and groups to assist staff with mailings, trail maintenance, special events, education programs, and bluebird monitoring.

Interns C&I: 4.10 | 6.12-14, 16
Each year, the FREC hosts interns from the Ocean County Vocational Technical School horticulture program and from the Marine Academy of Technology and Environmental Science program. These interns maintain trails and help with nursery operations.

Girl and Boy Scouts C&I: 6.12-14

Jackson Pathfinders C&I: 6.13-14
The Jackson Pathfinders, a volunteer organization started in 1999, works to preserve open space, maintain hiking trails, and encourage pride in the community of Jackson. The Jackson Pathfinders members assist with FREC special events.

Outreach & Other Projects C&I: 4.10 | 6.13-14
Teach at the Beach
Since 2002, FREC staff presents interpretive programs at Teach at the Beach (water connection), an annual workshop held each May. Typically, over 100 educators attend this event. Event locations include Sandy Hook, Cape May, Tuckerton, The Richard Stockton College of New Jersey, and Monmouth University.

Fort Dix Earth Day C&I: 4.10 | 6.12-14
Since 2003, FREC staff and with Fort Dix Natural Resources Management has held Earth Day Celebration at the Warren Grove Range. Over 150 students from four different school districts participate each

April. Students learn about wildlife habitats, perform a fire ecology quadrat study, and learn about forest products.

Sawmill Programs C&I: 4.10 | 6.12-14
FREC staff takes the portable sawmill to remote sites such as the Pine Barrens jamboree, Blueberry Festival, Tuckerton Decoy Festival, Fort Dix Earth Fair, NJ Shade Tree Federation Annual Meeting, Hunterdon County Soil Conservation District annual meeting, and the NJ Envirothon competition to provide demonstrations.

Rain Garden Schools C&I: 3 | 4.10 | 6.12-14
In cooperation with Ocean County Soil Conservation District, FREC staff works with Ocean County schools to create landscape designs, provide brainstorming sessions for students and teachers, fabricate oak picnic tables and podiums, install native trees and shrubs, and provide nest boxes, bird feeders, and interpretive signage.

Seasons of the Pines C&I: 6.13-14
Working with renowned author and nature photographer Bob Birdsall, FREC staff developed "Seasons of the Pines," an interactive CD and curriculum guide. The FREC also hosts Seasons of the Pines educator workshops with Bob Birdsall.

Envirothon C&I: 6.13-14
The FREC staff has facilitated the Forestry section of the Envirothon since 1993. The New Jersey Envirothon competition is a one day event that takes place at the end of the school year. Teams are tested on environmental topics through hands on interactive problem-solving.

Pequest: C&I: 1.4 | C4.10 | 6.13, 15 | 7.18
Anyone with an interest in fish, wildlife or the outdoors will enjoy a visit to the state-of-the-art Pequest Trout Hatchery and Natural Resource Education Center.

Forestry Education into the Future C&I: 6.13-14
The FREC strives to promote forest stewardship through education, special events, and outreach programs in cooperation with public and private environmental organizations. Since 1999, the FREC has given programs to over 96,000 people.

Forest Fire: C&I: 3.7, 5.11, 6.14
A new addition to the program is 'Tanner", a Labrador Retriever used to locate match & lighter ignitions. Tanner is trained to locate, and indicate, by sitting in the area of a burnt match or stand in the area of a lighter ignition. As far as we know, Tanner is the first dog trained to indicate on a match or lighter set wildfire in the nation.

The K-9 teams took part in over 85 information and education programs in 2008. The programs were conducted at schools, fire departments, civic organizations, fairs and festivals. Some of the highlighted programs were Bring Your Kids to Work. The K-9 unit also assisted other Bloodhound handlers form the National Police Bloodhound Association with a program for the Hamburg Police Department. These programs consisted of information related to forest fire prevention, information on the NJ Forest Fire Service, Firewise and Defensible Space Programs and law enforcement applications of our K-9 Program.

With the dogs, we are able to draw people to our informational displays. People are attracted and are willing to listen to information about our K-9 teams and our fire prevention message. Each year we are receiving more and more requests for the K-9 unit to present programs throughout the state.

Training continues to be conducted through the Cape May County Sheriffs Department K-9 Unit. The Bloodhounds are trained to work in various weather conditions. We also train to work in various geographic areas. K-9's Blaze and EO were also received training to fly in helicopters. This could shorten response time throughout the state. The dog handler is an active member of the National Police Bloodhound Association and attended their week long training in December with K-9 EO.

The K-9 unit conducted 17 training sessions with over 265 contacts in 2008. The trainings were given to police explorers, fire departments, search & rescue groups and forest fire personnel. The trainings consisted of scene preservation, scent preservation, and working with our K-9 teams.

The K-9 Team is an important part of a K-9 unit. K-9 team members assist the K-9 handler while the animal is trailing. They have received training to work with the dog and handler. K-9 team members may assist with traffic control while the K-9 is trailing, help locate evidence, and gather other information along the trail.

15. Forest ownership and land use (including acres of specially designated land)
This indicator is a measure of who owns forested lands. Ownership is important on making well informed decisions on forest related issues. Goals and objectives may defer depending on whether the land is publicly or privately owned. This land also measures the amount of forest land in different management areas including those designated as protecting ecological, cultural and social values. Protecting forest land from conversion to urban development is important to the sustainability of forest resources (USDA Forest Service et al. 2003).

Urban or community land in New Jersey comprises about 44.2% of the state land in 2000, an increase from 40.3% in 1990. Statewide tree canopy cover averages 43.6% and tree cover in urban or community areas is about 37.7%, with 16.9% impervious surface cover and 45.4% of the total green space covered by tree canopy cover. Statewide, urban or community land in New Jersey has an estimated 152.7 million trees.

Urban Forests

While over 200 species and cultivars have been found growing along the streets of New Jersey, the following data shows a preponderance of maples. It should also be noted that there was a 3% increase in the "other" category from 1994 to 1999.

NJ-Trees in Crisis, USFS 2000

Top Six Most Common Street Trees	1994	1999
Norway maple (*Acer platanoides*)	20%	18%
Red maple (*Acer rubrum*)	12%	11%
London plane (*Platanus x acerifolia*)	10%	8%
Callery pear (*Pyrus calleryana*)	6%	9%
Pin oak (*Quercus palustris*)	6%	7%
Silver maple (*Acer saccharinum*)	8%	6%
Other	38%	41%

NJ-Tress in Crisis 2000 Summary	1994	1999
Total Street Trees	2,000,000	2,100,000
Good Condition (best rating)	69%	34%
Trees Causing Sidewalk Conflict	25%	26%
Vacant Tree Planting Spaces	50%	54%
50% of Street Trees in NJ Are	4 species	5 species
Street Trees Needing Maintenance	75%	70%

Urban and Community Land

Urban land comprises 37.6% of the land area of New Jersey, while lands within communities make up 26.7% of the State (Fig. NJ-1). Between 1990 and 2000, urban area increased 12.8%, while community land decreased from 27.3 to 26.7%. Urban area in New Jersey is projected to increase to 63.6% by 2050, based on average urban growth pattern of the 1990s. The percentages are calculated using the total water and land area of the geopolitical units derived from US Census cartographic boundary data. Percent urban land varied across the State.

16. Employment and wages in forest related sectors

This Indicator is a measure of the contribution the forest resource sector provides in contributes to employment in State and at regional levels. Employment related to forest is an important social value. The utilization of forest products in provides the foundation for

many rural economies and the stability of communities. By having a forest related jobs the ability to achieve forest management objectives can be conducted while enhancing wildlife habitat and maintaining forest health (USDA Forest Service et al. 2003).

Forest products and processing industries: According to 2002 census data wood manufacturing industries in New Jersey are represented by 967 companies employing over 28,000. In addition, these businesses provide 1.1 billion in annual wages and manufacture value added products in excess of 5.2 billion dollars. These are businesses such as sawmills, lumber wholesalers, moulding and paper related products manufacturers, furniture, and cabinet makers (US Census Bureau 2002).

The flow of raw materials regarding these primary and secondary wood processors often travel across state and regional boundaries. New Jersey saw logs or pulpwood chips for example may be transported to another state for primary processing and then back again to New Jersey as lumber or pulp for finishing and secondary processing into cabinets, furniture or paper goods. In this way wood processing and the economy it creates is not dictated very well by state boundaries. In fact, New Jersey hardwood logs provided through forest management activities could commonly find their way to overseas markets as veneer logs to European, Asian or Mediterranean markets.

Consultant Foresters: The New Jersey Forest Service maintains an Approved List of Consultant Foresters that currently has 68 foresters. This List is necessary for not only referring woodland owners to ecological services that foresters provide but to attest to the requirements of the rules Farmland Assessment as it pertains to Woodlands. The amount of support staff the consultants have varies greatly depending on the size of the company. The consultants provide services involving silviculture, including the bidding of timber operations. Each prescription provides numerous contractors and supportive staff. The NJ Forest Service does not keep records of supportive staff and their corresponding wages.

Woodcutter data: The NJ Forest Service maintains a list of woodcutters in the State that are interested in receiving bids for harvests on State Lands. The list is categorized by sawtimber or firewood in the northern or southern part of the state, pine pulp and species specific interests in black walnut, Atlantic white-cedar and black locust. Currently there are approximately 80 woodcutters on the list. Woodcutters must maintain insurance at all times on State Land harvests. The list is updated every few years. The NJ Forest Service does not keep records of supportive staff and their corresponding wages.

Sawmill data: The NJ Forest Service also maintains a list of active sawmills within the State. This list provided information on what type of products the mill specializes in such as crane mats, decking, cedar products, furniture stock, custom moldings, shavings, landscape ties, fence post, etc. It is common to provide information to the public, including woodcutters on what mills are located in their area with the utilization forte needed. Similar to the woodcutter and consultant forester data, the NJ Forest Service does not keep records of supportive staff and corresponding records.

Criterion 7: Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

17. Existence, type, and monitoring of forest management standards and guidelines
This Indicator describes what type of forest management standards and guidelines determine governing forest planning, management and operational activities on the ground. These standards and guidelines are well designed, properly applied and effective to sustainably manage forest resources (USDA Forest Service et al. 2003).

State Land Monitoring
In order for the NJ Forest Service and other Natural and Historic Resources Group (NHRG) agencies (Forest Fire Service, State Park Service, Office of Natural Lands Management, Historic Preservation Office, and the Division of Fish and Wildlife) to implement activities on State Lands a formal interagency review process and GIS screening application is conducted. New proposals with written prescriptions must be developed taking into consideration all site characteristics such as tree, shrub and ground cover species, water, soils, wildlife, and archaeological findings. The screening application includes data layers specific to each agencies concerns such as tree cover, wildfire risk, threatened and endangered plant and animal species, and archeological sites.

Following the approval process and during execution of the prescription, the NJ Forest Service monitors the operation in accordance with Best Management Practices related to forestry and wetlands. This is to assure the prescription is conducted according to the proposal and sound ecological management. Upon activity completion, the site is monitored for the desired future stand. For example, if a site is planted the survivability of the planting stock is monitored. If mortality is too high supplemental planting will occur in order to increase stocking levels. These areas are also put on a list that restricts prescribed burning (RxB) up to 10-years.

State Hazard Mitigation Plan
The federal "Stafford Act" requires states to prepare and implement disaster preparedness plans for mitigation, warning, emergency operations, rehabilitation and recovery. The State Firewarden is appointed by the Governor's Office as a member of the State Hazard Mitigation Team regarding natural disasters in a partnership with other relevant State agencies. The NJ State Hazard Mitigation Plan (NJ-SHMP) was submitted by the State Police Office of Emergency Management (OEM) and has been approved by the Governor and the Federal Emergency Management Agency (FEMA). This document requires the county governments to develop all-risk disaster plans for integration into the SHMP, and lists the goal of having a Community wildfire protection plan for every municipality within the state.

Wildfire Protection Planning
A positive initiative became available when the Forest Fire Service received a $79,000.00 FEMA grant. This Pre-Disaster Mitigation Grant (PDMG) was obtained through the NJ State Police, Office of Emergency Management. The grant funds five tasks towards these goals to improve plan development and GIS data collection. A "Wildland Hazard Fuel Ranking" map was created for the state, as well as individual county map templates to provide map products to share with other planning agencies. Historic fire records and prescribed burning project maps were digitized to add as data layers during planning. Field crews collected structural assessments on homes within selected communities and provided education on Firewise principles to the homeowners. The collected data and map products developed are used by fire suppression forces, Firewise community planning, and Community Wildfire Protection Plans (CWPP).

Interagency Firefighter Mobilization
The Forest Fire Service marked the twenty-fourth season (2009) personnel have been supplied for interagency assignments. The Resource Ordering Status System (ROSS) dispatching system is used to complete the travel information for mobilized resources as well as creating crew rosters. Individuals of this agency participate in Type I Incident Management Teams from the Northern Rockies and the Great Basin.

Atlantic white-cedar Initiative
In July of 1995, the New Jersey Forest Service began the Atlantic white-cedar Initiative (AWCI) in cooperation with The Richard Stockton College, Rutgers University, New Jersey Pinelands Commission, NJ Forestry Association and private resource management consultants. The AWCI was established to facilitate communication and encourage cooperation among agencies, researchers, private landowners and the public. It explores and demonstrates approaches for restoration and sustainability. It also provides a management model for the Atlantic white-cedar resource and restoration methodology. The development of Best Management Practices (BMP's) to facilitate these goals was also accomplished.

18. Existence, type, and frequency of forest related planning, assessment, and policy review
This Indicator relates to focused and technically sound plans, assessments, and policy that considers the range of forest values and are coordinated with a variety of forest related sectors critical to comprehensively evaluate conditions and trends that affect forests (USDA Forest Service et al. 2003).

New Jersey Statute Authority Title 13
Conservation and Development – Parks and Reservations

Originally created by L.1915, c.241, the Department and Board of Conservation and Development succeeded to and exercised all the rights and powers of the former board of forest park reservation commissioners, the state geological survey and the board of managers thereof. The Department and Board of Conservation and Development was transferred for the most part to the Division of Forestry, Geology, Parks and Historic

Sites within the Department of Conservation by L. 1945 c.22. The functions, powers and duties of the division were then assigned to the Division of Planning and Development in the Department of Conservation and Economic Development by L. 1948 c. 448. The Division of Planning and Development was subsequently renamed the Division of Resource Development by L. 1961 c. 47.

A Division of Parks, Forestry and Recreation was established in the Department of Conservation and Economic Development by L 1966 c. 54 which continued in the Department of Environmental Protection by L.1970 c.33 and later re-designated the Division of Parks and Forestry by L. 1971 c. 133.

In 1991 the Department of Environmental Protection was reorganized into the Department of Environmental Protection and Energy but has subsequently dropped energy. N.J.S.A. 13:1D-2, continues the functions, powers and duties of the existing Department of Conservation and Economic Development in the Department of Environmental Protection.

Title 13 Chapter 1L, Acquisition, Construction and Management of State Parks and Forests. The short title of this section is known as the State Park and Forestry Resources Act. The purpose of this section is to update the statutes under whose authority the State's Parks and forests are regulated. The act consolidated 56 separate sections of existing law into a concise act that provides for the acquisition, planning, design, development and operation and maintenance of the State Parks and Forests. Sections 13:1 L 13-17 house the foundation of the Forest Management Program, the tree seed and seedling trees program, the forest protection sections the "No Net Loss Act" and the "NJ Shade Tree and Community Forestry Assistance Act; as well as defining the State Forester position.

Title 13 Chapter 9, State Forest Fire Service
This chapter is a compilation of the statutes related to the New Jersey Forest Fire Service and has as its base section 13:9 -44.1 the "Forest Fire Prevention and Control Act".

Natural & Historic Resources Group (NHRG): Forestry and Fish and Wildlife Services
New Jersey's Department of Environmental Protection's NHRG has a Land Management Review Policy that requires activities that could have adverse impacts go through a process that is designed to avoid any such affects. This is the same process mentioned in Indicator 17.

Farmland Assessment (As it pertains to Woodland Assessment)
The New Jersey Farmland Assessment Act of 1964 was amended in 1986, requiring woodland owners to develop and implement a state-approved forest management plan to qualify for reduced property taxation. Under the amended act, woodland owners must fulfill special requirements concerning property used exclusively and actively devoted for the production and sale of forest products, excluding Christmas and nursery trees. Eligible landowners must have at least 5-acres dedicated to active agricultural or woodland devotion. Woodlands of equal or lesser acreage to an owner's primary farm

operation are considered supportive and subordinate, and therefore the owners are exempt from filing a management plan and the woodland data form (WD-1), a document used to inform the Department of Environmental Protection and the local tax assessor of the forestry activities performed during the pre-tax year.

No Net Loss Reforestation Act
State entities are required to replant trees when trees are removed during development projects involving one-half acre or more by a State entity.

Dedicated License Plate (Treasure our Trees)
Proceeds from the Treasure Our Trees plates fund tree planting projects in communities across New Jersey. These plates are available for both passenger and commercial vehicles. The one-time fee and yearly renewal fees are tax deductible. This attractive plate features the New Jersey state tree, the northern red oak, and the New Jersey state memorial tree, the white flowering dogwood.

Forest Stewardship Program
The USDA Forest Service and the National Association of State Foresters initiated the Forest stewardship Program in 1990. Congress included the FSP in the 1990 Farm Bill and authorized it again in 2002. In New Jersey, the Program is administered through the NJ State Forest Stewardship Coordinating Committee with representatives from federal, state, and private natural resource agencies and organizations.

This program offers technical and financial assistance to private woodland owners. In addition, they help landowners develop a management plan for wood products, as well as wildlife, forest restoration, forest health, invasive species control, and water quality. It targets private woodland owners, farmers, wildlife enthusiasts, watershed associations, hunting clubs, scouting organizations, private schools, private organizations, and individuals.

Forest Legacy
The Forest Legacy Program (FLP) is a partnership between States and the USDA Forest Service to identify and help conserve environmentally important forests from conversion to non-forest uses. Nationally, the main tool used for protecting these important forests is conservation easements. However, fee-simple purchases are permitted. The Federal government may fund up to 75% of program costs, with at least 25% coming from private, state or local sources. (http://www.na.fs.fed.us/legacy/index.shtm)

This nationally competitive program is gaining success. The FLP is currently implemented in 48 States and Territories, with 5 more in the planning stages. In 2005, the program has protected over 1 million acres of working forests across 32 States. From its inception in 1990, to February 18th, 2010 the FLP nationally has protected 1,982,821 acres in 42 States and Territories. (http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml)

New Jersey is part of the 20-state FLP region under the Northeastern Area State & Private Forestry, that serves the 20 Midwestern and Northeastern States plus the District of Columbia. Since New Jersey's start in the program in 1995, New Jersey has preserved over 5,498 acres with the Forest Legacy Programs through grants totaling $ 11,336,000. The State has been awarded an additional $7,221,000 for 1,143 acres of open preservation projects. All preserved tracts are monitored and managed by either the State Division of Parks and Forestry or the Division of Fish and Wildlife.

The New Jersey Department of Environmental Protection Assistance Commission of Natural and Historic Resources has the authority over the state-side of the program. The NJ State Forester oversees the program's acquisition of land in cooperation with the

Green Acres Program. Land can be purchased in fee-simple or conservation easement from willing owners and must be managed to protect in perpetuity valuable forest lands from conversation to non-forest uses. Historically lands acquired were added to state parks, forests, and wildlife management areas.

State implementation of FLP is outlined in the state's Assessment of Need (AON). The AON is an implementation plan that defines the threat to a State's forests, identifies important private forest lands, articulates the public benefits provided by these forests, and identifies areas of focus for the program. In the AON, a State delineates specific Forest Legacy Areas (FLAs) in the AON. Conservation projects must be located in an

Global Warming Solution Fund
NJDEP Strategic Land Management Action Plan

The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort by ten Northeast and Mid-Atlantic States to limit greenhouse gas emissions. RGGI is the first mandatory, market-based CO_2 emissions reduction program in the United States.
New Jersey is one of the 10 signatory states to the RGGI agreement; the 9 others are: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. These ten states have capped CO_2 emissions from the power sector, and will require a 10 percent reduction in these emissions by 2018.

RGGI is composed of individual CO_2 Budget Trading Programs in each of the ten participating states, which are implemented through state regulations, based on a RGGI Model Rule, and are linked through CO_2 allowance reciprocity. Taken together, the ten individual state programs function as a single regional compliance market for carbon emissions. http://www.rggi.org/about

On July 6, 2007, the Global Warming Response Act, N.J.S.A. 26:2C-50 et seq. (Act), allowing the State to receive RGGI generated funds was initiated. The Act also required the state to engage in activities with measurability results to ensure that reductions of greenhouse gas emissions, energy use, or other benefits achieved, or expected to be achieved, are actualized. In addition it divided the funding amount key State Departments

to develop, monitor and implement this goal: 60% to Economic Development Authority, 20% to Board of Public Utilities, and 20% to the Department.

Of the 20% allocated to the Department under this task, 10% is to support local government efforts to reduce GHG emissions and 10% is to enhance stewardship and restoration of State forests and tidal marshes (CO_2 sequestration benefits). It is this latter 10% that is administrated by the NJ Forest Service.

Community Forestry

The Urban and Community Forestry (U&CF) Program was authorized by the Cooperative Forestry Assistance Act of 1978 (PL95-313) and revised by the 1990 Farm Bill (PL 101-624) to promote natural resource management in populated areas and improve quality of life. U&CF goals of awareness, outreach and environmental equity, partnerships, and comprehensive natural resource management focus on achieving healthy sustainable forests, sustainable economic development, and information management.

Every Community needs some form of community forestry management. The amount, type and administration of this management will depend on community size, tree budget and goals of community leaders. Under state law that established the New Jersey Community Forestry Program, any of the 566 municipalities and 21 counties can ask for assistance in dealing with their urban forest. Federal funds to address these needs have been important to the overall success of New Jersey's Community Forestry effort. New Jersey is able to boast as having one of the most proactive and innovative state community forestry programs in the country because of the continued federal support. Without this funding, programs that assist residents to recognize the environmental benefits derived from our community tress would be non-existent.

Forest Health Advisory Council (P.L. 2007, c.44)
This council was established to study and track the spread of forest health issues such as sudden oak death (*Phytophthora ramorum*) and bacterial leaf scorch (*Xylella fastidiosa*) and to evaluate our susceptibility and impact on our State's forest resource. The council will make recommendation on preventions, treatments and controls, conduct research, and seek advice and resources from State and Federal sources. Public outreach and education on issues of forest health will also be conducted.

Forest Tree Nursery Rules and Regulations
Revisions to the rules and regulations as expressed in Subchapter 2. Forestation Program 7:3-2.1 is being finalized. Under the existing rules the Nursery is restricted from shipping seedlings out of state. It is recommended that the Nursery be permitted to ship excess inventory out of state rather than plow them under.

Strategies

The National Themes discussed in this section provide long-term strategies for addressing issues discussed in the previous Assessment Section. Priority landscape areas are identified and the Forestry Services' programs that address them are discussed. The National Themes are:

1)   Conserve and Manage Working Forest Lands
2)   Protect Forests from Threats
3)   Enhance Public Benefits from Trees and Forests

While the themes and information discussed overlap they have been characterized individually and put into their own area. This is similar to the Criteria & Indicators having overlap due to their relationship with each other.

Conserve working Forest Lands

Sub-theme 1.1: Identify and conserve high priority forest ecosystems and landscapes

In many parts of the United States, forests and other open space are being fragmented and converted to development. The NJ Forest Service works with partners, stakeholders, and communities to identify and protect priority forest landscapes through land acquisition, conservation easements, and land use policies. We provide technical assistance to communities to help them strategically plan for and conserve forests and other open space.

Factors contributing to loss include residential, commercial and industrial development; expansion of utility infrastructure and transportation networks; and planning, zoning or policies that favor conversion. Consequences include the outright loss of public benefits associated with forests or the marginalization of those values provided by contiguous forested landscapes through fragmentation.

Priority Forest Resource Areas:

During the development of the Statewide Assessment and Resources Strategies, the Northeastern Area (NA) of State Forest Resource Planners and US Forest Service selected priority forest resource areas and issues within that are of multi-state and regional concern. The impetus behind the priority areas was to work with neighboring states on issues that are common and develop future strategies in order to coordinate stewardship activities that address issues pertaining to ecological integrity. The 20 NA states are divided into the regional areas. New Jersey is part of the Mid-Atlantic region along with Delaware, Maryland, Ohio, Pennsylvania, District of Columbia (Washington) and West Virginia.

Highlands Region
PA-NJ-NY-CT

The Mid-Atlantic, tri-state area (DE-NJ-PA) selected the Highlands Region, Atlantic white-cedar, southern pine beetle, and Delaware River Watershed as our priority forest resource areas.

Highlands Region Boundary Description

The Highlands region is a unique series of discontinuous, steep-sided ridges and narrow valleys running for hundreds of miles in a northeast to southwest direction from Western Connecticut, New York, and northern New Jersey to Reading, Pennsylvania. It varies from 10 to 20 miles in width and contains nearly 3 ½ million acres of forests, farms, and communities. Because of its attributes and proximity to major population centers in the eastern U.S., the region has been the subject of a number of congressionally mandated studies by the USDA Forest Service in cooperation with the States.

The Highlands are an essential source of drinking water, clean air, wildlife habitat, and recreational opportunities for about 25 million people who live within an hour of the region.

Major Landforms

This region has many open high hills with steep-sided valleys ranging from 350 to 1,500 feet in elevation. The region is underlain predominantly by granite, gneiss, and small amounts of marble (mostly in NJ). Ridges are northeast-southwest trending belts of folded sedimentary rocks very much like the Ridge and Valley region. The granites and gneisses are resistant to erosion and create a hilly upland which is dissected by deep, steep-sided valleys. The most recent (Wisconsin) glaciation extended across much of the Highlands, leaving a terminal moraine trending east to west across the Highlands in northern New Jersey. The moraine enters the Highlands from the east at Morristown, New Jersey, and then trends north for a short distance to Denville, then west across the Highlands at about the location of Interstate 80 to Belvidere on the Delaware River. North of the moraine, there are significant accumulations of glacial till outwash and numerous lakes and wetlands.

Forest & other ecological attributes
Regionally-defined important vegetation types include northern hardwood-hemlock-white pine, and central hardwoods. Kuchler vegetation types include northern hardwood, Appalachian oaks, sugar maple-birch-beech, hemlock-white pine, and northeastern oak-pine forests.

Drastic disturbance of the original ecosystems and their faunal component resulted from European settlement. Major predators (e.g., timber wolf) were intentionally exterminated. Other large vertebrates were exterminated (e.g., moose), reduced, or restricted (e.g., white-tailed deer, wild turkey) by hunting and habitat loss. Original distributions were re-established or exceeded for some species with the re-establishment of forests on abandoned agricultural lands, in some cases, with higher population densities. The large predators have been partially replaced by mid-size predators (e.g., bobcat, coyote). This ecological shift, combined with hunting access restrictions, has resulted in imbalances between herbivores and plant resources. Extensive areas of regenerating forest and associated early successional habitat are lacking. Hard tree mast (i.e., acorns, beechnuts) drives many faunal processes. Common wildlife species include the white-tailed deer, gray squirrel, white-footed mouse, red-eyed vireo, and red-spotted newt.

Large, unbroken tracts of forest are home to many species, especially large mammals such as black bear, bobcat, and river otter. The Highlands are a rich mosaic of habitats, the result of its many water bodies, rugged terrain, varied soils, and several forest types. Possessing wetlands, bogs, swamps, glades, ravines, ridges, and large tracts of forest interspersed with grassland, pasture and cropland, the Highlands support diverse plant communities and a large number of animal species; it is rich in biological diversity. Over 100 plants and almost 50 animals are listed as threatened, endangered, or of concern on Federal or State inventories find harbor in the Highlands. The Highlands are vital to neotropical birds, particularly songbirds, which fly above the forests of this multi-state region during their migration.

Precipitation, which ranges from 35 to 50 inches, is evenly distributed throughout the year. Snow increases with elevation; amounts vary from 36 to 100 inches of snow increasing with elevation. Mean annual temperature ranges from 45 to 50 degrees F. The growing season lasts for 120 to 180 days.

The natural landscapes of the Highlands provide a high quality of life for the people that live and visit the region. The forests, scenic mountains, waterways, and public lands attract over 20 million visitors for outdoor recreation such as hiking, hunting, fishing, biking, and canoeing. Over 200,000 acres are classified as having exceptional scenic value.

Landownership Characteristics
The majority of the region's timberland is privately owned, most of it in small lots of fifty acres or less. Forest land dominates 70 percent of the area, mostly in small holdings; residential uses increase concern over parcelization and fragmentation. About 15 percent of the area is in agricultural use and about 10 percent is urbanized.

Population attributes
The Highlands' population has been growing, and the trend in development over the past two decades has been at an accelerated pace and a greatly expanded pattern. Farms and forests are being converted into urban land, which has been affecting surface waters.

Communities/Major Population Centers
Over 300 municipalities of the four states are within the Highlands boundaries; population totals are approximately 5.7 million. Major population centers in or near the region include Torrington and Danbury, CT; Morristown, NJ, and Reading, Allentown, and Bethlehem, PA.

The Highlands are crisscrossed with major interstates including I-76 (Pennsylvania Turnpike and its northern extension I-476), I-78, I-80, I-84, I-87, and I-287. Populations continue to grow within the Highlands region.

Water Resources
The major rivers of the four-state area include Hudson, Delaware, Schuylkill, and Susquehanna. Abundant water resources include perennial streams, natural and artificial lakes and ponds, and wetlands. There are over 2,000 miles of trout streams, which are an indicator of high water quality, and over 600 miles of canoeable rivers. Average annual runoff ranges from 18 to 24 inches. Maximum monthly streamflows occur in March and April. Extreme peak flow may occur any time of year and usually are associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October. Most lakes and impoundments are small; however, there are various reservoirs such as Round Valley, Spruce Run, Clinton, and Split Rock in New Jersey, and Green Lane Reservoir in Pennsylvania that supply water to major population centers.

Where impervious surface exceeds ten percent of the drainage area, stream quality is impaired. Where more than half of a drainage basin is altered by development, the quality of surface and ground water suffers.

The undisturbed forests protect water quality in the reservoirs, watersheds, and aquifers, which reduces the need for water treatment facilities in some areas. The more forested watersheds also protect downstream communities from flooding.

The NJ Forest Service will work with landowners currently enrolled in the Farmland Assessment and Forest Stewardship Programs to encourage forest management for healthy forests and water quality and supply. Outreach will be conducted to enroll new participants into these programs.

Multi State Regional Priority Area: The Delaware River

General Area/Boundary Description
The Delaware is the longest undammed river east of the Mississippi, flowing freely for 330 miles from lower New York State, through Pennsylvania, New Jersey, and Delaware to the Atlantic Ocean. The Delaware's 13,539 square mile watershed drains about four percent of the continental United States land area and provides drinking water for 17 million people in four states. The river meets tide-water at Trenton, NJ and constitutes the entire boundary between New Jersey and Pennsylvania, most of the boundary between Delaware and New Jersey, and part of the boundary between Pennsylvania and New York.

The headwaters of the West Branch originate in Schoharie County, NY at 1886 feet above the sea-level and flow until they emerge from the Catskills. The East Branch begins in Roxbury, NY and flows southward towards New York City to create the Pepacton Reservoir, the largest reservoir in the NYC water supply system. The confluence of both branches is just south of Hancock, NY. Below Trenton, the river flows between Philadelphia and New Jersey before becoming a broad inlet of the sea, widening steadily into the Delaware Bay Estuary.

The Delaware Bay Estuary is the tidal portion, or the lower half, of the Delaware River Basin. The area surrounding the estuary stretches as far west as the Schuylkill River's headwaters near Pottsville, PA, and to the east near Fort Dix, NJ. The vastness of this watershed makes the Delaware Bay Estuary one of the largest estuaries in the country, approximately 6,800 square miles in size. Within these boundaries are over 200 species of fish, the continent's second-highest concentration of shorebirds, and over 400,000 acres of wetlands.

Major Landforms
The Upper Delaware River lies between the Appalachian Plateau Physiographic Province and Catskill Physiographic Province. Elevations vary from 800 to 2,000 feet, and as a result, many unique land forms exist. The Delaware River Gorge, identified as an outstanding scenic geologic feature, begins above Matamoras, PA and runs north along parts of the river. Below Port Jervis, NY, the Wallpack Ridge deflects the Delaware River into the buried, glacial till of the Minisink Valley, where it follows the southwest strike of the eroded Marcellus beds along the Pennsylvania–New Jersey state line to the Delaware Water Gap National Recreation Area. It then skirts the Kittatinny Ridge, which it crosses at the Delaware Water Gap between nearly vertical walls of limestone and passes through farms and forest until it crosses the Appalachian Plain and enters the hills again at Easton, PA. Here it is flanked by some of the finest cliffs known as the Nockamixon Rocks which are 3 miles long and more than 200 feet high.

Forest and Ecological Attributes

The Upper Delaware Valley Northern Hardwood forests support a thriving lumber industry, producing thousands of cubic feet of veneer logs, sawlogs, millwood, and pulpwood each year. Farther south these forests give way to rich Mixed Mesophytic forests. Dryer and rockier uplands and ridges support Oak-Chestnut type forests dominated by oaks, hickories and, in the past, by the American Chestnut. The Southern and Central Appalachians forests consist largely of Black, Northern, Red, White, Scarlet and Chestnut Oaks. The richest forests have dominantly White and Northern Red Oaks, while the driest sites are dominated by Chestnut Oak, or sometimes by Scarlet or Northern Red Oaks.

The Upper Delaware River Corridor contains diverse habitats that support abundant wildlife populations including the bald eagle. During the winter, bald eagles from the northern portions of the United States and Canada move southward to the Upper Delaware with its open water and reliable food supplies. Almost 70% of the Pennsylvania's otter population resides in the basin and wildlife biologists believe that Pike County, PA, has one of the highest black bear populations in the state. In addition, the river is part of the Atlantic Flyway, hosting approximately 200 species of birds in the wooded riverside habitats.

Geologic processes left many economically valuable deposits, including bluestone, sand and gravel, shale, and peat. The parent materials of most of the soils within the river corridor have been accumulated largely through glacial action and deposited as till or outwash from receding glaciers. The Marcellus Shale formation underlies about 36 percent of the Delaware River Basin. Much of the new natural gas drilling interest taking place in northeastern Pennsylvania and southern New York is targeted at reaching this natural gas.

Landownership Characteristics

Demographics vary considerably and population is unevenly distributed across the basin. The 2000 Census estimates the population at 7.76 million. This figure is expected to increase to 9 million by 2030. Density continues to increase with an average of 603 people per square mile, although it varies dramatically by location in the basin. The vast majority of people live in the Lower Region (78%), where older communities, most notably, Philadelphia, continue to experience population loss. While more sparsely developed areas continue to grow and urbanize. The Central Region of the basin known as the Pocono Region continues to grow. The Pennsylvania counties of Pike and Monroe and New Jersey's Sussex County experienced the greatest growth in recent years. Headwater areas have remained sparsely developed due to distance from other population centers, poor accessibility and steep terrain, although seasonal home development has increased considerably.

Population Attributes - Major Interstate Highway Routes
There are a number of major interstate highways within the Delaware River Basin. The western terminus of Interstate 84 connects to Interstate 81 in Scranton; Interstate 80 can be accessed near the Delaware Water Gap. Farther south, Interstates 276 is accessible in Philadelphia, Interstate 95 near Trenton and Interstate 295 near Camden, NJ.

In the northern part of the basin it is important to note New York State Route 97. NY State Route 97 is a 70 miles north /south scenic route in southern New York. It runs from U.S. Route 6 and US 209 in Port Jervis to NY 17 in Hancock. Its most famous feature is the Hawk's Nest, a tightly winding section of the road along the Delaware River, located a few miles north of Port Jervis.

Major Population Centers Description
Although the Upper Delaware River has few population centers along its banks, it is located within 150 miles of over 35,000,000 people. The Catskill Mountain region of the Upper Delaware River Basin is approximately 100 miles from the New York City. Roughly 1 in every 16 Americans lives in the New York Metropolitan Statistical Area, the most populous of all metropolitan statistical areas in the United States. In 2007 this area had an estimated population of 18.8 million. The southern boundary of the basin borders the Philadelphia–Camden–Wilmington Metropolitan Statistical Area which is the fifth-largest metropolitan area in the United States.

Smaller cities in the basin include Deposit and Hancock, NY, Narrowsburg, Milford and Philipsburg, PA. Medium sized cities within the basin include Port Jervis, and Allentown, Reading, Pottstown and Bethlehem, PA.

Water Resources
The Delaware River basin lies in two significantly different hydrological regions, the Appalachian Highlands and the Atlantic Coastal Plain which meet at a fall line near Trenton, NJ. Each hydrological region greatly influences flow and water quality to New York City and the Philadelphia Metropolitan area. The Catskill watershed provides high quality water, supplying New York City with more than half of its water. The headwaters of the Delaware River flow to Pennsylvania, New York, New Jersey, and Delaware, supplying water to much of the Philadelphia metropolitan area and portions of New Jersey. While impressive improvements in water quality have been made throughout the basin, current metrics indicate water quality is fair. Nutrient concentrations are high compared to other river systems, but harmful effects are not yet evident.

Major Forest Conservation Challenges
Because a significant relationship exists between landscape condition and the health of waterway systems, land use change and forest fragmentation issues are critical to the overall health of the Delaware River Basin and its water resources. Forests within the Delaware River Basin are decreasing by at a rate of 48 square miles per a five year period and developed land is increasing by a rate of 71 square miles in the same five year period, both at the expense of forest and agricultural land. Urbanized land nearly quintupled from 3% to 14% between 1930 and 1996.

Future challenges include:
- accommodating growth while protecting and enhancing water resources,
- sustaining water flow levels for aquatic habitat and human safety,
- addressing impacts of climate change on water quality and chemistry,
- addressing the impacts of Gypsy Moth, Hemlock Woolly Adelgid and Beech Bark Disease on forest resources;
- addressing the impact of economic and ecological damage caused by 275 species of invasive plants within the region that have been identified by The Mid-Atlantic Exotic Pest Plant Council;
- expanding conservation education programs across the region - the ultimate outcome is greater integration of the benefits of forest cover, forestry, and natural resource conservation into public education and public policy decisions. The need for public understanding of the importance of forests, and the trade-offs involved when forest cover is degraded or removed is critical.

Major Forest Conservation challenges
- Protection of the drinking water resources for over 15 million area residents.
- Conservation of the natural landscape important as wildlife habitat.
- Protection of critical long-term ecological health of the region.
- Retention of green space for outdoor recreation, as an important living filter/buffer between growing urban areas.
- Protection of the region's attributes to ensure its economic viability and livability.
- Suburban sprawl which threatens the drinking water supply, forests, farms, wildlife habitat, historic, recreational, and scenic resources.
- Fragmentation of landscape-scale habitat areas and wildlife corridors necessary for wide-ranging animals like bears and bobcats.
- Loss of rock outcrops and ridges that fulfill special habitat requirements for species like the Eastern timber rattlesnake.
- Competition with invasive and exotic species.
- Stream degradation and water quality impacts from flooding, increased impervious surface and pollutants from cars, homes and businesses.
- Preservation verses management attitudes among landowners.
- Possible conflicts between Stewardship and tax incentives.

Common Waters
The Common Waters Program of the Pinchot Institute is a regional partnership of public and non-profit organizations and agencies focused on supporting the development of sustainable communities and working landscapes in the Delaware River watershed above the Water Gap through cooperation, scientific research, education, and technical assistance.

Under Common Waters, funding will be provided to landowners in the upper Delaware River Basin interested in performing forest stewardship activities that promote healthy forests, riparian buffer stability, stormwater management and other activities that provide for clean drinking water.

The Common Waters program will coordinate forest stewardship activities landowners currently enrolled in the Farmland Assessment and Forest Stewardship Programs. Outreach will be conducted to enroll new participants into these programs.

The Pinelands National Reserve
The Pinelands National Reserve (PNR) was created by Congress under the National Parks and Recreation Act of 1978. The PNR encompasses over a million acres covering portions of seven counties and all or parts of 56 municipalities. It was the first of three National Reserves in the nation.

In 1979, our state formed a partnership with the federal government to preserve, protect and enhance the natural and cultural resources of this internationally important ecological region. In 1983 the area was designated a U.S. Biosphere Reserve by UNESCO an agency of the United Nations and in 1988 it was recognized as a International Biosphere Reserve.

In the center of America's most populous region lies over a million acres of forests, farms, and scenic towns -- the New Jersey Pinelands. The Pinelands National Reserve consists of approximately 1.1 million acres in southern New Jersey. It represents 22% of the state's total land area and includes portions of seven counties (Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Ocean). It is the largest body of open space on the Mid-Atlantic seaboard between Richmond and Boston and is underlain by aquifers containing 17 trillion gallons of some of the purest water in the land.

The Pinelands is a patchwork of pine oak forests, tea-colored streams and rivers, spacious farms, crossroad hamlets, and small towns stretched across southern New Jersey. In the country's early years it had been a place where fortunes were made from lumber, iron and glass. But the early industries died out, and as the state's major roads bypassed the area, the "Pine Barrens" gradually became known as a remote part of New Jersey abounding in local legends like the "Jersey Devil".

As the full weight of postwar urban sprawl came to bear on other parts of New Jersey, the fate of the Pinelands was uncertain. Would the Pinelands become the locale of grandiose development projects, such as a jetport and a city of a quarter million, or would the region's value come to be based on its open spaces, natural features, and traditional lifestyles, which uncontrolled development would damage or obliterate?
It took years of study and debate before the choice was made. Gradually the realization set in that the Pinelands was an environmental asset of national and international importance, deserving safeguards to divert the flow of growth from metropolitan Philadelphia, northern New Jersey, and New York. Nearby Atlantic City's casino gambling boom crystallized awareness of the need for Pinelands development controls. Today, under the authority of the New Jersey Pinelands Commission and with the (Pinelands Comprehensive Management Plan), the region is protected in a manner that maintains its unique ecology while permitting compatible development.

When human beings first occupied the Pinelands over 10,000 years ago, it was a cold and far less hospitable, tundra-like place. Quickly adapting to the harsh conditions, however, the first Americans hunted species now long extinct and settled near small ponds where traces of their culture can still be found. Gradually, though, the climate warmed, sea levels rose and, by about 5000 B.C., the region assumed the same general appearance it has today. Through the ensuing millennia, the Natives reaped the natural harvest of the Pines, using an evolving tool kit of stone and bone implements by which archaeologists can track their progress.

Europeans first began to come to the Pinelands in numbers in the seventeenth century, particularly after the English seized New Jersey from the Dutch in 1664. Whaling and shipbuilding were two of the major early enterprises, but these were pursued mainly on the coastal periphery of the Pines. It was only in 1765, when the first furnaces were built to exploit the region's bog iron deposits, that settlement in the interior of the Pinelands developed on any real scale. Soon after, glass production began, taking advantage of the high quality sands of the region, and other rural industries were founded. As these faded in the mid-nineteenth century, railroads began to be built, forever changing the pattern of settlements in the area. At this time also, the berry industry of the Pinelands had its beginnings, as did the development of resorts at the shore, both aided by the ready access provided by the railroads. Today, the locomotives have mostly disappeared, replaced by the ubiquitous automobile. The cultural face of the Pinelands continues to change, as it always has.

Today, over 700,000 people live in Pinelands communities. Population densities range from less than 10 persons per square mile in the interior sections to over 4,000 persons per square mile in more developed communities at the edge of the region.

Agriculture, including blueberries and cranberries, as well as row and field crops, is extremely important to the region's economy. New Jersey is among the top states in the nation in the production of blueberries and cranberries, and virtually all of these are grown in the Pinelands. Other major industries are recreation, resource related industries, construction (on the periphery), and shell fishing.

The Pinelands region is 1/3 publicly and 2/3 privately owned. Public lands of the State of New Jersey comprise over 300,000 acres and include parks, forests, and wildlife management areas such as Wharton, Bass River, Brendan T. Byrne, Belleplain, Island Beach, Colliers Mills, and Greenwood among others. The historic villages of Batsto and Double Trouble are visitor attractions administered by the Division of Parks and Forests of the New Jersey Department of Environmental Protection. Numerous county and municipal parks, as well as conservation lands owned by nonprofit organizations, exist within the Pinelands. Federal properties include three military installations, the Forsythe National Wildlife Refuge and the Cape May National Wildlife Refuge.

The Pinelands is located in the Atlantic Outer Coastal Plain, a geological formation characterized by gently rolling terrain and sandy soils. Underlying much of the Pinelands is the Cohansey Aquifer. This formation of unconsolidated sand and gravel functions as a vast reservoir estimated to contain over 17 trillion gallons of some of the purest water in the country. The water in this shallow aquifer frequently lies at or near the surface, producing bogs, marshes, and swamps. The streams of the Pinelands are fed by this aquifer, and are characteristically acidic and nutrient poor. Natural organic contents leaching out of the soils are responsible for the dark tea color of the region's streams. Low, dense forests of pine and oak, ribbons of cedar and hardwood swamps bordering drainage courses, pitch pine lowlands, and bogs and marshes combine to produce an expansive vegetative mosaic unsurpassed in the Northeast. The Pinelands also contains over 12,000 acres of "pygmy forest," a unique stand of dwarf, but mature, pine and oak less than 11 feet tall. Here can be found 850 species of plants, including rare plants such as the curly grass fern, and broom crowberry. The region contains unusual range overlaps where species of 109 southern plants and 14 northern plants reach their respective geographic limits. Development of the unique flora of the Pinelands is also closely related to the occurrence of fire.

The animals of the Pinelands have been affected greatly by the region's ecosystem. The existing animal communities are shaped by many environmental factors including vegetation, fire, moisture, and water chemistry. Many of theses unique species are dependent upon the special conditions present in the New Jersey Pinelands. Maintaining this fragile environment is essential for the preservation of the characteristic Pinelands, fish, bird, reptile, amphibian, mammal, and invertebrate species. Thirty-nine species of mammals, 299 bird, 59 reptile and amphibian species and 91 fish species have been identified as occurring within the Pinelands. They include 43 animal species listed as threatened or endangered by the New Jersey Division of Fish and Wildlife.

Miles of rivers course through the scenic Pinelands. Most feed the productive bays of southern New Jersey. The major watercourses are the Mullica, Great Egg Harbor, Maurice, and Toms Rivers. The Great Egg and Maurice are designated wild and scenic rivers, and the Mullica traverses the Preservation Area of the Pines. Lakes are man-made rather than natural phenomena and have generally been created by damming of streams and other wetlands in the distant past. The best known lakes are Lake Lenape, Harrisville Lake, and Lake Oswego.

The NJ Forest Service along with the NJDEP Natural & Historic Resource Group and stakeholders will continue to coordinate efforts to develop forest resource management plans that will maintain and enhance the ecological integrity of the Pinelands Region. Proper natural resource management will insure that the unique characteristics of this area will remain for generations to come.

Atlantic white-cedar:
Multi-State Regional Area: NJ-DE-MA
An Atlantic White-cedar: Ecology and Best Management Practices Manual was developed, as well as, an Atlantic White-cedar Resource Recovery Management Plan for Bass River State Forest. To date, the New Jersey Forest Service has engaged in 25 A WC restoration sites totaling 268.6 acres. A WC restoration efforts have occurred within many public lands across the State. Under the 2008 changes to the Freshwater Wetlands and Flood Hazard Area Control Act Rules, A WC restoration has been granted a permit-by- rule designation allowing restoration projects to occur without formal wetlands permits as long as BMPs are followed.

Atlantic white-cedar resource planning involves outlining the overall direction and management approach to reversing the decline of the cedar resource. The ecology of Atlantic white-cedar can be complex but assessing the efforts of previous management can certainly contribute to understanding of what is needed to reverse the decline of cedar in New Jersey. Through the efforts of cedar stand evaluation and inventory and GIS mapping a more accurate assessment of the cedar resource with respect to state parks and forests is now possible. Resource managers conclude that past and present levels of management have been inadequate, although valuable, to sustain sufficient acreage and purity of Atlantic white-cedar. A more active role in cedar management throughout the State is needed. Therefore, the primary goal for the management of Atlantic white-cedar can be stated as:

Goal: Expansion of the active cedar management program that addresses the decline, fragmentation, and restoration of the Atlantic white-cedar resource within the State. The following objectives have been developed to address these areas of concerns.

Objective 1. Increase current acreage of Atlantic white-cedar

Objective 2. Achieve a more equitable distribution of stands with respect to stand age and stand size

Objective 3. Address the fragmentation of cedar to restore continuity.

Objective 4. .Incorporate measures to minimize the effects of deer browse on cedar regeneration.

Objective 5. Encourage the continued support of research projects and educational studies by further developing cooperative partnerships and alliances with natural resource agencies and parties seeking to expand the knowledge base of Atlantic white-cedar and its associated wetlands ecology.

Objective 6. Sustain ecological significant cedar ecosystems and related cedar wetland associations.

Objective 7. Address the adverse influences of beaver presence, such as flooding, tree damage, and mortality.

Objective 8. Institute and revise existing monitoring measures to evaluate progress in the development of the target cedar stand as it relates to the surrounding landscape.

Now that the major goal and objectives have been identified to address specific management concerns it is important to next develop and define the following.

- The target stands
- Management level alternatives
- Management rotation options
- Older growth stands (Extended Rotations)

The Target Cedar Stands within the Forest:

A balanced or proportional distribution of age and size classes:
A balanced representation of size classes from saplings to mature cedar with variation from the present level of middle age classes is necessary to perpetuate the species sustainably through time.

Fragmentation of existing stands:
Atlantic white-cedar is a sub-climax species and over time will succeed into lowland deciduous hardwoods or become fragmented through natural disturbances. Many times this results in the formation of smaller pockets of pure cedar stands. Fragmentation of existing stands should be avoided by encouraging the development of larger pure cedar stands. Continuity can be restored and the trend reversed by combining adjacent smaller cedar stands together through restoration or conversion while maintaining native forest types. Additional measures to consider are providing adequate fire protection, minimizing partial stand disturbances, providing adequate protection to regenerating cedar stands, and preventing prolonged hydrological changes associated with beaver presence and culvert maintenance. This could include a larger homogeneous stand of the same age or a continuous cedar area with stands of different ages. This will help to contribute to the sustainability of the cedar resource.

Biodiversity:
Cedar management should in no way diminish the contribution that cedar stands make to biodiversity of the total forest resource. There should always be full representation to the total spectrum of cedar stand types and cedar associations. This includes representation of all age and size classes, stand sizes, and diversity in composition and structural parameters. Also, stands or cedar areas supporting unique ecological characteristics, critical ecological areas, representative old growth, or areas vital for threatened or endangered species will be identified for priority area concerns.

Increase acreage of Atlantic white-cedar:
The more pure cedar stands there are the more assurance of a sustainable cedar resource. Through conversion (where appropriate), expansion, and restoration projects, an increased amount of acreage in the pure cedar stand type can be accomplished. Acreage of larger stand sizes should also be increased when appropriate.

Floral and Fauna Species:
The target cedar forest on a landscape scale will consider the needs of wildlife and allow for the natural perpetuation of plant species when implementing management activities. Applications of cedar management practices and intended outcome should not result in adverse irreversible impacts of threatened and endangered species or their habitats.

Increase the number of stands of larger cedar acreage:
Depending on the parcel and existing and historical cedar resource larger stands may need to be created either through peripheral expansion or merging adjacent stands where possible. This will contribute to landscape diversity, make favorable habitat for those species requiring niches associated with larger stands, and help build a larger cedar resource base. In the example of Bass River State Forest stand size averaged only 10.4 acres and only a few stands of pure cedar exceed 30 acres in size. The above approach was prescribed to increase the amount of cedar acreage on the multiple drainage areas for a landscape approach.

Establish stands within all of the rotation options:
Stands should be established within all rotation options. This would serve to increase stand age diversity within cedar and to create habitat niches and conditions that are presently lacking or rarely exist. Sites should be carefully evaluated to determine ability to support cedar for longer rotational periods.

For example, in Bass River State Forest, very little acreage exhibits older growth characteristics so every opportunity has been made to maintain stands in this category. However, at some point these stands will eventually need to be regenerated unless stands are selected to grow in perpetuity (extended rotation). Eventually, physical characteristics of the stand essentially determine when the stand is ready for replacement. The following criteria should be applied when deciding to regenerate the stand.

- Is the stand declining in health?
- Has the stand lost pure cedar integrity and breaking up?
- Has hardwood encroachment become increasingly evident, or is the stand represented by less than 60 percent cedar?

Developing the Future Forest:
To develop the target or future forest will take time, planning, cooperation, and an understanding of what needs to be accomplished. To achieve the target cedar forest as envisioned, it will be necessary to implement certain silvicultural prescriptions. The creation of new cedar stands can only be accomplished through manipulation of the present vegetation and modifying site conditions favorable to cedar growth. This may

include such measures as harvesting, deer exclosure fencing, site preparation, vegetation and brush control, supplemental planting, and/or herbicide application.

It has been determined from past restoration experience costs vary depending on the prescriptions necessary to manage AWC. The following table provides a breakdown of the costs that may be incurred through AWC restoration.

Costs associated with AWC restoration		
Site Treatment	**Cost ($ / acre)**	**Cost ($ / acre)**
Mowing w/ GyroTrac®	$375.00	$375.00
Spraying (competition control)		
Aerial	$186.00	$186.00
Ground (in-house)	$66.00	$66.00
Fencing		
PVC coated mesh	$1,091.00	
Electric		$464.00
Seedlings (1,000/acre)	$1,000.00	$1,000.00
Planting (1,000/acre)	$250.00	$250.00
Total	$2,968.00	$2,341.00

*It is important to note that many cedar sites selected for management will not have the same prescriptive needs. Therefore, not all treatments will be necessary.
Stakeholder efforts to restore AWC statewide are included as part of the Atlantic white-cedar Initiative. Recovery plans are being developed for other state parks and forests within the Pinelands Region.

Due to the ecological significance of Atlantic white-cedar it is important to maintain this species in the forested environment. Proper management and restoration practices have and will continue to be prepared and implemented.

Regional Greenhouse Gas Initiative (RGGI)
The NJ Forest Service's, State and Private Lands Management have developed a five-year Strategic Land-Management Action Plan for over 750,000 acres of DEP NHRG State landholdings, across managing agencies: Division of Parks and Forestry, Division of Fish and Wildlife, and Natural Lands Trust. The Forest Service worked in conjunction with two broad inter- and intra-agency working groups to address the complexity of this task. The strategic action plan is directed to enhance vegetative carbon sequestration and avoided greenhouse gas (GHG) emissions from forests and the tidal marsh resources. The plan will be assessed over time and refined to be responsive to statutory goals.

During the assessment, 4 integrated priorities were developed:
- Forest Protection and Health - protection against damage causing agents
- State Forest Nursery and Tree Improvement - documented local seed source and supply
- State Forest and Tidal Marsh Restoration - reclaiming and restoring to ideal conditions
- Forest Stewardship Planning and Resource Certification- stewardship plan development and third party certification

The strategic plan addresses planning, restoration, monitoring, data collection and analysis, and reporting methods. The implementation of the 4 integrated priorities are to be done through contracts and partnerships with green industry for planting stock and supplies, execution and development of stewardship plans, research, and data collection and analysis. The Department will continue to engage our partners in traditional and innovative ways to implement these initiatives, assessing them, and in developing future initiatives.

Forest Legacy Program (FLP)
The Department works hand-and-hand with the New Jersey Forest Stewardship Coordinating Committee (FSCC) in submitting potential FLP projects for consideration, review and approval. The FSCC is composed of federal, state and private sector resource management professionals and representatives of land from various conservation organizations and private landowners. The FSCC in conjunction with recommendations from the State Forester and the Green Acres Program review and approve all FLP projects for funding submission.

The Department solicits all state land-management agencies; county and local governmental and nonprofit preservation agencies asking for project suggestions. Only tracts within our designated Forest Legacy Area, the Highlands, can be considered.

Strategies:
In recent years several social and economic trends have significantly affected the balance of natural resources utilization and land protection in NJ. Increasing residential and commercial pressures have caused the development of substantial areas of previously open or forested lands, raised questions of water supply protection and altering the visual landscape to which communities are accustomed.

New Jersey has concluded that the Forest Legacy Program (FLP) will be implemented according to the current Assessment of Need (AON) approved in 1995, which is hereby incorporated into this document by reference. A copy of the State Lead Agency designation letter, the AON, and the AON approval letter can be found at New Jersey State Forester, PO Box 420, 501 East State Street, Trenton, NJ 08625.

In 1995 the Forest Legacy Committee, a subcommittee of the FSCC, considered all of NJ's forested areas for eligibility and decided that a single area met all of the eligibility criteria. In making its determination, the committee considered value in terms of

regionally distinctive geological or ecologic occurrence (for example, habitat corridors or important watersheds). Ideally, a nominated Forest Legacy Area would embody multiple and regional public values, be acquirable and enjoy public support for that purpose, be threatened with conversation to non-forest use, abut existing public open space blocks and corridors, and contribute to bio-diversity and ecological protection.

The NJ Forest Legacy Committee in applying the eligibility criteria to the state's forests determined that the Forest Legacy Area will be the Highlands Region. Since this State recognition of the ecological importance of this area, the Federal governor conducted its own study, NY-NJ Highlands Regional Study. This study confirmed the region's ecological importance to NJ and confirmed its significance to the United States. The regional study was updated in 2002, New York – New Jersey Highlands Regional Study: 2002 Update (http://www.na.fs.fed.us/highlands/maps_pubs/regional_study/highlands.html). The reports note the ecological significance and the high land-conversation threat of this region, which lead to the legislative act to protect this region in New Jersey and four other states; Highlands Conservation Act, HR 1964, October 10, 2004.

The committee did consider all of the state's forest areas in its determination. In so doing, it acknowledged that the Pinelands Forest in South Jersey was then sufficiently protected by its National Preserve designation and the state's Pinelands Commission; that land conservation efforts were very strong and received considerable attention by conservationists and that although North Jersey forest may be receiving equal attention their accompanying resources most effectively meet the eligibility criteria for a Forest Legacy Area, and are under greater threat of conversation to non-forest use because of their proximity to a greater population.

In consideration of the established FLP eligibility criteria and the current Statewide Forest Assessment, it is clear that more that more than one area of the State holds these high ecological concerns that would be best preserved through the FLP. Based on the analytical assessment of our current forests, particularly the Spatial Analysis Project, and recent changes in development pressures and state regulations, the Department will be compiling a proposal to expand its Forest Legacy Areas starting federal fiscal year 2013. Thus, allowing for the necessary time to receive comments and coordinate with the necessary state agencies, FSCC, and the public, and to received and process applications.

During the development of a proposal to increase the Forest Legacy Areas, the Department will also address fostering a stronger FLP conservation easement component of the program, review the FLP eligibility criteria and solidify a bi-agency easement monitoring protocol. One of the main benefits of FLP conservation easements is that it fosters private working woodlands while meeting the FLP and State goal of protecting in perpetuity valuable forest lands from conservation to non-forest uses. All FLP conservation easement lands require an approved Forest Stewardship Plan that addresses traditional forest uses and public values. This will insure privately-owned working forests protect environmental values and encourage contributions towards rural economies.

We also will be revising our current protocol to more accurately reflect our current implementation and staffing changes and to determine if the current Eligibility Criteria needs updating. For instance, The New Jersey FSCC no longer supports an independent Forest Legacy Committee. This work is being done by the entire committee. The current Assessment of Need does not address easement monitoring or easement record keeping; in addition, it will need to reflect any changes in the Forest Legacy Areas, or to the AON approved by the FSCC.

The FLP focuses on "working forests"—those that provide an array of environmental services and products. This includes clean air, clean water, carbon sequestration, and a variety of fish and wildlife habitats and recreational opportunities, as well as timber and other forest products. The FLP works to maintain healthy, productive forest lands that are sustainable over the long-term. The program requires forest planning in order to define management objectives through professional natural resource management. This is accomplished by the inclusion of FLP funded tracts under state management or FLP funded conservation easement under an approved Forest Stewardship Plan. Due to the nature of natural resource management, many uses will be compatible; however, this program does not require every use from every acre.

For New Jersey, most of our FLP funded tracts have enhanced, connected and/or expanded on existing State land holdings. This has directly increased the ecological protection investment of the State, as well as directly increased recreational opportunities for the public. Although optional under the program, all of New Jersey's FLP funded tracts have full public access.
(http://www.fs.fed.us/spf/coop/library/flp_strategicdir.pdf)

Forest Tree Nursery Strategic Planning Components
The NJ Forest Tree Nursery Strategic Planning is part of a course of action in order to collect, grow and store tree species of special concern with the State. With damage casing agents, both native and non-native impacting our forest resources it is important to have the capability of artificial regeneration of tree species under threat.
The following two tree species have been selected by the State Tree Nursery as species of concern due to potential and previous impacts.

Ash seed banking: threat from emerald ash borer (EAB):

The New Jersey State Forest Nursery in cooperation with the USDA National Tree Seed Laboratory located in Dry Branch, GA is collecting samples of native species of ash seed. Seed trees from native NJ sources will be collected and 1.) Banked by the New Jersey State Forest Nursery. This seed will be processed by collection area (GPS) and dried and stored on-site in Jackson. 2.) Seed will be sent to the USDA Forest Service for germplasm preservation. Protocols can be found at the National Seed Laboratory - http://www.nsl.fs.fed.us/GeneticConservation_Ash.html.

The purpose of this effort is to bank native genetic populations of New Jersey ash species by preserving seed prior to the migration of EAB from surrounding states into New

Jersey. More information on ash seed banking and germplasm storage can be found at http://www.nsl.fs.fed.us.

American Chestnut Foundation Partnership:
The State Tree Nursery established an American chestnut seed orchard and production of whip saplings. The Nursery continues to work in conjunction with the American Chestnut Foundation and Penn State University.

Sub-theme 1.2: Actively and sustainable manageable forests

The NJ Forest Service provides landowner assistance and incentives to help keep working forests working. Providing forestry assistance to landowners improves the economics of, and encourages sustainable forest management. In urban and suburban areas, the NJ Forest Service assists communities to develop sustainable forest management and green infrastructure programs.

Farmland Assessment Program (FLA)
The FLA Program encourages derivation of income through active and sustainable land management. Forest management of New Jersey's private woodlands under FLA will not only help curtail excessive and unnecessary cutting of one of the state's valuable natural resources, but will also enhance the benefits of properly managed woodlands, such as improved air, water quality, wildlife habitat and improved health and growing conditions of the forest resource while contributing to timber markets.

There are currently 4,479 woodland owners currently enrolled in Farmland Assessment covering 227, 438 acres. These properties are located throughout the state in all 21 counties but Hudson County.
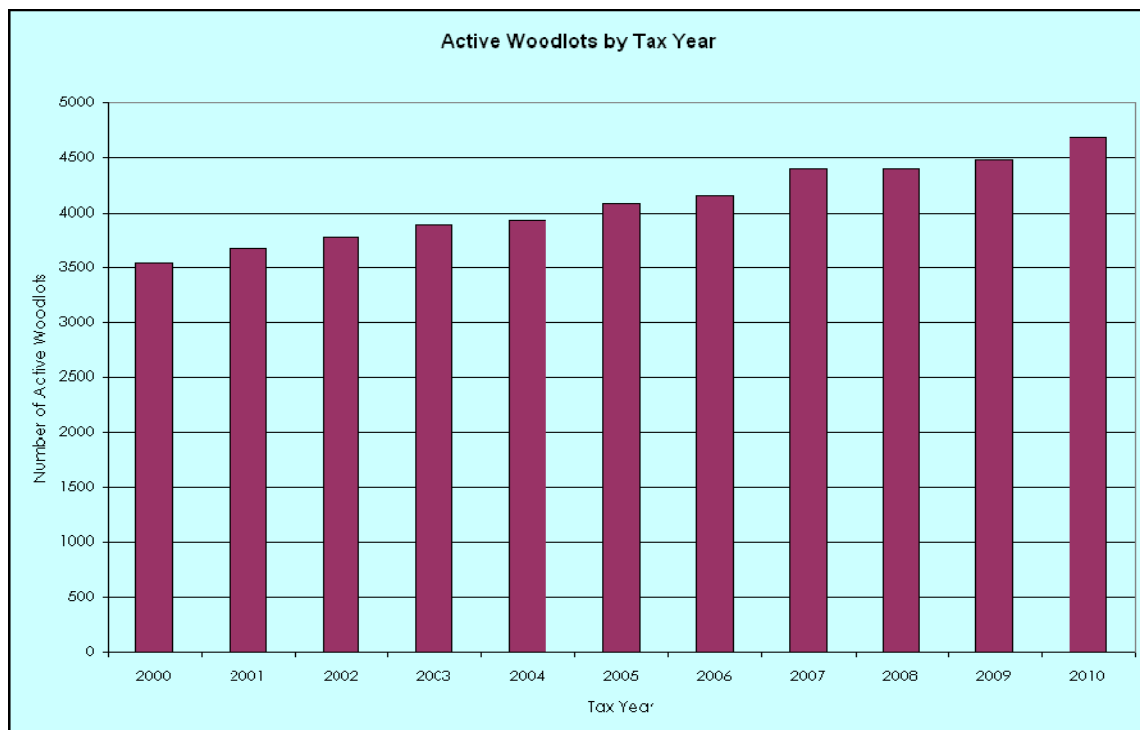
The Forest Service is responsible for reviewing the woodland management plans of private forest landowners and conducts periodic inspections to verify whether or not the woodland management plan accurately portrays the owners' woodland management objectives.

Active Woodlot Area by County
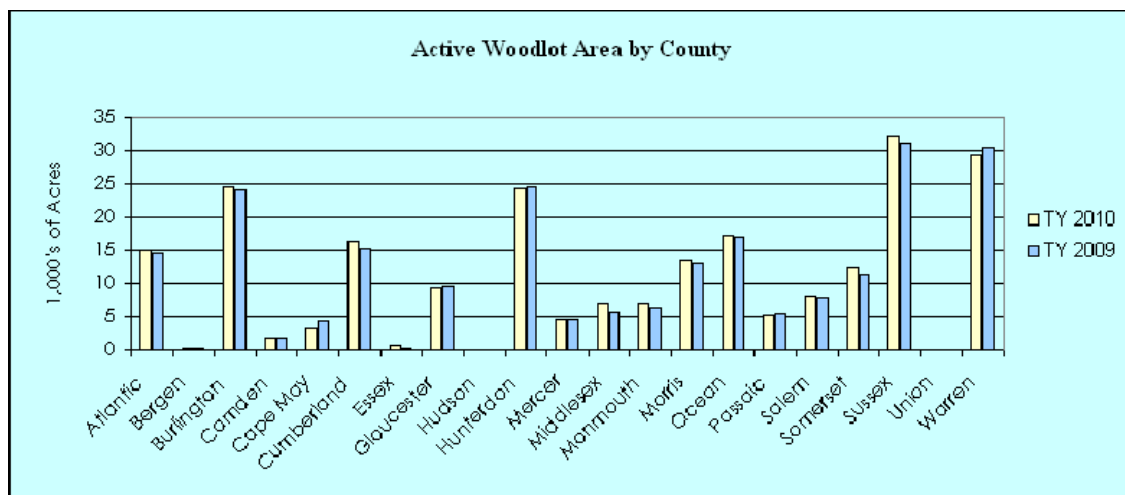
Woodland owners are required to complete and submit an application (Form FA-1), the woodland data form (Form WD-1) and a woodland management plan to qualify for farmland assessment.

Number of Active Woodlots by County
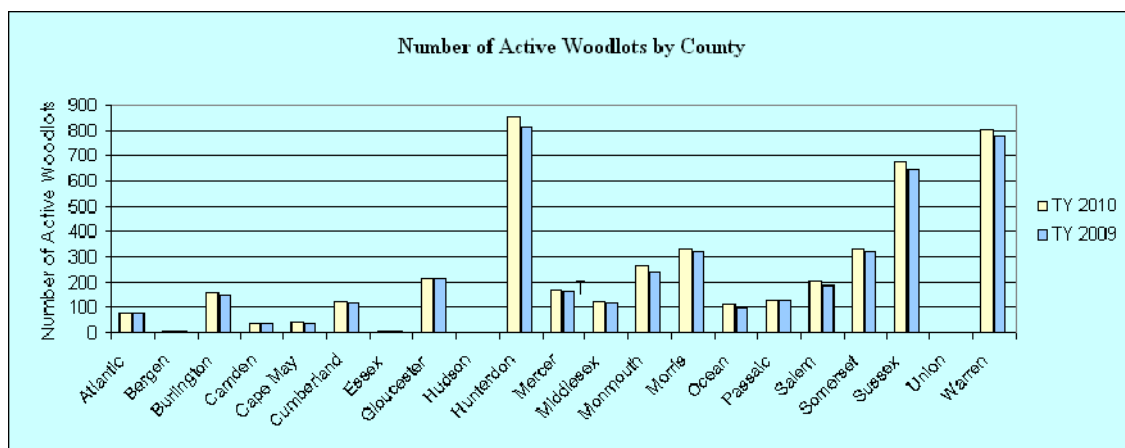
Forms must be submitted to the local tax assessor and to the New Jersey Forest Service annually by August 1st. The local tax assessor retains the final authority to determine who qualifies for farmland assessment.

The New Jersey Forest Service assists the woodland owners by reviewing the application for required information and by reporting to local tax assessors the findings or inspections of that review, thereby meeting the requirements of amended legislation. In addition, the Forest Service inspects the accomplishments reported on the WD-1 form and reports the inspection results to the local tax assessor, whether a property is in compliance or non-compliance with the Act.

Forest Stewardship Program (FSP)

The purpose of the FSP is to assist landowners in actively managing their forest resources, to keep these lands in a productive and healthy condition for present and future generations, and to increase the economic benefits and environmental services that these lands provide. The goal of this program is to provide landowners with a Forest Stewardship Management Plan that outlines management activities based on a landowner's objectives. Plans can be diverse and contain many objectives or there can be one main objective, but plans must be action orientated. Assistance is available, for whatever the landowners' interests are in their woodlots.

Non-industrial private woodland owners who own 5 acres or more are eligible to participate. The land must have existing tree cover or other woody vegetation, or land suitable for growing such vegetation. Ownership must be a legal private entity such as an individual, family, group, association, or corporation.
A landowner can enroll in the Forest Stewardship Program by having a Forest Stewardship Plan developed. Through participating agencies and with cost sharing, landowners can obtain technical and financial
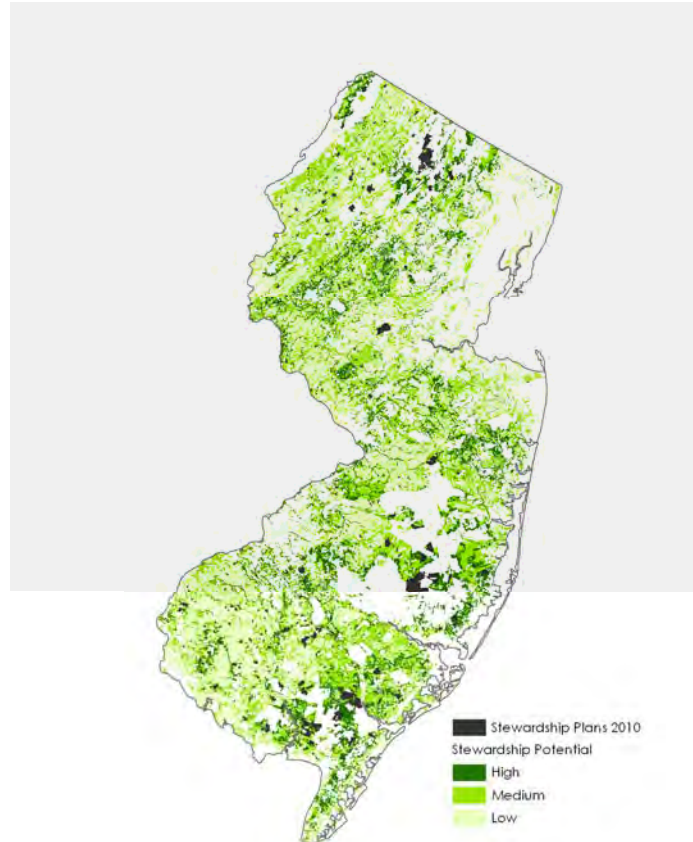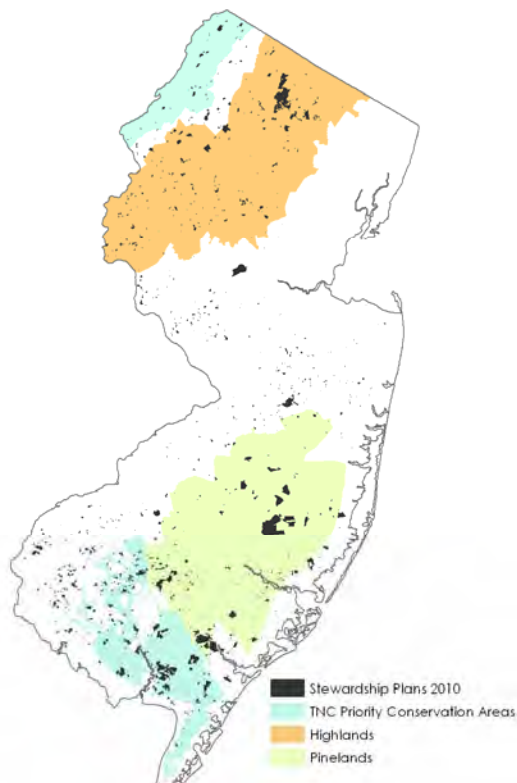
assistance to develop this Forest Stewardship Plan. Stewardship plans guide the landowner in achieving the objectives for protecting and improving the forest resources and outline the activities to accomplish these goals. Once the Plan is approved by the NJ Forest Service, landowners receive a framed certificate, a Forest Stewardship sign to post on their property, and a partial refund up to 75% for plan development.

Duel FLA / FS Plan Preparation
Many landowners choose to develop a plan that meets the criteria of both the Farmland Assessment and Forest Stewardship Programs. A duel plan results in a more comprehensive management scheme while offering tax incentives and cost-share opportunities. The NJ Forest Service encourages landowners and consultant foresters to enroll in other cost-share or grant programs (federal and non-governmental) in order to provide funding for the development of the plan and the activities prescribed. This makes forest management more economically feasible thereby encouraging the practice of sustainable forest management.

Seed / Orchard Management: C&I: 1, 2, 3.7 | 4.10 | 5.11 | 6.12, 14, 16 | 7.17, 18
The NJ State Forest Tree Nursery is responsible for providing seedlings to woodland owners, state, county and other agencies for reforestation or afforestation purposes. In order to obtain seed for these seedlings, the nursery currently maintains several tree seed orchards and seed collection areas throughout New Jersey. These orchards are maintained by providing weed control, fertilization, and insect and disease control. Orchards of importance include a pitch pine orchard and shortleaf pine orchard developed jointly by Dr. John Kuser, Rutgers University and the NJ Forest Service. The pitch pine orchard is producing high quality seed used in Nursery sowing and is located on-site at the Nursery in Jackson.

Another orchard of interest is the pitch x loblolly pine clonal orchard located at Assunpink Wildlife Management Area. Development of this orchard began in the late 1960's between a list of cooperators including Silas Little of the USDA Forest Service, the West Virginia Co. and the NJ Forest Service. New Jersey maintains one of the few remaining pitch x loblolly hybrid orchards in existence.

In addition to utilizing seed orchards for a seed source, the nursery also has designated collection areas for many native tree species throughout the State.

New Jersey's Urban and Community Forest Resource Goals and Strategies
This section focuses on the objectives and strategies related to the five major goals found in the NJFS Community Forestry Program Five-Year Strategic Plan in effect for January 2007 through December 2011. This Strategic Plan includes not only the five goals and their related objectives but also a chapter on the three unique partners (Community Forestry Council, NJ Tree Foundation, and NJ Shade Tree Federation) as well as a chapter on the chronology, background, organization, and purposes of the Community Forestry Program.

Priority Areas for Tree Planting (Nowak and Greenfield 2009)
Priority areas for tree planting tend to be highest in more urbanized areas due to higher population density These index values can also be produced using high resolution cover data to determine local planting priority areas (e.g. neighborhoods).

The combined index (I) used by USDA-FS Technical Report NRS-47 (Fig. NJ-11) combines three criteria that are each weighted in a formula after they were standardized on a 0 to 1 scale with one being the highest priority:

$$I = (PD \times 40) + (CG \times 30) + (TPC \times 30)$$

- Population density (PD) – The greater the population density, the greater the priority for tree planting.
- Canopy green space (CG) – The lower the value, the greater the priority for tree planting.
- Tree canopy cover per capita (TPC) – The lower the amount of tree canopy cover per person, the greater the priority for tree planting.

The combined index was standardized again and multiplied by 100 to give each county, county subdivision, and community a tree planting priority index (PPI) which is a type of "environmental equity" index. There are three detailed data tables for New Jersey available at http://ww.nrs.fs.fed.us/data/urban.
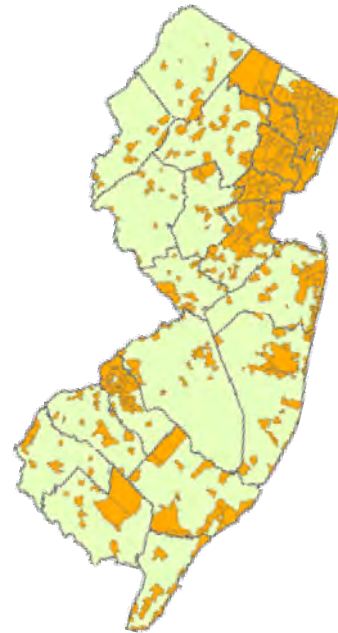
Priority Planting Areas.
"The New Jersey Community Forestry Program Five-Year Strategic Plan" is a 41-page document containing five goals and scores of specific objectives or strategies for attaining these goals. For the purposes of this report we have included here our strategies for attaining the goal of Community Forest Resource Management. Additionally, we have listed the other four goals of the Community Forestry Program as we feel that there unquestionably exists a synergy among the achievement of these five goals simultaneously.

Community Forest Resource Management Goal (cool cities reduces energy consumption). Related Criteria & Indicator: 1 | 3.7 | 5.11 | 6-12-16 | 7.17, 18
The Resource Management goal is to provide New Jersey communities with technical assistance, support, and training necessary to maintain effective community forestry operations at both the municipal and county level.

• Establish criteria for proper selection, planting, and care of trees.

• Explore legislation that would promote safer schools through the inclusion of 616 school districts into the New Jersey Shade Tree and Community Forestry Assistance Act.

• Provide technical information about tree planting, care, and project planning and analysis to municipalities or groups establishing or maintaining community forestry programs.

• Advise local governments and shade tree commissions in the development and coordination of policies, programs, and activities for the promotion of community forestry.

• Incorporate technical information from other states into New Jersey's program when appropriate.

• Partner with the New Jersey Tree Foundation to offer hands-on training and workshops to professionals and volunteer groups concerned about healthy community forests.

• Offer assistance specifically tailored to land use planning boards and developers.

• Provide staffing and support for the Board of Tree Experts through Board representation, test administration, printed materials, and by encouraging participation of tree organizations.

• Provide staffing and support for the New Jersey Society of Tree Experts through their Licensed Tree Expert (LTE) Exam Preparation courses.

• Maintain the electronic version of the Municipal Tree Database with updated contact information for all 566 municipalities.

• Administer the Community Forestry License Plate Fund account.

• Provide CORE Training and CEU workshops so that municipalities and counties will have opportunities to fulfill the requirements of the Training Skills and Accreditation Program, and to provide information to professionals and laypersons concerned about healthy community forests.

• Provide an annual Consultant Workshop to inform New Jersey's Tree Experts and Approved Foresters of the status of state programs and of new opportunities, and to allow new consultants to be placed on the list of Recommended Consultants for Writing a Community Forestry Management Plan or a No Net Loss Reforestation Plan.

• Promote the importance of using a Certified Tree Expert or Approved Foresters or other qualified professionals to assist in local Community Forestry planning, tree planting, and tree maintenance.

• Offer training and workshops on hot topics affecting municipalities including sidewalk conflict mitigation, Storm Damage Assessment Protocol, tree ordinances, working with utilities, right tree for the right place, iTREE, hazard trees, and community forest health issues.

• Encourage more towns/counties to form Shade Tree Commissions over other types of municipal/county governmental community forestry groups.

• Provide inventory and iTree training to municipal and county representatives.

• Develop a program to help communities use iTree.

• Coordinate the implementation of the New Jersey No Net Loss Reforestation Act:
Renew Memoranda of Agreement (MOA) with State entities, update project guidelines, and improve methods to facilitate review and approval of reforestation plans;
Monitor installation and maintenance of reforestation stock on projects;
Manage alternate payment option and coordinate granting of moneys to local entities; and
Provide technical assistance to State entities involved with No Net Loss Reforestation.

• Provide assistance to municipalities that received trees from the Cool Cities Initiative or the ALB Reforestation Project.

Citizen Action Goal C&I: 6.13-14
The Citizen Action goal is to develop a strong base of individuals throughout the state who will serve in a volunteer capacity, coordinate events, and act as a conduit for the flow of information to and from the served constituencies.

Community Partnerships and Special Projects Goal C&I: 6.13, 14
The Community Partnership goal is to build bridges between community groups and leaders who share common interests. Opportunities presented by Special Projects, will be seized upon within budgetary and staffing constraints.

Program Monitoring and Evaluation Goal C&I: 7.17, 18 | 6.14, 16
The Program Monitoring and Evaluation goal is to maintain an up-to-date and effective program that will focus community forestry efforts where they are most needed, when they are most needed, and in a manner that takes local interests into account while tracking achievements and progress towards attaining established goals.

Information, Research, and Public Awareness Goal C&I: 6.14, 15
The Information, Research, and Public Awareness goal is to raise public awareness of critical community forestry concepts and ideals by providing accurate information in clear and accessible formats addressing a diverse population of interested parties as well as supporting ongoing research wherever appropriate.

Protect Forests from Harm

Sub-theme 2.1: Restore fire-adapted lands and reduce risk of wildfire impacts
The strategic management of wildfires is crucial to the health of our nation's forests, the safety of our citizens and the contributions of forests to our economy. Management can significantly reduce the risk of catastrophic wildfire while enhancing multiple associated forest values and services.

Many forest ecosystems are dependent on fire for their health and sustainability. Decades of fire suppression and a changing climate have disrupted natural fire regimes, resulting in fuel buildup, loss of biological diversity, changed species composition, and loss of some fire-dependent species. Areas have been identified where these effects of fire exclusion can feasibly be mitigated or countered through sound management. Resource strategies should identify appropriate treatment strategies for priority landscapes.

The NJ Forest Fire Service has an active prescribed burning program that projects to prescribe burn (RxB) 20,000 acres per year throughout the State. Depending on weather conditions this target may not be reached. Excessive moisture in the form of rain, snow pack or wind conditions outside acceptable parameters for conducting RxB.

Prescribed Burning Accomplished in NJ

The window or opportunity for RxB in the State is from November 15th - March 15th of each year. There are some cases due to the adverse conditions mentioned that this window can be extended.

Forest Types and Areas Susceptible to Wildfire
Fire has played a significant role in the development and distribution of the natural communities found within New Jersey. The New Jersey Pinelands is a fire adapted forest ecosystem that depends on wildfire for reproduction and the control of fuel buildup. This forest community is one of the most hazardous wildland fuel types in the nation. Additionally, the oak forests of the north, particularly those found on the slopes of the Appalachian Mountains within the state, produce rapid rates of spread and were once considered a greater threat due to slash piles
and scattered debris left after logging for charcoal for furnaces in the late 1800's.

Mechanical Fuel Reduction Projects

Multi-agency Forest Management Activities

The NJ Forest Service and the Joint Base McGuire-Dix-Lakehurst (JB MDL) are collaborating on forest management proposals for the reduction of hazardous forest fuel accumulation.

The project areas center on the interface area of Brendan T. Byrne (BTB) State Forest and the JB MDL in Burlington and Ocean Counties. The scope of the forest management activities will be to reduce overstocked stands of pitch and shortleaf pine through thinning at various levels. In addition these projects promote a healthier forest and enhance wildlife habitat. This type of management activity provides direct protection to residential areas within the interface area. This project also fits within the scope of the US Forest Service's, Stewardship Project that incorporates multiple agencies and landowners (public and private) in order to promote landscape and region-wide ecological benefits.

The projects proposed will be located along Route 70, 530, and 539 and within the northern boundary of Brendan T. Byrne State Forest. Areas in the southern portion of JB MDL will be selected based on resource need while taking into account existing and future impact and training zones.

The vegetation has regenerated to overstocked conditions that are again favorable to the spread of wildfire, insects, and disease. Through the strategic location of variable thinning intensities hazardous fuels can be reduced. For instance, areas immediately adjacent to major roadways (Routes 70, 530 and 539) will have a higher level of thinning areas away from roadways will be thinned at a lower intensity.

The DEP Natural & Historic Resources Group and JB MDL will collaborate on all proposals for proper placement of thinning regimes while taking sustainability e.g., Criteria and Indicators and the National Themes into consideration.

Fuel Hazard
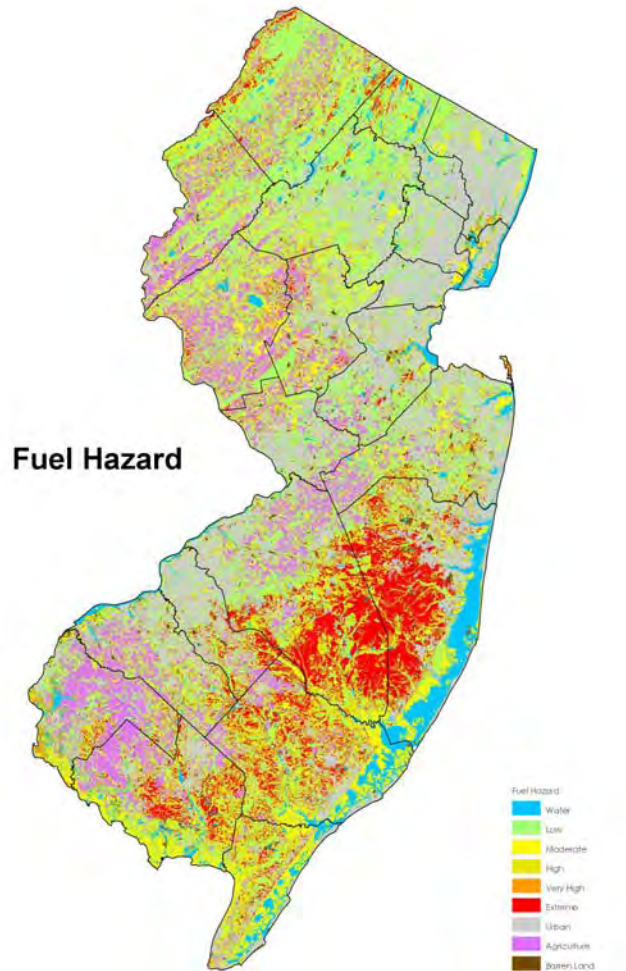
Sub-theme 2.1: Identify, manage and reduce threats to forest and ecosystem health
A healthy forest landscape has the capacity for renewal and for recovery from a wide range of disturbances, while continuing to provide public benefits and ecosystem services. Threats to forest health include insects, disease, invasive plant and animal species, air pollution, and climate change.

Gypsy Moth
Necessitated by high mortality levels by this exotic pest, the NJ Forest Service conducts aggressive salvage harvest efforts. Sawtimber and firewood sales are developed in order to improve the safety and recreational opportunity of state parks and forests. This provides and opportunity to recover some economic return before it would be lost to decay.

Forestry personnel locate, inventory and plan the marketing of dead and dying trees. Gypsy moth killed trees generally will remain sound for approximately 2-3 years after the trees have died. After that, various secondary pathogens create wood deterioration and rot to the point where their market value is drastically reduced.

Salvaged trees are marketed based on their optimal value, from higher quality sawtimber to firewood or hardwood pulp. As an example, in Stokes State Forest over 526,000 board feet and 12,500 cords of firewood/pulpwood were salvaged during the last great defoliation. Management efforts focused on the worst affected areas in order to improve health and safety. In addition, salvage sites were and continue to be managed to promote forest regeneration and provide wildlife habitat.

In order to reduce widespread mortality, a suppression plan for controlling gypsy moth populations must be conducted. Egg mass surveys are performed after mapping the defoliation of the current year and then surveying those areas. It is necessary to determine if egg masses in a given area are greater than 400 egg masses per acre. Typically if the eggs masses are 0.75 to 1.50 inches it can be determined that the gypsy moth population is healthy and needs to be suppressed.

Following the survey a suppression plan is developed for the following spring (May). The NJ Forest Service and the NJ Department of Agriculture coordinate an aerial spray program utilizing *Bacillus thuringiensis* (B.t.) as the control agent. During the suppression program forestry and agricultural personnel provide on site conditions to the aircraft in order to stay within application parameters.

Bacterial Leaf Scorch
Currently, there is no known cure for BLS. Injecting diseased trees with antibiotics can suppress symptom development, but cannot eliminate the bacteria. The injections are expensive, must be repeated yearly, put additional stress on affected trees, and result in only marginal success.

While the distribution of BLS in the urban environment is fairly well known, the distribution in forests is not. In 2001, the NJ Forest Service in coordination with the US Forest Service was the first state to detect BLS in the forested environment. Since then sampling within state parks and forests and on private lands has occurred. It is determined that BLS is prevalent in southern New Jersey. In order to determine the full distribution of BLS additional sampling throughout the State's parks and forests is proposed. This will provide a better understanding of the potential impacts to the red oak group. From this, management decisions can be made on consequences to biodiversity, wildlife habitat, fragmentation, changes in forest types, marketability, and carbon sequestration.

Silvicultural Treatment
The Forest Service developed an experimental sanitation harvest in 2008 to prolong the life of infected mixed oak species in the forested environment. This was developed to see if silvicultural treatments could mitigate the impacts of BLS in the woodland environment. The objective is to facilitate a healthy vigorous stand of trees by reducing the overall basal area from an overstocked level to fully stocked. Additionally, the prescription will retain a minimum canopy closure of 70% for certain threatened and endangered wildlife species. Overall, residual tree species will include the healthiest and largest oaks, and pitch pine.

The NJ Forest Service (NJFS) integrated the Homeowner Firewood Program with Forest Health Monitoring by prescribing this silvicultural treatment to improve forest health. Trees testing negative and positive for BLS will be removed and other select individuals will remain for long-term observational purposes. The spatial arrangement and amount of residual BLS trees will be dependent on additional sampling. Residual trees will be evaluated for success of this silvicultural prescription in order to determine if additional sanitation / improvement harvests could prolong a stand's rotation when infected with BLS. The experiment is being performed with the assistance of a forest pathologist from the US Forest Service.

Suppressed and poorly formed trees that are occupying vital growing space adjacent to healthy and select infected trees have been removed in the first year of harvesting. In addition, trees that are a result of previously harvested coppice were also identified and reduced to a single standard. No standing dead or live den trees with cavities were marked for removal but are left standing for current and future wildlife purposes. After each section is finished, a prescribed burn is used to reduce harvesting slash and prepare the potential seedbed for natural regeneration.

NJFS personnel divided the site into multiple sections where harvesting will only start in a new section after one has been completed. The sections were established using the outline of the road system already in place. We are entering the second growing season of this treatment and are coordinating with the USFS on recording results of the previous year.

Southern Pine Beetle
The need to develop a control and suppression program in New Jersey is direct result of SPB being a significant damage causing agent in our pine forests. Our forest resource has suffered increased fire hazard, reduction of T&E habitat, recreational opportunities, and loss of crown closure. Timber values have also decreased due to mortality and decay. Homeowners have also suffered losses with trees dying on their properties. The fire hazard is particularly important considering NJ's history of wildfire in the pinelands region. As the trees brown, they drop their needles onto understory vegetation. This creates a ladder fuels that can cause a ground fire to quickly climb into the tree crowns. A crown fire can spread fast, be difficult to control, and contribute to spot fires hundreds of feet away where this process could be repeated.

Recommendation for Control:
Expedited suppression has proved effective in the southern US, moving several states to provide cost-share for control practices and mandating immediate spot control on private land. The NJ Forest Health Program (FHP) has provided funding opportunities for suppression and restoration activities and will continue this effort. The FHP recommends that the approval process for suppression be expedited and expanded to include salvage and restoration proposals. It is critical that active infestations have immediate suppression before they spread. Of the thousands of acres of dead pine, hundreds of acres should be salvaged before the economic option is lost. Rapid deterioration of standing dead trees requires that if salvage is to be attempted, it should be conducted as soon as possible after the trees have died. However, in some priority areas deterioration makes salvage and restoration efforts extremely difficult, hazardous and improbable. A no-cost operation can change to a costly operation, therefore may not be performed at all.

Suppression Project Criteria
These factors have been taken into consideration prior to recommending SPB suppression:

1. Aggressive suppression early in apparently building populations.
Suppression activities at this stage have been successful in preventing future generations from becoming established. A pilot project in Belleplain State Forest was successful in reducing the spread of SPB to surrounding stands and should be replicated in other areas with new infestations.

2. Potential for change of forest type.
This factor is of importance due to many areas infested having little or no tree regeneration in the understory. Understory composition is a mixture of shrubs (mountain laurel, sweet pepperbush, highbush blueberry, etc) and red maple and tupelo. SPB suppression in conjunction with salvage operations followed by reforestation is necessary to prevent these sites from becoming shrubby lowland areas. This will also provide future canopy closure for barred owl habitat, reduce fragmentation and assist in the sequestration of carbon.

3. Presence of fresh attacks.
Freshly attacked trees give an indication that an infestation is occurring and expansion is likely. Trees that have soft pitch tubes with no exit holes indicate that they are currently under attack by adult beetles constructing egg galleries.

4. Forest management objectives.
Conservation of native pine dominated forest types is a key component of current management objectives.

5. Loss of recreation use.
The Pinelands have a high level of recreational use such as camping, picnicking, bird rodeos and hiking. Further mortality of the pine component could lead to increased fragmentation and decreased quality of the outdoor experience.

Suppression project criteria have been further refined for state owned lands. Priority areas have been established and will be amended as necessary. These areas have been grouped into forest resource and recreational categories.

Forest Resource Priorities:
Civilian Conservation Corps (CCC) and other historical plantations, experimental plantings, seed orchards, representative communities, areas of high stand density, and proximity to private lands.

Recreational Resource Priorities:
Campgrounds, picnic areas, administration areas, priority trails, and forested areas adjacent to recreational facilities.

Private lands whether commercial, residential, rural or urban will have priorities pertaining to the landowners' objectives and desire to implement suppression, salvage and restoration practices.

Suppression Alternatives for SPB Control
Currently four control strategies are recommended for implementation in New Jersey. The combining of alternatives is possible in controlling SPB infestations. Individual or a combination of alternatives will be based on site-specific conditions.

Alternative 1 – No Action
Areas where the SPB has infested, vacated and no longer in threat of expansion do not need to be suppressed.

Alternative 2 – Cut-and-Remove
Removal of infested trees should begin immediately. Where needed, a 50 to 100 foot buffer strip should be marked and cut next to and ahead of the most recently infested trees. A percentage of trees on-site that have been vacated entirely by SPB could be left standing if they do not pose a fire or other public health hazard. This may help

populations of checkered beetles and other biological control agents to increase and prey on SPB. The priority of removing infested trees is as follows:

Spring – Fall
1. Remove trees in the buffer zone. A 50 - 100 foot buffer strip of uninfested green trees around the spot head should be removed to minimize reinfestation and to disperse the beetles. The buffer zone should be equal to the height of the trees in the stand being treated.
2. Infested green trees. This will remove SPB pheromone source and potential broods.
3. Fading trees. This removes the potential brood.
4. Red-topped trees. It may not be necessary to remove these trees if the SPB have exited. These could be left standing for the development of predators to the SPB.

Fall to Spring
1. Red-topped, fading and green infested trees. These trees may still contain living brood during the fall and winter.
2. Trees with fresh attacks.
3. Trees in the buffer zone.

Alternative 3 – Cut-and-Leave
Cut-and-leave is designed to disrupt spot growth and reduces mass attacks by dispersing the SPB.
1. Identify all active trees within the spot.
2. Fell all active trees toward the center of the spot.
3. Fell a horseshoe shaped buffer around green, uninfested trees with fresh attacks toward the center of the spot. In small spots, the buffer can encircle the spot. The buffer width should not be less than the height of the trees being treated.
4. Dead trees where the SPB have emerged do not have to be felled unless there is a fire or other public health hazard.

Alternative 4 – Pile-and-Burn
Felling, piling and burning is one of the oldest methods in controlling SPB. All of the bark must be thoroughly burned to achieve control. This alternative should be performed when the chance of the fire to escape and when wildfire danger is low.
1. Identify and fell all infested trees toward the center of the spot.
2. Pile and burn until all bark is thoroughly burned.
3. Do not burn if fire danger is moderate or high.

Special Wildlife Consideration
Some areas infested by SPB are known to contain populations of the Barred owl *(Strix varia)*. Although the barred owl is secure in its natural range, it is listed as threatened in New Jersey. SPB may have a negative impact on existing and future barred owl populations. Preferred barred owl habitat in southern New Jersey has been primarily associated with three habitat types; Atlantic white-cedar swamps, pitch pine lowland habitat and hardwood swamps (Sutton and Sutton 1985, Laidig and Dobkin 1995). SPB induced mortality in southern NJ occur primarily in pitch pine lowland stands, stands of

mixed pine and hardwood, and on pine occurring in Atlantic white-cedar swamps and has altered existing habitat. Great horned owl *(Bubo virginianus)*, a predator of barred owl and competitor of considerable prey overlap (Bosakowski and Smith 1992) may benefit from forest fragmentation attributed to SPB caused mortality. Continued mortality will open the crown canopy, possibly creating favorable conditions for the great horned owl while adversely affecting existing barred owl populations**.**

Local woodpecker populations have assisted in control of SPB populations by foraging and scraping of bark from infested trees. Inversely, SPB has provided an additional food source for woodpecker activity following the infestation heads. The checkered beetle has also assisted in the control and can be observed preying upon SPB on the bark of newly infested trees. However, these short-term benefits will be exhausted once the overstory fragments as previously mentioned.

Monitoring
The NJ Forest Health Program monitors SPB activity by performing a Billings Trap Survey, aerial mapping and ground truthing.

The trap survey involves strategically deploying up to eighteen funnel traps throughout the pine forest types in southern New Jersey during the spring of each year. The trap contents are collected and insects identified each week for a period of six weeks in order to determine the potential SPB population for the current year. This information is important for assessing where SPB will or may not be a problem in a given area. For the past eight years the NJ Forest Service has adjusted the distribution of traps in order to gain an understanding of their migration and establishment in southern New Jersey.

The aerial survey occurs following the trap survey and consists of flying the entire pine component of southern New Jersey. Areas infested with SPB are mapped and photographed. This information combined with the trap survey data assists in determining how much and where the forest resource is being impacted. Forest planning and management decisions are formulated by the results of these surveys.

Hemlock woolly adelgid
The NJ Forest Service is a partner in a multi-state Forest Health Monitoring proposal to control HWA in selected test areas with chemical treatment. States participated are NJ, MA, PA, and WV. Additionally, the NJ Forest Service will prepare an Eastern hemlock Assessment and Recovery Plan. This will addresses the current extent of hemlock within the State and provide guidance on long-term control and restoration feasibility.

The NJ Forest Service continues to monitor the HWA populations in within the hemlock resource. While performing the monitoring of HWA, the health of the hemlocks is also evaluated for susceptibility and resistance to the insect. This is in coordination with the North Carolina State University in collecting hemlock samples for genetic variability and future seed banking for restoration purposes.

The NJ Forest Service also assists the NJ Department of Agriculture in releasing predatory insects to HWA. Insects are reared at the Phillip Alampi Beneficial Insect Laboratory in Trenton are *Laricobius nigrinus* and the imported lady beetle, *Sasajiscymnus tsugae*. These biological predators have been successfully introduced into test areas on forested lands within the State. Research and monitoring continue in order to gain an understanding of how well HWA populations are controlled. The adult predatory insects *Sasajiscymnus tsugae* (Courtesy: Connecticut Agricultural Experiment Station) and *Laricobius nigrinus* (Courtesy: Virginia Polytechnic Institute).

Sasajiscymnus tsugae

Laricobius nigrinus

Emerald Ash Borer

The NJ Forest Service performs trap surveys throughout the State in order to determine if EAB is present. Additionally, sites that are suspected possible infestation are evaluated for EAB activity. To date, no EAB has been confirmed in New Jersey. The NJ Forest Service performs these activities in coordination with the NJ Department of Agriculture and the US Forest Service.

In order to control the spread of EAB federal and state quarantines were established in infested areas to regulate the movement of ash commodities. Additionally, infested trees and potential host ash species in a local area are removed. This is to prevent new populations from becoming established and furthering the spread of EAB and tree mortality.

The NJ Forest Service and the NJ Department of Agriculture coordinated efforts in preparing strategies for the movement of potential infested forest products into the State in order to prevent EAB from entering. The Division of Parks and Forestry also provides recreationalists with information pertaining to the movement of firewood when they reserve camp sites. They are informed to buy their campfire wood at the state park or forest where they intend to stay. In the event that EAB is discovered in the State quarantines would be established to prevent movement of forest products.

Invasive Plant Species
The NJ Forest Stewardship Program requires that stewardship plans address the following invasive plant species when prescribing activities on private lands. Invasive plants that are not on this list are encouraged to be included when considering silvicultural activities.

The Natural & Historic Resource Group prepares proposals and implements projects that are designed to control invasive species within state parks, forests and wildlife management areas.

The NJ Forest Service has participated with the NJ Department of Agriculture in releasing predatory insects to control the species of invasive plant species.

The NJ DOA rears predatory insects to control mile-a-minute-weed and purple loosestrife. These insects have been release on state land and have proven to be successful in controlling these invasive pests. Efforts to continue this cooperative are on-going.

Enhance Public Benefit from Trees and Forests

Sub-theme 3.1: Protect and enhance water quality and quantity
Forests and forestry practices can help protect, restore, and sustain water quality, water flows, and watershed health. Healthy urban and rural forested watersheds absorb rainfall and snow melt, slow storm runoff, recharge aquifers, sustain stream flows, and filter pollutants.

Regulations and Procedures for Wetlands and Buffers
In order to protect the integrity of our water resources, the Freshwater Wetlands Protection Act (FWPA) regulates many activities including forestry conducted within forested wetlands and transitional areas. Specific forestry activities have been granted a conditional exemption of the requirement of needing a wetlands permit.

To obtain the forestry exemption from the FWPA, a proposed forest management harvest within a wetland, or its regulated upland transition area, must be detailed in a forest management plan that has been approved by the State Forester. If a harvest is not in an approved plan, it is subject to regulation under the FWPA and may be considered a violation.

Wetlands regardless of size are regulated, provided they meet the three parameter wetland delineation methodology. In addition to wetland areas, their associated buffers or transition areas come under regulation of the FWPA. The width of the buffer area is based on the resource value of the wetland.

- Buffers of 150 feet are establishes for wetlands of exceptional resource value. Those wetlands are documented habitat of certain endangered or threatened species, or are adjacent to trout production waters or their tributaries.
- Ordinary resource value wetlands require no buffer. These wetlands include: ditches and swales; detention basins; and small isolated wetlands surrounded by at least 50 percent development.
- Buffers of 50 feet are required adjacent to wetlands of intermediate resource value. These buffers are associated with all other wetlands such as intermediate streams.

Woodland owners implementing normal harvesting of forest products, in accordance with a forest management plan approved by the State Forester, are not required to obtain a wetland permit to work in forested wetlands. In New Jersey, normal silvicultural activities are exempt from the requirement of a wetland permit with an approved forest management plan, as long as the practices are conducted in accordance with the NJ Forestry and Wetlands Best Management Practices Manual, 1995. These practices include activities such as: thinning; tree planting; seeding; cultivating; harvesting for the production of food and fiber; upland soil and water conservation practices; maintenance of drainage ditches; the construction or maintenance of forest roads; and fencing.

The DEP, through the Land Use Regulation Program, has established a procedure to obtain a formal letter of exemption for these activities. This document is not required before conducting normal harvesting activities approved by a forest management plan, but may help to ensure compliance with the law.

To administer the forestry exemption, the Land Use Regulation Program works in cooperation with the Division of Parks and Forestry, NJ Forest Service. The Forest Service will assist anyone proposing a forest practice in a regulated wetland or buffer area to obtain an approved forest management plan prior to conducting the work.

Anyone submitting a forest plan to the State Forester for approval for harvesting of forest products in a regulated freshwater wetland or upland buffer area should submit a copy of a proposed management plan to a regional forester of the New Jersey Forest Service. The plan is to include the following information:

1. Landowner's name, address and telephone number
2. Applicant's name, address and telephone number
3. If the applicant is not the landowner, they must submit the authority for requesting the wetland forestry approval
4. Map of total land in contiguous block including:
    a. Forest types delineated with acres
    b. Land use classification
    c. Soil types and erodibility erosion control procedures
    d. Percent slope
    e. Stream's location
    f. Filter and buffer strips
    g. Proposed harvest area clearly defined on a map with acreage including:
        Loading deck location
        Stream crossings
        Proposed skid trails
5. Description of forest products to be harvested including:
    a. Volume cords, MBF (1000 board feet)
    b. DBH (Diameter at breast height) classes
    c. Age classes
    d. Heights
    e. Number of trees, etc. when harvesting is to take place
    f. Dates when harvesting will take place
6. Regeneration practices and other intermediate management practices recommended of the proposed harvest area
7. Proposed harvest area clearly delineated on the ground
8. Statement indicating how seed trees will be marked at DBH and at stump (if applicable)
9. Individual BMP's to be used
10. Statement concerning threatened and endangered species (State if none exist on the site. If threatened and endangered species do exist, assess impact of activity and outline mitigation steps).

11. Assessment of impacts to reach and flow of any water courses, and explanation how reach and flow will be maintained.
12. Wetland clearly marked on forest map. To review and gain approval for the proposed forest practice, a site inspection must be arranged with a representative of the Bureau of Forest Management. If the plan is approved, it will be stamped approved by a regional forester and returned with a letter to verify that approval. Once this process is complete, the proposed forest harvest is in compliance with the wetland forestry permit exemption as long as the plan is followed accurately.

It is important to understand that the proposed forest practice is still subject to all other applicable local, state and federal regulations. Once any forest practice starts, it may still be subject to a wetland violation if the practice or harvest diverts from the approved BMP or harvesting plan.

Forestry activities proposed as part of any approved plan must not:
- Have an adverse impact on a state or federally listed endangered or threatened species;
- Impaired the flow and circulation patterns of the freshwater wetlands or state open waters;
- Reduced the extent of freshwater wetlands or open waters;
- Violate the plan outline and intent during implementation.

Streamside Management Zones
The purpose of a Streamside Management Zone (SMZ) is to protect a water body from adjacent land-use activities by providing a relatively undisturbed vegetative zone to trap and filter out sediments and other pollutants before they enter the water resource.

In addition to protecting the water resources, SMZs also have benefits, including: maintaining the proper water temperature of a stream; providing a wildlife corridor for improved wildlife movement; and serving as an aesthetic buffer or screen to minimize the visual impact of silvicultural activities.

The width of a SMZ is determined through on-site evaluation. Variation in topography or other conditions along a water course or surrounding body of standing water may require changes in the SMZ width. Generally, the steeper the slop, the wider the SMZ, and the more gentle the slope, the narrower the SMZ. Similar standards apply for the erodible soils; the more erodible the soil, the wider the SMZ, and the less erodible the soil, the narrower the SMZ (Georgia Forestry Commission 1990).

The width of a SMZ should range form at least 25 feet on each side of a streambed in slightly erodible soils, to 50 feet in severely erodible soils where slopes perpendicular to the stream are 10 percent or less.

Forest managers should be aware of special site conditions such as, the management being practiced (e.g. harvesting), or the vigor of the streamside vegetation, that may require a change in the width of the SMZ from what is generally recommended.

Filter Strips

Filter strips are defined as undisturbed areas consisting of natural vegetation and litter, such as leaves, brush and branches, located between a wetland or water course, truck loads, skid trails, and harvest or loading areas. Filter strips are most effective when placed in close proximity to the activity most often being used outside the SMZ.

Filter strips are used to help slow the velocity of water runoff so that any sediment load is dropped into the filter strip, thereby preventing it from washing into the adjacent wetland or water course. Filter strips also are important in helping to maintain water temperature and preserve wildlife habitat.

1. Plan filter strips prior to the implementation of the harvest schedule.
2. Filter strips should increase in width as slopes adjacent to wetlands or streams increase.
3. Restrict equipment operation in filter strip areas.
4. Construct or maintain a filter strip between disturbed areas and wetlands or water courses.

Stream Crossings

Stream crossings represent the point at which a forest road or skid trail comes in contact with a body of water. The purpose of a stream crossing is to provide a stable bottom or surface that allows for equipment to cross intermittent or perennial streams without increasing stream sedimentation.

Stream crossings, if not properly constructed, have the potential to adversely affect the quality of water resources through erosion, and should be avoided if possible. Advance planning will reduce or eliminate the number of crossings necessary.

The Flood Hazard Area Control Act Rules (NJAC 7:13) regulate construction within and/or adjacent to the 100-year flood plain of non-delineated streams or the flood hazard area of delineated streams. The intent of these regulations is: to minimize losses and damage to public and private property caused by land uses and channel modifications which, at times of flood, increase flood heights and/ or velocities; safeguard the public from the dangers and damage caused by materials being swept into nearby or downstream lands; protect and enhance the public health and welfare by minimizing the degradation of stream water quality from point and non-point pollution sources; and protect wildlife and fisheries by preserving and enhancing water quality and the environment of the stream channel and flood plain. According to Flood Hazard Area

Control Act Rules, the construction of permanent structures such as bridges, culverts, or fords is regulated. These structures are typically needed to access a stand of trees.

In the case of temporary crossings, the DEP may issue a letter of no jurisdiction rather than a permit. For permanent crossings a Stream Encroachment Permit will be required. If a permit is required, the forest manager should work with the local Soil Conservation District without expending a lot of energy, time and expense.

Additional information regarding sedimentation control and the construction and use of bridges, culverts or fords can be obtained from publications developed by the USDA Forest Service and the Natural Resource Conservation Service (NRCS). For more information on stream encroachment regulations, call (609) 777-0454.

Endangered and threatened bird species have made a remarkable recovery over the past 20 years due to improved water quality, habitat protection and state management efforts.

Timber Harvesting
In addition to sediment production, harvesting can create an accumulation of organic debris, which may be washed from the forest floor and enter water resources. Harvesting, if not properly applied, also can result in thermal pollution, when the removal of the forest canopy over a stream causes a raise in the water's temperature. When harvesting is properly planned and applied, the cutting of trees for a prescribed silvicultural purpose will minimize adverse impacts on the environment. Trees and other vegetation will grow back naturally and soil disturbance will be limited. When managing a forest, it is important to develop a forest management plan that addresses areas to be harvested; any forest roads to be constructed; and the timing of the activity.

The type of system best suited for harvesting in terms of the managers' objectives and system impact on site quality should be determined during the initial planning stage. Potential water quality and habitat impacts should be considered when selecting a silvicultural system. Yarding systems, site preparation methods, and any pesticide applications also should be addressed during pre-harvest planning.

**Sub-theme 3.2: Improve air quality and conserve energy**
Urban and exurban forest cover, including agroforests can improve air quality, reduce energy consumption and produce biomass for energy production. Efforts are made to identify areas where management or restoration of the urban or exurban forest canopy will have significantly positive and measurable impact on air quality and produce substantial energy savings.

Impervious Surface Cover Characteristics

Currently, State agencies continue to track and attempt to limit additions to overall impervious surface cover throughout the State. Efforts to mitigate the impacts of impermeable surface include the use of permeable pavement for State building projects, tax incentives for woodland landowners to keep their woodlots forested, as well as cost-sharing for private forest management plan creation and land management practices not related to development.

Average impervious surface cover in New Jersey is 8.3% of the land area, with 188.6 m^2 of impervious surface cover per capita. Average impervious surface cover in urban areas was 19.2%, with 175.0 m^2 of impervious surface cover per capita. Within community lands in New Jersey, average impervious surface cover was 20.3% with 171.6 m^2 of impervious surface cover per capita. Impervious surface over varied across the State (Nowak and Greenfield, 2009).
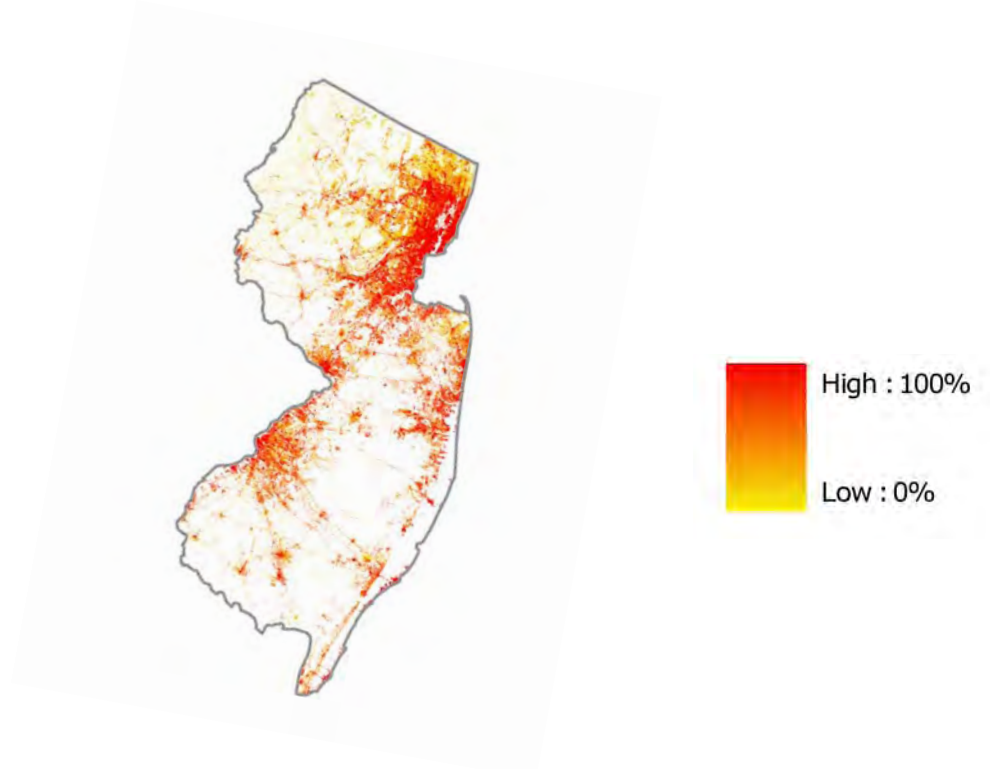
Human Population Characteristics and Trends

The population in New Jersey increased by 8.9%, from 7,730,188 in 1990 to 8,414,350 in 2000. In New Jersey, 94.4% of the State's population is in urban area, and 72.0% of the population is within communities.

Population:

New Jersey		Statewide	Urban[A]	Community[B]	Urban or Community[C]
Population	2000	8,414,350	7,939,087	6,058,833	n/a
	1990	7,730,188	6,910,220	5,483,802	
% Change 1990-2000		8.9	14.9	10.5	n/a
% Total Population		100.0	94.4	72.0	n/a
Population Density					
	2000	438.4	1,099.3	1,183.1	n/a
(people/land area km^2)					
	1990	402.8	1,079.2	1,044.8	n/a
% Change 1990-2000		8.9	1.9	13.2	n/a

[A] Urban Land is based on population density and was delimited using the US Census definitions of urbanized areas and urban clusters. Wikipedia: The term urbanized area denotes an urban area [core census block groups or blocks that have a population density of at least 1,000/mile^2 (386/km^2) and surrounding census blocks that have an overall density of at least 500/mile^2 (193/km^2)] of 50,000 or more people. Urban clusters are urban areas with less than 50,000 people.
[B] Community Land is based on jurisdictional or political boundaries of communities based on US Census definitions of incorporated or census designated places.
[C] Urban or communities is land that is urban, community or both. Communities may include all, some, or no urban land within their boundaries.

Sub-theme 3.3: Assist communities in planning for and reducing forest health risks
Communities play an essential role in reducing the risks of catastrophic wildfire. State & Private Forestry programs assist communities in identifying wildfire risks, developing Community Wildfire Protection Plans (CWPP), and promoting FIREWISE and other risk reducing policies and actions.

Some communities are especially prone to loss of life and property from wildfire. Local or state laws, regulations and ordinances, landowner attitudes and priorities, and public policies all play important roles in managing fire risk near communities.

Community Wildfire Preparedness Plan (CWPP)
While the NJ Pinelands Commission regulates development, the enforcement of those regulations is by individual municipalities. Unfortunately, gaps exist that allow a housing development to be built and occupied without adequate defensible space. To remedy this situation, the NJ Forest Fire Service has developed a CWPP template that, when adopted, will solidify support for Firewise Communities, zoning and land use regulations, and infrastructure improvements. A pilot project for developing CWPP's was initiated for Stafford and Barnegat

Townships in cooperation with the NJ Pineland Commission. The active Firewise Communities of Horizons in Barnegat, and Warren Grove in Stafford, have spurred

No.	Community
1	East Vineland
2	Fox Hollow
3	Hardwick Township
4	Hopatcong
5	Horizons at Barnegat
6	Lake Plymouth Community Center
7	Liberty Township
8	Milmay
9	Richland
10	Roosevelt City
11	Shawnee Country Open Space
12	Timber Green
13	Wynnewood
14	Heritage Point
15	Mirage
16	Brighton
17	Pinewood Estates
18	Warren Grove
19	Fawn Lakes
20	Perry's Lake
21	Atlantic Hills
22	Parmount Homes
23	Ocean Acres
24	Millville
25	Woodland Township
26	America's Keswick
27	Presidential Lakes

Firewise Communities

interest by other communities within the townships. This grassroots support by the Firewise Communities may, in the future, provide the doorway to establishing municipal and county wildfire protection planning throughout the region. The Forest Fire Service has set a goal of having at least one CWPP for each of it Section administrative areas. With a grant from the US Forest Service, an outside contractor has been hired to work with the Section Firewardens to develop 25 municipal CWPP's within the next 2 years.

Countywide Wildfire Response Plan
In cooperation with the NJ Division of Fire Safety, a Wildfire Response Plan will be required for each county within the State to define the roles and responsibilities of the county coordinators and fire company officers during wildland/urban interface structure protection assignments.

The intent of this plan is to provide a format for statewide planning of emergency response to wildfire incidents that affect a local jurisdiction where large numbers of fire apparatus and staffing are needed to protect life and property. The specific purpose is to define the responsibilities of the responding agencies to ensure a coordinated delivery of initial and extended attack resources for control, evacuations, structure protection, and

station cover assignments during wildfire emergencies. This procedure will reduce the need for unnecessary resources, expedite response times, enable or provide better control of staffing and equipment, and do so in a manner that will not leave any one fire company unprotected.

The plan lists pre-established staging areas, facilities, and helispot locations established within the county, pre-designated Task Force/Strike Teams, and include resource ordering procedures, operational periods, and communications strategies. These plans will be used for both sending and receiving mutual aid and to highlight specific resources available for statewide assignments.

Measurement and Mapping of Hazardous Fuel Loads
The US Forest Service research scientists at the Silas Little Experiment Station are conducting a study to characterize 3D canopy fuel structure using LIDAR products and models developed from destructive harvest to quantify crown fuel structure and canopy bulk density (CBD). This research has been focused on the Cedar Bridge/Greenwood Wildlife Management Areas (WMA) and Warren Grove/Stafford Forge WMA areas. They have extended this research to Pitch Pine forests in Massachusetts, and to Lodgepole and Ponderosa Pine in Montana (with Elizabeth Rhinehardt as a co-investigator).

The USFS FERA group was at the experimental station in March 2007, and installed pre-burn plots to measure fuel combustion during prescribed fires. These measurements are used to characterize fuel loading, and use a similar protocol to the fuel photo series for Pitch Pine.

In addition to these measurements, the experiment station is assisting with fuel loading measurements at Warren Grove with Dr.Walt Bien of Drexel University. These measurements are used to characterize fuel accumulation following wildfires in 1956, 1971, 1998, and the 2007 wildfire.

Sub-theme 3.4: Maintain and enhance the economic benefits and values of trees and forests
Forest landscape areas have been identified where there is a real, near term potential to access and supply traditional, non-timber, and/or emerging markets such as those for biomass or ecosystem services. These areas have the necessary infrastructure where group certification of landowners has created market supply aggregation potential, Strengthening and developing new market opportunities for forest products and benefits provide incentives for forest stewardship and conservation.

Forestry in New Jersey tends not to be driven by direct economic return but a diverse array of other amenities (tax incentives, wildlife habitat, forest health, water quality). Economic return from timber harvesting is usually considered as means to defray the cost of management for these amenities. Despite this, priority resource areas have the potential to offer long-tern economic benefits for sustainable forest management. Areas with a state park or forest, forest stewardship or farmland assessment management plan provide economic benefits while maintaining the ecological integrity. The enhancement or development of timber markets is achievable based on foresters, forest products industry and landowners knowing that raw products are available on a sustained yield.

Ecological services provided by foresters under an approved management plan will ensure that forests remain forests while enhancing economic benefits.

Sub-theme 3.5: Protect, conserve and enhance wildlife and fish habitat
Protection, conservation, and restoration of forested wildlife habitat are critical to maintaining and enhancing the rich biodiversity of our nation. Major threats to fish and wildlife habitat include the patchwork of public-private ownership, threats associated with urbanization, and uncharacteristic wildfire.

The NJ DEP, Natural & Historic Resources Group's Forest Service and Fish & Wildlife Service activity coordinate forest management with habitat improvement projects. Our multidisciplinary efforts date back decades. Improvement projects involve enhancing habitat for various T&E species such as redheaded woodpecker and timber rattlesnake, while promoting forest health through various silvicultural prescriptions.

As previously mentioned Eastern hemlock is a resource for various ecological benefits. Hemlock stands and small aggregates of trees provide valuable shade to native trout streams and winter cover for wintering areas of Barred owl (Sutton and Sutton, 1985). The continued decline and corresponding mortality of hemlock will lead to increased stream temperatures thereby reducing the quality necessary for trout habitat. The proposed Hemlock Assessment and Recovery Plan will address these issues further.

Forest management projects are conducted to enhance habitat for a range of other species, including ruffed grouse, quail and woodcock. At the same time, these projects have helped strengthened our working relationships with other state natural resource management agencies as well as non-governmental organizations focused to wildlife and nature resources conservation.

The Natural & Historic Resource Group has moderated a project designed to consolidate stakeholders associated with State and non-profit administrated lands located within the NJ Pinelands region. The group's objective is to prepare comprehensive Forest Stewardship Plans for a 13,000 acre cooperative project area. The resulting plans will provide management prescriptions promoting forest health, wildfire protection, game and non-game species management, in addition, provide planning details for all other standard stewardship guideline objectives. Known as the Berkeley Triangle Project, properties administered under the Natural Lands Trust, NJ Audubon Society, Division of

Fish and Wildlife, and Division of Parks and Forestry are united and included in this coordinated effort.

Sub-theme 3.6: Connect people to trees and forests, and engage them in environmental stewardship activities

Our urban and private forests are the natural backyards for many communities and serve as society's connection to nature. The Division of Parks and Forestry continues to find opportunities to educate the people on the value of natural resources for the benefit of current and future generations.

Many of New Jersey's Forestry Services programs designed to connect people to forests are listed in the **Forestry Services Investments in Training** under Criteria 6, Indictor 14.

Sub-theme 3.7: Manage trees and forests to mitigate and adapt to global climate change
America's forests offset a significant portion of the nation's annual carbon emissions. Additional climate change mitigation benefits could be achieved through partnerships and management measures. These measures include supporting the development of markets for carbon offsets, utilizing woody biomass for energy, wood product substitution, and promoting tree growth in urban areas.

The important benefits that forests provide such as biodiversity, wildlife habitat, and water storage and flows are affected by climate change. Forest range, type and composition are projected to change significantly with corresponding changes in wildlife habitat, biodiversity, water flows, and fire regimes.

NJ Forest service has served as project coordinator for a DEP funded project assessing the potential for NJ forests to sequester carbon and contribute to greenhouse gas emissions avoidance. This project by Rutgers University, currently in its final draft, has produced a range of forest-land carbon, carbon sequestration, and greenhouse gas avoidance assessment for NJ including:

1. Provides a spatially explicit picture of carbon stock by presenting results by physiographic region. In addition, estimates were also undertaken (where feasible and appropriate) by other categorizations: forest type, rural vs. urban land use, private vs. public ownership.
2. Soil organic carbon estimates in young, post-agricultural forest of NJ by physiographical region.
3. Quantification of the capacity to sustainability produce wood based biomass renewable energy.
4. Identification and description of carbon sequestration projects that could serve as models for future initiatives.
5. Potential income estimates from the sale of carbon offsets and Class 1 renewable energy certificates

This valuable resource provides not only baseline data regarding forest carbon and carbon sequestration options for NJ, but will also help guide forest management and stewardship practices focused to mitigate climate change.

Data Gaps
The NJ Statewide Forest Resource Assessment makes an attempt to be comprehensive however data gaps still exist and became apparent during the development of the document. Throughout the document, generalizations are made about NJ's forest resources as a whole. It is important to note that even where there are clear patterns statewide that individually, the forests of New Jersey have tremendous variability from site to site. Considerations such as the "average tree" or "average forest" in NJ are tools that are used in order to make an attempt to better visualize a very complex resource with the understanding that the "average tree" may not actually exist on the landscape in a physical sense. Natural resource assessment is a dynamic process that is ongoing because the resource itself is always in a state of flux. It is inevitable that as more questions are answered, that more will arise calling for the collection of additional and ever changing knowledge of the resource on many levels.

The US Forest Service, FIA online database known as FIDO was consulted throughout the assessment. This data is very helpful when evaluating forest resources statewide. However it is important to note that as society's values and priorities have changed, so too has the data that is collected and considered important. FIA data sets collected prior to 1999 in NJ focused primarily on the commercial aspects of the resource and therefore focused on NJ's timberlands and growth, mortality, and removals of growing stock trees, rather than all trees across all forested lands. This is why some of the comparisons made across multiple sets of FIA data from different years are restricted to timberlands and/or growing stock trees. As of 2004, the FIA started conducting annual inventories of NJ's forested lands. As adjustments are made to the new data sets, some of the data was not available at the time of the assessment. Data newer than 2006 was not available at the start of the Assessment. Growth, mortality, and removals are not yet available on FIDO from 2004 forward.

As the needs for information regarding the forest resource become more complex in order to take into a growing number of considerations such as biodiversity, ecosystem resilience, climate change, etc. Forest management planners and stakeholders will have to wrestle with how to obtain data that can scale from forest or site level with data sets regarding the state as whole, as well as the rest of the country and possibly the globe. One of the values that have gained significant importance in understanding the forest resource as a whole is a greater need for knowledge of understory species beneath the overall tree cover. This data tends to be quite variable and is difficult to summarize statewide. However, multiple state agencies collect this data. Scalability of this data should be considered. Likewise, data regarding succession at the landscape level versus at the site level in the face of changing conditions tends to be rather speculative. Characterization of desirable forest patch size has also been particularly difficult for resource planners in the face of many varied and changing values towards land use. In

the face of global climate change, there is a demand for greater information regarding the carbon sequestration value of forests and biomass. The collection and interpretation of this information is still developing.

Other data sets are still in the process of being created at the time of the development of the Assessment, such as newer watershed-level land-use/ land-cover data. Inventories of state-owned forested lands are ongoing.

Statewide Forest Resource Assessment and Resource Strategies Summary:
This document has provided baseline data for forest resource planning using the Criteria & Indicators for measuring sustainability. The information discussed related to critical topics including biodiversity, forest composition, forest health, and carbon sequestration has given the status of our urban, exurban and rural forests. By knowing what current conditions are, management decisions have been made to enhance, maintain and expand the forest resources and the benefits they provide for future generations.

While this document focuses on large-scale areas and issues of concern, individual management plans and strategies are being developed to focus on specific issues. During development, many if not all C&I will be addressed in order to build upon the current available data sets and to provide guidance on where data is needed. Through these efforts existing and projected metrics will enable comprehensive planning on a state, regional and national scale.

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Appendix

NJ Forest Type-groups by Forest Type, US Forest Service, FIA 2006									
Forest Types	Forest Type Group								
	loblolly/shortleaf pine	other eastern softwoods	oak/pine	oak/hickory	oak/gum/cypress	elm/ash/cottonwood	maple/beech/birch	other hardwoods	nonstocked
shortleaf pine	X								
pond pine	X								
pitch pine	X								
eastern redcedar		X							
eastern white pine/northern red oak/white ash			X						
eastern redcedar/ hardwood			X						
other pine/ hardwood			X						
post oak/ blackjack oak				X					
chestnut oak				X					
white oak/red oak/ hickory				X					
white oak				X					
northern red oak				X					
yellow-poplar/ white oak/ northern red oak				X					
sassafras/ persimmon				X					
sweetgum/yellow-poplar				X					
scarlet oak				X					
yellow-poplar				X					
black walnut				X					
black locust				X					
chestnut oak/ black oak/scarlet oak				X					
cherry/white ash/ yellow-poplar				X					
elm/ash/black locust				X					
red maple/oak				X					
mixed upland hardwoods				X					
sweetgum/nuttall oak/willow oak					X				
Atlantic white-cedar					X				
sweetbay/swamp tupelo/red maple					X				
black ash/ American elm/red maple						X			
river birch/ sycamore						X			
sugarberry/ hackberry/elm/ green ash						X			
silver maple/ American elm						X			
red maple/lowland						X			
sugar maple/beech/ yellow birch							X		
black cherry							X		
hard maple/ basswood							X		
red maple/upland							X		
other hardwoods								X	
nonstocked									X

Forest type-groups vs Forest types