Pine Barrens

Photo by Pete Bowman

Acres in NH:	8099
Percent of NH Area:	<1
Acres Protected:	3240
Percent Protected:	40

Habitat Distribution Map

Habitat Description

Pine barrens are early-successional habitats occurring on northeastern coastal sand plains or on sandy, glacial outwash deposits of major river valleys (Howard et al 2005). Soils are acidic, droughty, nutrient-poor, and excessively well-drained. In New Hampshire, pine barrens are dominated by pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia*) and form a matrix of dense scrub oak thickets and heath barrens interspersed with pockets of pitch pine forest and grassy openings (Sperduto and Nichols 2011). This structural and compositional heterogeneity is in constant flux, a process maintained by frequent disturbances such as wildfire. Fires occur naturally and regularly in pine barrens, with lightning serving as the primary ignition source (Howard et al 2005). These fires are able to spread rapidly across the community's flat expanse of dry, fire-prone vegetation (Howard et al 2005). Lee sides of habitat features, such as eskers, rivers, and slopes act as natural firebreaks, creating variation in species composition as well as vegetational age distributions (Howard et al 2005).

The two variants of the pitch pine-scrub oak woodland community occurring in New Hampshire are the Merrimack Valley variant and the Ossipee variant (Sperduto and Nichols 2011). The Merrimack Valley variant occurs in the Concord pine barrens and occupies Windsor sandy loams and Hinckley cobbly sandy loams (VanLuven 1994), both deposits of the post-glacial Lake Merrimack (Sperduto and

Nichols 2011). This variant is characterized by a high diversity of both common and rare vascular plants, including wild lupine (*Lupinus perennis*), clasping milkweed (*Asclepias amplexicaulis*), and New Jersey redroot (*Ceanothus americanus*) (Sperduto and Nichols 2011). The Ossipee variant occurs in the Ossipee pine barrens, occupying deep outwash deposits between Ossipee and Silver Lake (Sperduto and Nichols 2011). Less diverse than the southern variant, the Ossipee variant is instead associated with more northern plant species such as red bearberry (*Arctostaphylos uva-ursi*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), and blue ground-cedar (*Diphasiastrum tristachyum*) (Sperduto and Nichols 2011).

Justification (Reason for Concern in NH)

Pine barrens are among the most imperiled communities in the world (Raleigh et al 2003). Throughout the thousands of years of their existence, pitch pine-scrub oak woodlands have significantly contributed to the biological diversity of the northeast (Howard et al 2005). These communities support a suite of species that are regionally and globally rare (Howard et al 2005). Of the rare fauna occurring within them, the largest assemblage is Lepidoptera, as demonstrated in New Hampshire (VanLuven 1994). Of the 726 Lepidoptera species collected in the Concord pine barrens, 4 are globally imperiled and 37 are rare to the state, including the federally and state endangered Karner blue butterfly (*Lycaeides melissa samuelis*) as well as the state endangered frosted elfin (*Callophyrus* [*Incisalia*] *irus*) and persius duskywing skipper (*Erynnis persius persius*) (VanLuven 1994, Chandler 2001, Sperduto and Nichols 2011). A large proportion of these Lepidopteran fauna are exclusively dependent on blue lupine and other plants restricted to pine barrens (Sperduto and Nichols 2011). The Ossipee pine barrens lacks the level of Lepidopteran diversity found in its southern counterpart, although it does support the only New England occurrences of the pine pinion moth (*Lithophane lepida lepida*), and the Acadian swordgrass moth (*Xylena thoracica*) (Sperduto and Nichols 2011).

Pine barren communities also serve a role in the life histories of a number of vertebrates, a relationship based on edaphic and structural features, rather than host plant specificity (Howard et al 2005). These species include approximately 50% of northeastern birds, almost 60% of northeastern mammals, and a number of reptiles and amphibians (Howard et al 2005).
Historically, pine barrens provided the array of distinctive habitat features required by their associated fauna (Howard et al 2005). However, with increased fire suppression during the last half-century, this habitat's natural course of succession has been severely disrupted (Howard 2003). Reduced intensity and frequency of natural disturbance caused the pitch pine-scrub oak woodland to advance into a closed pitch pine-scrub oak forest, eliminating structural elements critical to the long-term viability of indigenous species populations (Raleigh et al 2003, Howard et al 2005). Moreover, urban development has added to the effects of fire suppression, further reducing the extent of pitch pine-scrub oak woodland communities (Howard et al 2005). The result has been significant habitat loss and fragmentation in systems that were historically large and contiguous (Howard et al 2005).

Protection and Regulatory Status

Federal

National Plant Protection Act: promotes the preservation of wild lupine, clasping milkweed, and golden heather (Hudsonia ericoides) on state lands, but provides no protection on private property (VanLuven 1994)

State

New Hampshire Native Plant Protection Act of 1987.

Local
Concord Municipal Airport Development and Conservation Management Agreement: restricts development within designated conservation zones, authorizes the New Hampshire Fish and Game Department, the Department of Resources and Economic Development, the New Hampshire Army National Guard, and the United States Fish and Wildlife Service to undertake management actions to provide and enhance essential habitat for federally and state listed threatened and endangered species of Lepidoptera.

Distribution and Research

Pine barrens are predominantly restricted to New Jersey, though regionally rare examples occur in Maine, New Hampshire, Massachusetts, Pennsylvania, and New York (Howard 2003). In New Hampshire, this habitat is limited to the Sebago-Ossipee and Gulf of Maine Coastal Plain ecoregion subsections (Sperduto and Nichols 2011). The Ossipee pine barrens is located within the towns of Ossipee, Tamworth, Freedom, Madison, and Effingham, at an elevation range of 137-152m (Howard 2003). Its estimated historic extent encompassed over 2,833 ha (7,000 ac), which has since been reduced to about 1,214 ha (3,000 ac) (Howard 2003). The Concord pine barrens occurs within the city of Concord at an elevation of 105m. Its distribution once covered approximately 1,821 ha (4,500 ac) along the Merrimack River from Concord south to Nashua, of which only 227 ha (563 ac) re-main today (VanLuven 1994).
Areas requiring further research include historical distribution, geologic and ecological processes contributing to the formation of pitch pine-scrub oak woodland communities, distribution and condition of populations of pine barrens-dependent fauna, and the role of land-use history in maintaining and/or promoting the establishment of pitch pine-scrub oak woodland habitat.

Relative Health of Populations

Good examples of pitch pine-scrub oak woodlands in New Hampshire occur in the Concord pine barrens (Concord) and the Ossipee pine barrens, (Freedom, Madison, Ossipee, and Tamworth), with the Ossipee pine barrens being considered the largest and most pristine pitch pine-scrub oak woodland community in the state (Howard 2003, Sperduto and Nichols 2004). A small, heavily managed population of Karner blue butterflies exists in the Concord pine barrens, and populations of other lepidopteran species associated with this habitat are found in both the Concord and Ossipee pine barrens. The Ossipee pine barrens support the largest concentration of Eastern Whip-poor-wills in the state, as well as significant populations of several other species of shrubland-dependant birds (Hunt 2013).

Habitat Condition

A set of GIS data was used to assess ecological condition of each habitat type. Chapter 3 describes the methodology. The data used for this habitat is described below.

Biological Condition:
Species richness of rare animals within their dispersal distances
Richness of rare and exemplary natural communities
Species richness of rare plants by landform and elevation zone
Vertebrate species richness (VT/NH GAP Analysis)

Landscape Condition:
Landscape Complexity

Local Connectedness
Similarity of habitat within 5km
Size of unfragmented block within which matrix forest is located

Human Condition:
Index of Ecological Integrity

Habitat Management Status:

Current habitat management and restoration techniques used in the Concord pine barrens include native plant propagation, vegetation management using specialized mowers and feller bunchers, and prescribed fire. Habitat monitoring is completed before and after management implementation. The goal is to create a shifting mix of native grassland, shrubland, and woodland features (Fuller et al. 2003).

The Nature Conservancy has been actively managing the Ossipee pine barrens since 2007 including mechanical treatments to create firebreaks and remove unwanted vegetation, and prescribed burning. The intent is to maintain, enhance, and restore ecological processes vital to the overall function of the pitch pine-scrub oak woodland community (Raleigh et al 2003).

Threats to this Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat degradation from catastrophic fire (Threat Rank: Medium)

Without a regular fire regime, fuels have accumulated, increasing the risk of high intensity wildfires inappropriate to pine barrens regeneration. Changing climate may also modify the existing rate and severity of disturbance events such as fire.

Refugia are needed within the landscape to protect Lepidoptera populations (Swengel and Swengel 2007). Refuges have three main functions in relation to fire: they enhance immediate survival during a fire event, facilitate the persistence of individuals and populations after fire and assist with re-establishment of populations in the longer term (Robinson et al. 2013).

Habitat degradation and mortality from a lack of fire that leads to loss of constituent plant species (Threat Rank: Medium)

Due to the xeric soil, flammable pine litter, and flat terrain on which they occur, pine barrens have been subject to frequent wildfires (Howard 2003). The absence of such disturbance, combined with the natural processes associated with succession, have caused the community composition of pitch pine-scrub oak woodlands to shift into a closed-canopy forest dominated by fire intolerant hardwoods (Howard et al 2005).

In the northeast, pitch pine-scrub oak woodland communities require periodic fire to persist (Wagner et al 2003). Fire suppression has been a major factor contributing to the decline of disturbance-dependent habitats throughout the northeast (Raleigh 2003). In the last half-century, natural fire

disturbance has been eliminated from both the Concord and Ossipee pine barrens systems, leading to a significant shift in community composition and structure (VanLuven 1994, Howard 2003). In Concord, the distinguishing mosaic of grassy openings, heath barrens, scrub oak thickets, and pitch pine woodlands no longer exists, as it has been replaced by medium-fire tolerant white pine and fire intolerant hardwoods (VanLuven 1994). Similarly, white pine and fire-intolerant hardwoods have substantially increased over the last 50 years in the Ossipee pine barrens and are predicted to soon be the dominant canopy species (Howard et al 2005).

Habitat impacts from inappropriate timber management (Threat Rank: Medium)

Selective cutting has been the dominant method for timber management over the past few decades. In a fire adapted forest such as pine barrens, this method may be inappropriate for maintaining a typical species composition resulting in a more hardwood dominated forest.

Cut unit size is the most important factor influencing landscape pattern in pine barrens due to the importance of large openings in the fire adapted system (Radeloff et al. 2006).

Habitat conversion from infrastructure development (Threat Rank: Medium)

It has been asserted that one of the major threats to pine barrens is habitat loss, primarily as a result of development (Howard et al 2005). Habitat features associated with these communities, such as level terrain, sandy soils, high stability, high permeability, and low compaction, make them optimal for commercial and residential development. Some species of vertebrates that use pine barrens can travel significant distances, requiring large blocks of contiguous habitat. A half-century of constant growth has resulted in a severe loss of habitat in communities that were historically large and contiguous (Howard et al 2005).

Throughout the northeast, nearly half of all known pitch pine-scrub oak woodland communities have been lost as a result of development and fire suppression (Jordan et al 2003). New Hampshire had at one time supported 4 such communities, including the Nashua, Manchester, Concord, and Ossipee pine barrens (The Nature Conservancy 2004). As in the remainder of the region, increased development and urban sprawl throughout the state drastically reduced the extent of these communities. Both the Nashua and Manchester pine barrens have been entirely altered, while a mere 10% of the historic Concord Pine Barrens and 30% of the Ossipee remain today (Helmbolt and Amaral 1994, The Nature Conservancy 2004).

Species impacts from fragmentation (Threat Rank: Medium)

As more patches are created isolation prevents dispersal of moth species eventually losing them at certain locations over time. Size of fragment affects the species that survive based on life history charactersitics.

Affinity of a species to forest habitat or less dtermines the size of fragment they will use ranging from hedgerow, small to large patches (Slade et al. 2013). Declines in species related to severity of fragementation also releated to the functional group - tree, shrub or grass forb feeding species (Schmidt and Roland 2006).

List of Lower Ranking Threats:

Habitat impacts from herbivory (deer browsing)

Habitat degradation and species impacts from introduced or invasive plants

Habitat degradation and species impacts from introduced or invasive plants

Species impacts and mortality from introduced animal species

Habitat degradation and species impacts from change of structure

Mortality (accidental) of species from recreational activity

Mortality of lepidoptera species from recreational activity

Mortality from the collection of individuals from the wild

Mortality from collecting lepidoptera species

Habitat degradation from the selective removal of species through mowing

Habitat impacts from shifts and changes in species composition

Habitat impacts from the fragmentation of remaining populations

Mortality related to development

Actions to benefit this Habitat in NH

Habitat Conservation

Primary Threat Addressed: Habitat conversion from infrastructure development

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

General Strategy:
Identify remaining patches of pine barrens and potential pine barrens sites in Ossipee and Concord for future protection. Protection plan should also include the intent to manage the parcel as needed to restore or maintain pine barrens on site.

Political Location: **Watershed Location:**

Habitat Mangament and Restoration

Primary Threat Addressed: Habitat degradation from a lack of fire that leads to loss of constituent plant species

Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:

General Strategy:
Habitat management will increase the distribution and abundance of pine barrens within their existing and historical range by restoring closed-canopy stands to an early-successional structure. Standard habitat management techniques including forestry, fire, and herbicide application have well-documented efficacy in reducing the cover of canopy-forming, shade-tolerant, and fire-sensitive species. Early-successional plant species abundance increases in response to a broad range of

vegetation management techniques (Smallidge et al. 1996). Management simulates natural and anthropogenic disturbance, creating areas of open or semi-open habitat interspersed with closed woodlands. In addition to maintaining open habitat structure, fire management releases scarce nutrients, exposes bare mineral soil, and stimulates flowering, germination, and seedling establishment of fire-adapted species, while serving to promote and maintain connectivity across the landscape (Wagner et al 2003). This continually changing heterogeneous landscape satisfies the microhabitat needs of a suite of indigenous species.

Political Location: **Watershed Location:**

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