Endangered Plants

Background

The native flora of New Jersey is an important component of its biological diversity. This diversity is diminished as species, populations, and habitats are lost from the state. Seventeen percent of New Jersey's native flora, which comprises more than 2,100 species, is currently classified as endangered. In New Jersey, an endangered plant species is one whose survival within the State or nation is in jeopardy.

New Jersey has a surprisingly high concentration of native plant and animal species relative to other states. Its native flora has representatives of more than 50% of the plant species found in the Northeast from Pennsylvania to Maine, despite the fact that it contains a mere 5% of the total land area of the region. Similarly, although it amounts to less than 0.26% of the total land area in the United States, and is the fourth smallest state in the nation, approximately 13% of the plant species in the US can be found in New Jersey.

In large part, this high diversity is due to the variety of habitats and landscapes. New Jersey is comprised of four physiographic provinces: Coastal Plain, Piedmont, Highlands and Ridge and Valley. These regions have distinct combinations of geologic, topographical and hydrologic features, which give rise to a wide range of environmental conditions and a tremendous botanical diversity.

The habitats and conditions that foster this diversity are the result of natural processes that have been taking place for millions of years. For this reason, the current distribution of many species is closely tied to the geological history of the region. The ranges of many rare NJ species reach their geographic limit in the state. Species such as the snowy orchid (*Platanthera nivea*) and seabeach evening primrose (*Oenothera humifusa*) are more typical of the southern flora, but reach as far north as Cape May and Ocean counties. Similarly, the ranges of northern species such as northern yellow-eyed grass (*Xyris montana*) extend as far south as the northern counties of the state. These species may be less abundant in New Jersey than in the more central portions of their respective ranges, but many have unique morphological or genetic characteristics due to their long-standing exposure to the unique set of environmental conditions present here.

Endangered plants are defined as native New Jersey plant species or subspecies whose survival in the state or nation is in jeopardy, including but not limited to plant species listed or proposed as endangered or threatened by the federal government under the Endangered Species Act of 1973, any additional species known or believed to be rare throughout its worldwide range, and any species having five or fewer extant populations within the state (N.J.A.C. 7:5C-1.1 et seq.). An extant population (also referred to as an occurrence) is one that still exists in the natural environment. Those species that are no longer found in a certain geographic area, but which are not globally extinct, are referred to as extirpated. The primary source of information regarding such species in New Jersey is the Department's Natural Heritage or Biotics Database, which contains information on the taxonomy, rarity, threats, protection, location and population data for all endangered plant species, plant species of concern, and extirpated plant species in New Jersey.

Pine barren savanna with globally rare bog asphodel (*Narthecium americanum*) in flower (David Snyder, 2021)

Status and Trends

The currently posted List of Endangered Plant Species and Plant Species of Concern,[1] last updated in June 2016, is based on information in the Natural Heritage Database, and includes all 818 native plant species tracked by the New Jersey Natural Heritage

Program as rare, representing 39% of the state's flora. Of these 818 rare plant species, 356, or 17% of the state's 2100 species of vascular and non-vascular plants, are codified at N.J.A.C. 7:5C as state endangered. The last time amendments were made to the endangered species list was in 2013, when 37 plants were added to the list and 20 plants were removed. The following examples using plant species on the list illustrate some observed trends in plant species rarity statewide. These examples highlight two iconic species of the New Jersey Pine Barrens. Many of the species native to this region of New Jersey evolved in response to a fire and disturbance regime that has been greatly altered in recent decades, resulting in increased habitat succession.

The single NJ population of chaffseed (*Schwalbea americana*) in Brendan T. Byrne State Forest, Burlington County, is the last of approximately 19 historic NJ occurrences, and one of only two remaining in the northern half of the species' range from Cape Cod, Massachusetts, to Fort Bragg, North Carolina. Road widening and reduction in periodic burning are responsible for the loss of some populations of this federally endangered species. Another factor is that until a few years ago, the biology of this species was poorly known. As a hemiparasitic species, chaffseed requires the presence of a host species if the seedlings are to thrive. In NJ, the identity of the preferred host species, Maryland golden aster (*Chrysopsis mariana*), and soils were first identified in 2006.[2]

Maryland Golden Aster (Fritz Flohr Reynolds, Wikimedia Commons, 2021)

By contrast, bog asphodel (*Narthecium americanum*) is found only in NJ, but is known to have over 50 populations. Many of these populations are found in the core of the Pinelands where the species may be locally abundant in its globally rare streamside savanna wetland habitat. Unfortunately, changes in the Pine Barrens savanna habitat are causing a decline in abundance and number of populations of bog asphodel. Recent research points to habitat succession and/or hydrological changes as the predominant causes of this decline. In particular, encroachment of Atlantic white cedar (*Chamaecyparis thyoides*) is reducing the suitability of the savannas for bog asphodel and other rare plant species.[3,4]

Bog Asphodel (Jason Hafstad, 2021)

Habitat loss is widely acknowledged to be the leading cause of species extinction and endangerment both in the nation and worldwide. Following these national and global trends, habitat loss and destruction caused by development and urbanization have been the major threats to endangered plant populations in New Jersey. Since most rare plants occur in wetland habitats, many of these species are also threatened by hydrological changes associated with development, climate change, and water consumption.

The proliferation of invasive nonindigenous plant species is also having a significant, and perhaps an irreversible, impact on rare plant populations, and this threat continues to increase in each succeeding year. New Jersey has been affected to an even greater degree than is typically found elsewhere, which is likely due to a longer history and greater intensity of development activities in the state in comparison to other states, and a much higher human population density.

The impacts associated with white-tailed deer have recently become much more understood. In many areas of northern NJ, deer populations are now 7-11 times their historical densities. In the 1970s, there were approximately 10 deer/mi^2; now the density is as high as 125 deer/mi^2.[5] The increasing deer population has been attributed to the absence of natural predators and large amounts of supplemental food resources provided by suburban and agricultural development.[5] Deer populations have been associated with severe declines in forest understory vegetation, as documented in a recent study showing that since the 1970s there has been a 70-80% decline in large tree seedlings and saplings, native woody shrubs and herbs.[6] At the same time, exotic invasive shrubs, herbs, and lianas have increased 5-40 times due to their increased use in ornamental plantings, as well as facilitation by deer browse, which suppresses the growth of competing native species.

Climate change is also having an effect on New Jersey's endangered flora. A 2013 analysis of 70 endangered plant species in two distinct regions of the State—the Skylands and the Pinelands—determined that 50 of these species were either extremely vulnerable (1 species), highly vulnerable (8 species), or moderately vulnerable (41 species) to climate alteration. The vulnerability classifications were based on the projected exposure of each species to the impacts of climate change, as well as each species' sensitivity to changes in climate. For example, the current range of some species overlaps entirely with areas that are anticipated to experience measurable changes in temperatures and precipitation. Other species are likely to be especially sensitive because of their biological requirements. Such species may depend on specific habitats that are limited in distribution, making it difficult for the species to disperse beyond its current range. The overall vulnerability ratings for each species were developed by combining the climate exposure and species sensitivity rankings.

Rare plant species will also be exposed to risks associated with sea level rise, increasing temperatures, and the expansion of invasive pest insects exacerbated by climate change. Endangered beach dwelling species such as seabeach amaranth (*Amaranthus pumilus*), seabeach knotweed (*Polygonum glaucum*), and seabeach sandwort (*Honckenya peploides*), all critically imperiled in New Jersey, are at risk of more frequent inundation and habitat loss as a result of sea level rise. Endangered species that reach their southern termini in northern New Jersey, such as rush aster (*Aster borealis*), are likely to experience poleward range shifts due to rising temperatures but will be limited in their ability to migrate due to strict habitat preferences. Furthermore, climate change will worsen the infestation of Eastern hemlock (*Tsuga canadensis*) by hemlock woolly adelgid (*Adelges tsugae*), a sap sucking insect. Eastern hemlock is an ecologically important species, regulating microclimate and soil moisture in both wetland and upland communities. The 2013 climate vulnerability analysis of rare plants included 41 species native to the northern Skylands region of the state that are averse to sudden changes due to strict habitat preferences, but there are over 120 rare plant species in northern New Jersey that exist in similar habitat types and are likely vulnerable to changes brought on by climate change.

There are several other factors that affect plant populations in New Jersey. Artificial changes in the fire regime, increased forest cover and density, flooding patterns, or depth of the water table can have profound effects on populations. Once the pattern of flooding or fire is altered, especially in places such as the Pinelands, the conditions limiting the growth of woody species are severely affected. As a result, there is often a loss of populations for those rare plant species that thrive in open habitats. For instance, some species, such as the chaffseed, are found only in open habitats and depend on fires to suppress the growth of trees and shrubs that would otherwise come to dominate the sites where it occurs.

It is also important to consider that many of New Jersey's rare plant species were never common or abundant. This is supported by the historical collection records obtained from examining herbarium specimens, some dating back 200 years or more. Some species occupy habitats or ecological communities that are themselves rare or unique. Other species occupy specialized niches, or are tolerant of extreme conditions or periodic disturbance, such as exposed cliff faces, rock outcrops, or dynamic coastal sand dunes. For this reason, the Department's Natural Heritage Program focuses its resources on monitoring and, if possible, managing rare plant occurrences with the goal of maintaining viable populations in their native habitats, especially those found on state-owned lands and waters.

In 2013, three species were added to the endangered plant species list that are considered by the Department to be globally rare. Globally rare species are defined as those found at 80 or fewer locations worldwide. These three species included mountain doll's-daisy (*Boltonia montana*), Pine Barren spike-rush (*Eleocharis olivacea* var. *reductiseta*) and New Jersey dewberry (*Rubus novocaesarius*). Mountain doll's-daisy occurs at fewer than 10 documented locations in Sussex and Warren counties in New Jersey and is only extant elsewhere in the Appalachian Mountains of Virginia, where it is known from fewer than five documented extant occurrences. The worldwide distribution of Pine Barren spike-rush is restricted to freshwater intertidal rivers within southern New Jersey, with 15 documented records in the Natural Heritage Database, of which only three are currently confirmed to be extant. The worldwide distribution of New Jersey dewberry is restricted to a single occurrence in Cape May County. Both New Jersey dewberry and Pine Barren spike-rush are endemic to New Jersey and found nowhere else in the world.

Figure 1 shows the status of plant populations in NJDEP's Natural Heritage Database as of 2017. Among the 356 state endangered plant species, 1,079 populations were verified as extant. A total of 407 populations were reported to

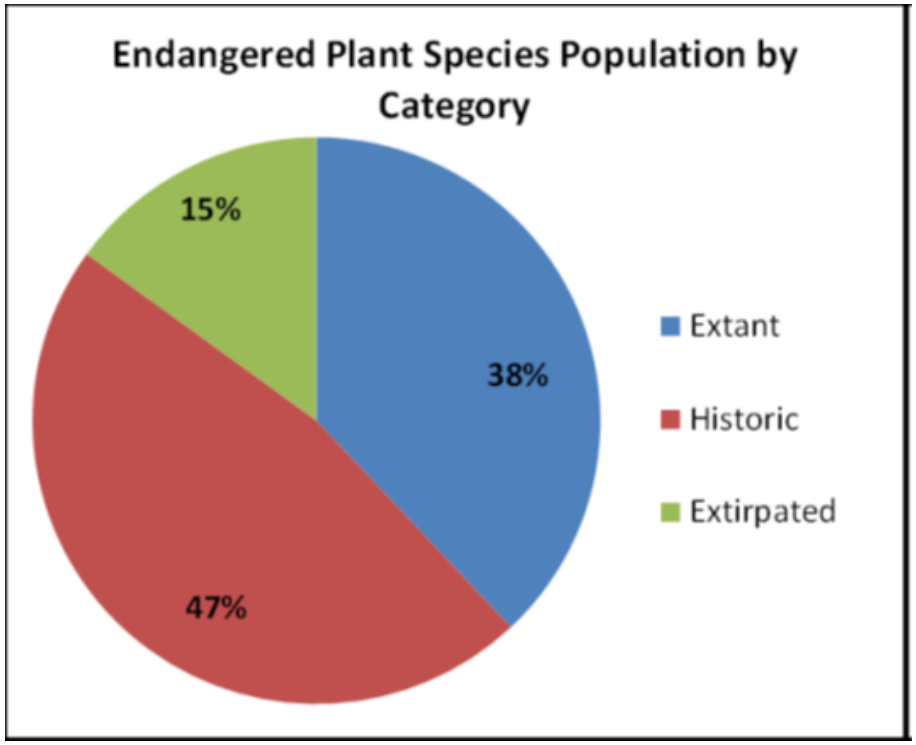

Figure 1: Extant, historic and extirpated endangered plant species populations in the Natural Heritage Database.

have been extirpated, meaning there are no longer populations of these plants in New Jersey. Forty-seven percent of the occurrences (representing 1,317 populations) of state endangered plant species are only known historically. Although suitable habitat is believed to be present, these historical occurrences have not been observed recently.

Stalked woolgrass (*Scirpus pedicellatus*) is one of these historically known state endangered species that was rediscovered in 2018 along the banks of the Delaware River. Prior to this, the last documented sighting of this species was in 1918 in Sussex County. There are 10 other species of woolgrass that grow in the state, but stalked woolgrass is the rarest. The species is more common in states north and west of New Jersey and reaches the southeasternmost limit of its range in this state. Its habitat is open marshes on floodplains and river shores.

Seventy-two percent of the endangered species that have been verified as extant are represented by three or fewer extant populations. This is extremely significant because the risk of extirpation tends to increase for those species with a smaller population size and number of populations. Forty percent of state endangered plant species have at least one verified extant population located entirely or partially on state land (Figure 2). However, 60% of state endangered plant species have no verified extant populations on state lands.

Stalked woolgrass (David Snyder, 2021)

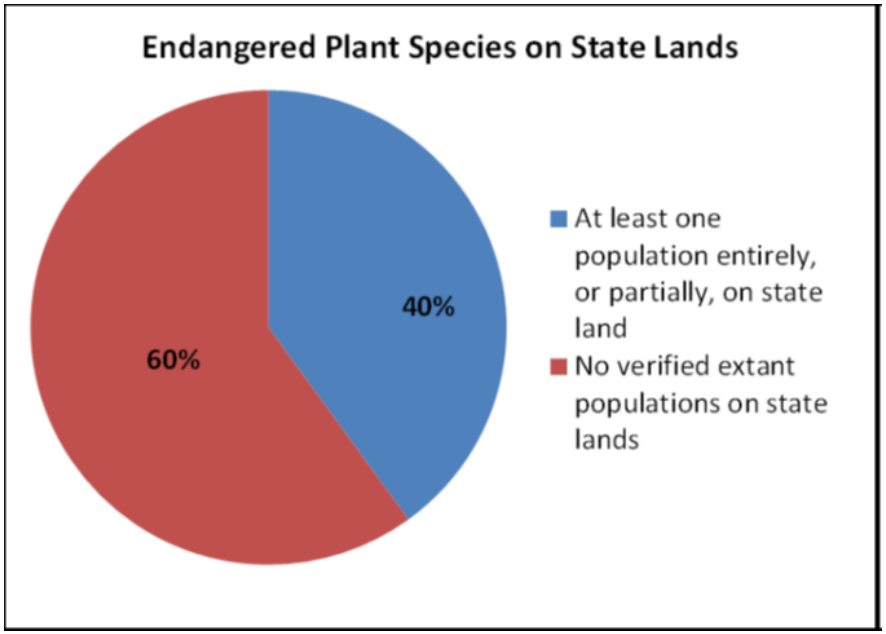

Figure 2: Percentage of endangered plant species that are entirely or partially on state lands.

Outlook and Implications

Our natural heritage is diminished whenever elements of biological diversity are lost from the state, regardless of whether it is in the form of an entire species, the individual populations of which they are comprised, or the habitats, communities and ecosystems of which they are a part. This diversity provides us with a wealth of economic, aesthetic, cultural, and other values and services, and represents a tangible connection to our past and to the greater community of life that we are not only a part of, but are utterly dependent upon.

Habitat destruction and degradation has been, and continues to be, the greatest threat to endangered plant species in New Jersey, the nation and the world. In New Jersey, the impacts associated with invasive species and elevated deer densities are also highly significant. The protection, monitoring, and management of the habitats where these populations occur is widely recognized as the best, and oftentimes the only, way of ensuring the survival of endangered plant species. The preservation of open space is extremely important for the protection of endangered species. While high priority habitat for concentrations of endangered species should be protected, it is important to ensure that representative populations of each endangered species throughout the state are preserved. It is also important to continue to monitor the occurrence and distribution of both state endangered and rare plant species to ensure that protective measures can be implemented before a species disappears entirely from the state.

Furthermore, attention must be given not merely to areas where plant populations occur, but to adjacent buffers and other sites as well, if both the habitats and the associated ecological systems that maintain them are to be adequately protected. The amount of land actually occupied by a particular population may be very small, whereas the ecological processes that they depend upon, such as pollination and dispersal, often extend well beyond these boundaries. Consequently, changes in the forest structure, water table, or other aspects in surrounding areas may be detrimental to these populations as well. Likewise, regional and local land-use plans are a critical component in protecting sensitive populations. To that end, plant occurrence information is factored into the NJDEP's planning process through rules, including the Water Quality Management Planning rules at N.J.A.C. 7:15.2.

While the protection of habitats is necessary for the survival of these species, this may not be sufficient unless the land is managed in a suitable manner. Significant natural and man-made changes may occur even after the locations have been protected. Site-specific monitoring information, such as threats from changes in hydrology, climate, invasive species, or herbivory, along with an understanding of the biology of each species, is therefore of great importance for the long-term survival of many of these populations. For instance, while monitoring known occurrences of rare plant species, the Natural Heritage Program also notes the presence and likely threat posed by invasive plant species.

In 2018, the Department initiated the development of science-based Recovery Plans for priority species located on lands managed by the Department. The intent for each species is to perform literature research, develop plans with stakeholder input, seek funding, recruit assistance, implement annual activities, and monitor

and adaptively manage results within an initial five-year time horizon. In addition, Rare Plant Profiles are being developed by the Department summarizing the natural history, to the extent known, for New Jersey's rare flora. Information in these Profiles may include diagnostic characteristics, seed dispersal and plant reproduction, pollinator dynamics, interspecies interactions, associated species, general habitat requirements, national and state distribution and range, conservation status, potential threats, and management recommendations.

This chapter provides a baseline assessment of the status of endangered plants in New Jersey. More research and resources are needed in order to track the populations of these species and develop the appropriate management strategies to ensure that these species continue to be part of the state's biological heritage.

More Information

NJDEP Division of Parks and Forestry, The New Jersey Natural Heritage Program
https://www.nj.gov/dep/parksandforests/natural/heritage/

NatureServe Explorer
https://explorer.natureserve.org/

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