

NJ Biology Technical Note: Forest Management in Disturbance-Dependent Pinelands Habitats

Introduction

The Pinelands region of southern New Jersey includes 1.1 million acres of pine/oak uplands, Atlantic white-cedar swamps, pine plains, savannas, and streams. It spans all or part of seven counties (Ocean, Atlantic, Burlington, Camden, Gloucester, Cumberland and Cape May) and makes up approximately 22 percent of the entire state. Pinelands habitats are characterized by sandy and nutrient-poor soils, tea-colored waterways, and fire-adapted biota. In 1978, the Pinelands National Reserve, the first national reserve in the country, was created to protect the integrity of this unique ecosystem, the rare and endangered plants and animals that inhabit this area, and the sensitive water resources that underlie the region's sandy soils.

Rich in natural and cultural history, this area relies heavily on disturbances to the natural forests to maintain biodiversity and ecosystem health. The Pinelands has been largely shaped by natural and man-made disturbance, including fire, flooding, windstorms, agricultural practices, and timber harvesting. Although the Pinelands region is largely undeveloped, the frequency and intensity of these disturbances have changed over time, resulting in different effects on species composition and ecosystem structure. Approximately two thirds of the Pinelands are privately owned, and proper management of forested land is crucial for the protection of these unique habitats.

Why Is Forest Management Important in the Pinelands?

Disturbance of natural habitats is one of the most crucial aspects to maintaining the unique mosaic of Pinelands ecosystems. Many plants and animals that inhabit the Pinelands have adapted to withstand wildfires, flooding, and other disturbances, while several even require fire to reproduce and regenerate. When a habitat is disturbed, the structure is altered, which helps maintain a healthy cycle of succession. Soil conditions may change and light availability will often increase, providing many plant species the opportunity to regenerate. Different wildlife species will also benefit from certain changes in the habitat, such as the creation of standing snags or exposure of mineral soils.



This Pinelands forest is being managed under a Forest Stewardship Plan to increase ecosystem health, reduce fuel, and improve habitat for rare plants and animals (Kristen Meistrell, NJA)

Historically, wildfires were relatively large and frequent, with some literature suggesting that fire in pitch pine or pine-shrub oak-dominated stands reoccurred at intervals ranging from 5 to 25 years. The average area burned before the 1940s was around 110 acres per fire, but each wildfire was extremely variable. After 1940, the average fire was approximately 15 acres in size, and each fire was very similar in size and intensity. The decrease in size and variability can largely be attributed to suppression and pre-suppression efforts correlating to increased development in the region.

Prescribed burning and other forestry practices that mimic the results of natural disturbances can have several ecological, economic, and recreational benefits, including:

- Decreasing fuel sources that would otherwise contribute to intense, hard-to-control wildfires
- Maintaining biodiversity by promoting regeneration of disturbance-dependent plants
- Increasing forest stand health by removing competitive vegetation

- Creating open canopy habitat that is necessary for the survival of several species
- Preventing a shift in plant composition to later-successional ecosystem types (e.g. oak dominant)
- Increasing resistance to disease and insect outbreaks by promoting healthy tree growth
- Improving recreational opportunities and aesthetics

Although fire and disturbance are important components for maintaining the ecosystems of the Pinelands, it's essential to maintain safety and prevent property damage for the 700,000 residents of this area. Fortunately, proper forest management techniques can improve both ecosystem health and the safety of nearby residential areas.

Management Options

Depending on the landowner's goals and objectives as well as the habitat types present, management can be guided by a Forest Stewardship Plan drafted by an approved forester or natural resource professional. The Forest Stewardship Plan will reflect the guidelines in the New Jersey Pinelands Commission's *Recommended Forestry Management Practices* manual. Forestry work done in the Pinelands may also be regulated under the New Jersey Pinelands Commission's Comprehensive Management Plan. Silvicultural techniques that can enhance biodiversity and ecosystem health include:

- Prescribed burns
- Selective cutting and felling
- Girdling
- Herbicide application
- Tree and shrub establishment

Depending on the existing fuel loads, selective cutting may be a necessary first step before using controlled burns. Although these managed burns are very effective in the Pinelands, implementation requires special training, specific weather conditions, and a permit from the New Jersey Forest Fire Service. In addition to these general management options, certain techniques can be used to



Open savannas provide valuable resources to rare and endangered plants and animals, including the endangered bog asphodel (Rick Radis, NJA)

enhance specific habitat types and to meet the needs of rare and endangered plants and animals. The following ecosystem types have been defined in the Pinelands Comprehensive Management Plan as well as the New Jersey Pinelands Commission's *Recommended Forestry Management Practices* manual.

Oak-Dominated Uplands

This habitat type is characterized by low fire frequency with a plant community dominated by several oak species, including post oak (*Quercus stellata*), black oak (*Quercus velutina*), and scarlet oak (*Quercus coccinea*). These ecosystems are normally found at the margins of the Pinelands and are an important habitat for many wildlife species. Wildfire frequency is typically lower than in pine-dominated forests; however, infrequent prescribed burns can be beneficial for maintaining ecosystem health and diversity. Selective cutting, herbicide application, and girdling can also be used to reduce competition, enhance forest regeneration, and promote tree vigor.

Pine-Dominated Uplands

As one of the most abundant upland habitat types in the region, pine-dominated forests have been shaped by moderate to frequent fire events. Pitch pine (*Pinus rigida*) makes up approximately 50 percent of the basal area in these forests; this species has physiological characteristics, such as serotinous cones and the ability to sprout from dormant buds, that give it a competitive advantage over other trees in ecosystems that regularly experience fire. Broadleaf trees, primarily black oaks (*Q. velutina*) and post oaks (*Q. stellata*), are present in this forest type; however, due to the moderate fire frequency, oaks are significantly less common in these areas. A dense shrub layer composed of various heaths, including black huckleberry (*Gaylussacia baccata*) and lowbush blueberry (*Vaccinium angustifolium*), is typically present in these forests. Prescribed burns integrated with selective removal of competitive vegetation can be an important tool for managing these habitat types. Selective cutting can mimic



The pygmy pine plains, shaped by frequent and severe wildfires, rarely reach a height above 6 feet (Rick Radis, NJA)

some of the effects of a severe wildfire and this step, often accompanied by chipping or removal of some of the downed trees, may be advisable prior to a prescribed burn to help reduce fuel loads and create safer fire conditions. Prescribed fires require specific conditions, special training, and are not recommended for all situations.

Pine-Shrub Oak Uplands

Dependent on moderate to high fire frequency, pine-shrub oak uplands consist mainly of pitch pine (*P. rigida*), blackjack oak (*Quercus marilandica*), and scrub oak (*Quercus ilicifolia*). This habitat type is a mosaic of open, bare mineral soils and an open canopy of pines and oaks. The shrub layer is somewhat sparse, and the understory is comprised of early successional herbaceous species. Proper habitat management is crucial to preserve species composition and vegetative structure. Tree thinning, brush mowing, and prescribed burns can be used to maintain the open canopy characterized by these ecosystems. Depending on site conditions, selective cutting may be necessary before a prescribed burn. Once the habitat has been thinned and fuels are manageable, an integrated plan of different fire intensities can be implemented to maintain ecosystem structure. Because of the sensitivity of certain plants and animals, it is important to refer to the Pinelands Comprehensive Management Plan before implementing any forestry practices.

Pine Plains Uplands

Also known as pygmy pine forests, pine plains consist of pitch pines (*P. rigida*) and blackjack oaks (*Q. marilandica*) that rarely reach a height above six feet. Worldwide, the largest contiguous acreage of this rare and unique forest community can be found in New Jersey, spanning more than 3,000 acres. This area's long history of frequent and severe fires has shaped the unique characteristics of this habitat type. Bare mineral soil is abundant and is typically colonized by pyxie moss (*Pyxidantha barbulata*), golden heather (*Hudsonia ericoides*), and the rare broom



Atlantic white-cedar typically forms dense, even-aged stands (John Parke, NJA)

crowberry (*Corema conradii*). Integrating fuel reduction techniques with low-intensity fires, and eventually using higher-intensity burns, can help maintain this rare plant community. Creating soil disturbances by bulldozer scraping can also help mimic a severe burn until a larger prescribed fire is appropriate. In areas containing broom crowberry, it is important to consult the appropriate natural resource professional for assistance.

Savanna and Grassland Uplands

These habitat types are characterized by a dominant grassy herb layer with either widely spaced trees forming an open canopy (savanna) or no trees (grassland). Dry grasslands and savannas are typically the result of natural or man-made disturbance, such as an intense fire, frequent fire, or agricultural practices that create early successional habitat characteristics. Areas that encountered an extreme wildfire, were at one time cleared for agricultural purposes, or are burned annually may sometimes succeed to grassland habitat in the Pinelands. This ecosystem type can provide crucial resources to many rare and endangered animals, including the state threatened frosted elfin (*Callophrys irus*). Fire, selective cutting and felling, herbicide application, and girdling can be applied to remove competitive or encroaching vegetation in these habitats.

Atlantic White-cedar Swamps

Valued for its excellent timber quality, Atlantic white-cedar (*Chamaecyparis thyoides*) has become increasingly rare throughout the Eastern United States due to overexploitation. This forested wetland is characterized by even-aged, dense stands dominated by Atlantic white-cedar with few hardwood trees and pitch pines (*P. rigida*) scattered throughout. These swamps provide valuable resources to many rare and endangered plants and animals, including curly grass fern (*Schizaea pusilla*), swamp pink (*Helonias bullata*), and Hessel's hairstreak (*Callophrys hesseli*). Atlantic white-cedar is not fire tolerant, but disturbance, such as fire, flooding, or windstorms, does play a major role in regeneration. The seedlings require ample sunlight in order to grow, so clearings in mature stands can provide optimal conditions for regeneration. In an existing stand, strips or patches can be cleared, followed by natural regeneration or artificial planting. In some instances, new cedar stands can be established in areas that provide proper site conditions. When preparing an area for regeneration, it is important to remove existing vegetation, and typically a deer exclosure fence is needed to prevent overbrowse. Natural regeneration can occur if a seed source is nearby, but in some instances it may be necessary to obtain seedlings from a local nursery. It is important to monitor seedling growth and to control any competitive vegetation with mechanical or herbicide treatments. In mature stands, selective removal of

competitive vegetation by cutting, girdling, or herbicide application can help improve tree vigor. In some cases, harvested timber can be used for wood products; this may be regulated by the New Jersey Pinelands Commission's Comprehensive Management Plan. Guidelines for best management can also be found in the New Jersey Division of Parks and Forestry's *New Jersey Forestry and Wetlands Best Management Practices Manual* and the *Atlantic White-cedar Ecology and Best Management Practices Manual*.

Pitch Pine Lowlands

This forest type is generally dominated by pine, but also contains many moisture-loving plants, including red maple (*Acer rubrum*), highbush blueberry (*Vaccinium corymbosum*), and sweet pepperbush (*Clethra alnifolia*). In some areas, sphagnum moss (*Sphagnum* spp.) may cover the understory, creating a deep layer of organic material. These forests generally lie at or near the water table, but can sometimes seem drier than neighboring cedar swamps and herbaceous wetlands. Pitch pine is typically the dominant tree species in these areas, and disturbance plays an important role in restoring these habitats. In order to enhance ecosystem health and maintain diversity, selective cutting, felling, herbicide application, and girdling of competitive vegetation can be applied. Prescribed burns can then be used to maintain vegetative structure and forest health. Certain lowland plant communities are considered globally rare, including communities containing sand myrtle (*Leiophyllum buxifolium*) or certain reed grass species (*Calamovilfa* spp.), so it is important to refer to the Pinelands Comprehensive Management Plan and the *New Jersey Forestry and Wetlands Best Practices Manual* for guidance.

Hardwood Swamps

Hardwood swamps are not typically shaped by disturbances with the exception of natural fluctuations in the water table, but some forest stand improvement techniques can be implemented to increase ecosystem health and diversity. Generally located within floodplains,

these habitats are characterized by moisture-loving plants such as black gum (*Nyssa sylvatica*), red maple (*A. rubrum*), and highbush blueberry (*V. corymbosum*). Hardwood swamps provide critical habitat for many neotropical migrants and other rare and endangered species. To promote tree vigor, improve water quality, and preserve vegetative structure, a landowner can selectively remove competing vegetation by cutting, girdling, or herbicide application. Work conducted in wetlands may be subject to special wetland regulations; as with any forestry practice implementation, it is important to refer to state and Pinelands regulations. In some instances, a hardwood swamp can be converted to an Atlantic white-cedar stand, but regulations may apply. Before implementing such a project, it is important to review habitat on the landscape level and consider the site conditions and the species that occupy the area.

Savanna and Grassland Wetlands

Although small in acreage, wetland savannas and grasslands are rich in plant diversity and support a wide range of rare and endangered animals. Several species of orchids, carnivorous plants, and other rare plants, such as the curly grass fern (*S. pusilla*) and bog asphodel (*Narthecium ossifragum*), inhabit these areas. Sections of these wetlands that include Pine Barrens reed grass (*Calamovilfa brevipilis*) may support one of the largest populations of the endangered arogos skipper (*Atrytone a. arogos*). Disturbance such as fire and flooding play an important role in maintaining the open conditions that are critical for the survival of many plants and animals. Selectively removing encroaching trees by cutting, girdling, or herbicide application along with prescribed burns can help maintain these habitats. Additional caution and restrictions should be exercised when using heavy equipment and herbicides in and around wetlands.

Management Considerations for Select Rare and Endangered Species

The Pinelands region supports a wide variety of rare and endangered species, hosting some of the largest



(From left to right) The swamp pink (Mike Crewe, NJA), bog asphodel (Rick Radis, NJA), sand myrtle (John Parke, NJA), and Pine Barrens gentian (Rick Radis, NJA) are all unique plants that thrive in the harsh conditions of the Pinelands.



(From left to right) The threatened red-headed woodpecker (© Michael Hogan), the endangered corn snake (Kristen Meistrell, NJA), the threatened northern pine snake (© Nick Scobel), and the endangered timber rattlesnake (Kristen Meistrell, NJA) are all species that inhabit disturbance-dependent ecosystems.

populations of these plants and animals found throughout their range. When implementing a Forest Stewardship Plan, it is important to consider strategies to either minimize any negative potential impacts to these species, or to improve habitat conditions. Below are some general habitat characteristics needed for certain wildlife species that may exist in disturbance-dependent ecosystems listed in this document. It may be useful or necessary to consult the appropriate state or federal wildlife agency, such as the New Jersey Endangered and Nongame Species Program (ENSP) or the U.S. Fish and Wildlife Service (USFWS) before implementing habitat management practices for these species.

Red-Headed Woodpecker (*Melanerpes erythrocephalus*)

Threatened in New Jersey, the red-headed woodpecker thrives in open forest wetlands and uplands, often created by natural disturbance. This species requires dead snags for nesting and an open shrub layer for foraging during the breeding season. In the winter, an area with ample forage and mast production is crucial for the survival of this species. Preserving and creating snags by girdling select trees is recommended to create crucial nesting habitat.

Corn Snake (*Elaphe guttata*)

This secretive snake is endangered in New Jersey and reaches its northernmost extent in the Pinelands. It requires mature, dry pine/oak forests with a moderately dense shrub layer and plenty of forest openings for basking and foraging. Nesting and overwintering activities can take place within old stumps, logs, old railroad ties, or ground burrows, so leaving debris in or near cleared canopy openings is optimal for this species. In areas with known or potential den sites, restrict the use of heavy machinery and avoid disturbing soil and root structure.

Timber Rattlesnake (*Crotalus horridus*)

One of two venomous snakes in New Jersey, the state endangered timber rattlesnake occurs in the Pinelands, the Highlands, and the Ridge and Valley regions of the state. In the Pinelands, this species uses Atlantic white-cedar swamps and stream corridors as overwintering sites. During the active season (April through October), large contiguous forests with some canopy openings can provide this species with ample foraging and basking habitat. Preserving forest debris and enhancing vegetative cover for hunting activities is recommended. In areas with known or potential den sites, restrict the use of heavy machinery and avoid disturbing soil and root structure.

Timber rattlesnakes are considered passive animals, but may become defensive when threatened. If you happen to encounter a timber rattlesnake, do not attempt to handle or relocate it. Move to a safe distance and call NJ ENSP at 1-877-WARN-DEP for assistance.

Northern Pine Snake (*Pituophis m. melanoleucus*)

As one of the largest snakes in New Jersey, the state threatened Northern pine snake can be found in the Pinelands region. This extent of their range is relatively isolated from other populations in the Southern region of the United States, so protecting this species is critical. The northern pine snake requires dry, upland pine/oak forests and plenty of canopy openings and exposed mineral soils with little vegetative cover for nesting. This species is a fossorial nester, digging through the sand to lay their eggs underground. Overwintering sites are typically found near nesting sites; however, these areas may have more vegetative cover than nesting sites. Preserving forest debris and stumps during forest activities is recommended for this species. In areas with known or potential den and nest



(From left to right) The rare Hessel's hairstreak (© Chris Davidson), endangered arogos skipper (© Kevin Keating), threatened Pine Barrens treefrog (© Brian Zarate), and threatened frosted elfin (© David Amadio) are all unique species that reside in a variety of Pinelands habitats.

sites, restrict the use of heavy machinery and avoid disturbing soil and root structure.

Pine Barrens Treefrog (*Hyla andersonii*)

Threatened in New Jersey, the Pine Barrens treefrog is a vibrantly colored amphibian that has adapted to breed and survive in the acidic conditions of the Pinelands. Although this species does exist throughout the Southern region of the United States, the isolated population of New Jersey may serve as the stronghold for this species. They inhabit many wetland areas, including Atlantic white-cedar swamps, pitch pine lowlands, and herbaceous wetlands, but prefer to breed in early successional ponds, wetlands, and seeps with a high vegetative structure. Preserving breeding pools is crucial for the persistence of this species, so precautions should be taken when conducting any forestry activities near a potential breeding site.

Arogos Skipper (*Atrytone a. arogos*)

As a state endangered butterfly, the arogos skipper can be found in two isolated populations in New Jersey and persists throughout the eastern United States in small, disjunct populations. The habitat used by the arogos skipper varies regionally, but in the Pinelands it consists of post-burned wetlands with an abundance of its host plant, Pine Barrens reed grass (*Calamovilfa brevipilis*). Because this species has specific habitat requirements, additional precautions should be considered when working in savanna wetlands. Removing encroaching trees and shrubs is recommended to maintain open conditions.

Frosted Elfin (*Callophrys irus*)

The frosted elfin is a state threatened butterfly that occurs in scattered populations across the eastern United States. It prefers dry grasslands and savannas that contain its host plant, wild indigo (*Baptisia australis*), which thrives after wildfires. Mowing, controlled burns, and select removal of encroaching trees and shrubs are the best way to maintain early successional habitat for this species.

Hessel's Hairstreak (*Callophrys hesseli*)

This highly specialized butterfly is considered a species of special concern in New Jersey and is found within a small band along the East coast. It is found exclusively within Atlantic white-cedar stands, typically near areas with abundant nectar plants. Eggs are laid on cedar trees while the caterpillars feed on its foliage. Preserving, enhancing, and creating Atlantic white-cedar stands are highly recommended for the survival of this species.

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