Frosted Elfin

Callophrys iris

Federal Listing	N/A
State Listing	E
Global Rank	
State Rank	S1
Regional Status	

Photo by NHFG

Justification (Reason for Concern in NH)

The frosted elfin, along with the Karner blue butterfly, is an indicator of the health of the pine barrens habitat. As habitat goes unmanaged and reverts to a closed canopy system, the frosted elfin will die out. Frosted elfins are highly susceptible to population declines, which are a product of host plant specificity, environmental change, low dispersal rates, and small subpopulation size (Cushman and Murphy 1993), as well as cannibalism among larva. These factors are magnified by a severe loss of habitat. Nearly 90% of historic pine barrens communities along the Merrimack River have been lost, leaving a mere 560 fragmented acres, primarily in Concord (Helmbolt and Amaral 1994).

Distribution

The range of the frosted elfin extends from northern New England across to New York, Ohio, Indiana, Michigan, and Wisconsin, and along the eastern seaboard with pockets in southern New Jersey, eastern Maryland, West Virginia, South Carolina, and northern Florida (Swengel 1986, Schwitzer 1992, NatureServe 2005). The frosted elfin is believed to have been extirpated in Ontario, Maine, and Illinois (NatureServe 2015).

In New Hampshire, populations of the frosted elfin currently occur only in the Concord Pine Barrens, but there are records from the towns of Webster and Durham from the early 1900s, indicating that these areas once supported frosted elfin habitat (New Hampshire Natural Heritage Bureau 2015).

Habitat

The habitat of the frosted elfin in New Hampshire is identical to that of the federally endangered Karner blue butterfly *(Lycaeides melissa samuelis*): pine barrens with ample patches of blue lupine (*Lupinus perennis*), the only larval host plant (Schweitzer 1992, Swengel 1996). Whereas Karner blue butterfly larvae consume the leaves, frosted elfin larvae typically consume flowers and seedpods of the blue lupine (Swengel 1996). Flight period of the frosted elfin is from May to June, coinciding with the first flight of the Karner blue butterfly. Frosted elfin eggs are laid among the flower stalks and buds of the blue lupine (Swengel 1996). Larvae pupate underground and remain there until the following spring (Schwitzer 1992, Swengel 1996). For a detailed habitat description, see the Pine Barrens profile.

NH Wildlife Action Plan Habitats

- Pine Barrens

Distribution Map

Current Species and Habitat Condition in New Hampshire

The Concord pine barrens supports the largest and only known remaining population in the state. There is a possibility that the species still exists on the Manchester Airport where there is a small colony of lupine, but no surveys have been conducted. Monitoring of the species between 2005 and 2014 indicate that the population in Concord has remained stable with a estimated size of 1600 adults in 2008 (NHFG annual report). Habitat management in the pine barrens is designed to be rotational with intervals of recovery allowing recolonization of areas from nearby refugia. Frosted elfin pupate in the soil in New Hampshire (Schweitzer/Nature Serve 2015) providing them better protection and likelihood of survival during a fire. Frosted elfin larvae are frequently collected during the captive rearing of Karner blue butterfly during the collection of lupine leaves for larval feeding and flowers for oviposting females. Larvae are reared in the lab through to pupation on lupine leaves. There are currently no recovery goals outlined for the species in New Hampshire.

Population Management Status

Frosted elfins do not receive direct population management. Habitat management activities to maintain openings and restore lupine at the Concord Pine Barrens benefit the species.

Regulatory Protection (for explanations, see Appendix I)

- Endangered Species Conservation Act (RSA 212-A)
- Native Plant Protection Act RSA 217-A

Quality of Habitat

The minimum habitat requirements of frosted elfins have not been defined.

Habitat Protection Status

Approximately 227 ha of the remnant Concord pine barrens is protected through the Concord Municipal Airport Development and Conservation Management Agreement (2000). This area is managed to enhance and restore critical habitat for Karner blue butterflies as well as a suite of other rare species including the Frosted elfin. The land is owned by the City of Concord, with an 11 ha conservation easement granted to the United States Fish and Wildlife Service. The conservation easement is open to the public, but wheeled vehicles are forbidden. In addition to the conserved area

there is a 5 ha patch of habitat located along a powerline right-of-way. This parcel is privately owned and maintained by Eversource and NH Fish and Game in cooperation with the landowner.

Habitat Management Status

Current habitat management and restoration techniques include native plant propagation, vegetation management using specialized mowers and feller bunchers, and prescribed fire. These techniques create sandy and herbaceous openings within a matrix of heath, scrub-shrublands, and woodlands.

Threats to this Species or 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 conversion and mortality due to development (conversion to pavement or infrastrucure) (Threat Rank: High)

The only known extant population of Frosted Elfin resides in the Concord pine barrens. Extensive commercial and residential development has severely reduced habitat for Frosted elfins; about 5-10% of the original Concord pine barrens remains today, and virtually all pine barrens south of Concord have been lost (Helmbolt and Amaral 1994). The remaining habitat is limited to the conservation area around the airport and one private parcel totalling ~230ha. Development projects within the airport boiundaries could result in a loss of lupine and primary habitat for the species.

Habitat degradation from lack of high intensity disturbance (Threat Rank: High)

Lack of fire in the pine barrens allows leaf litter to accumulate over time and canopy cover to increase reducing the amount of lupine available.

Seedling survival of lupine was four times greater in openings and partial shade than dense shade (Pavlovic and Grundel 2009). Seedling survival was also greatest when litter cover was low, but moderate amount of vegetation available to provide shade. Similar results were observed by Plenzler (2008), litter removal from prescribed burning was important to the establishment and recruitement of lupine, but the microhabitat influenced by soil moisture, ferns, moss cover etc. provided conditions for better seedling survival.

Mortality from litter and fuel accumulation that cause fires (Threat Rank: High)

The population of frosted elfin in Concord is limited to 227 hectares. A large-scale fire that burned a significant portion of this habitat could result in extirpation of the species.

Insects that are small in number and have a high degree of ecological specialization are extremely susceptible to extirpation from local fire (New 2014). Swengel and Swengel (2007) recommneded the establishment of permanent non-fire refugia that is maintained with low intesity mowing and brush control for the long-term benefit of species such as the frosted elfin and Karner blue butterfly.

A species response to fire is dependent on five characteristics 1) ecological specialization 2) vagility (movement ability) 3) above ground life stages 4) voltinism (number of broods) and 5) response to key plant food to fire (Swengel 1996).

Mortality caused by mowing activity (Threat Rank: Medium)

Maintenance of active runways and taxiways is required for safety compliance with FAA regulations. Mowing during the growing season may scatter eggs and developing larvae from lupine plants. Larvae dispersal is limited, and without access to a sufficient amount of lupine to complete development there could be a negative impact to the population.

Delayed annual mowing and partial mowing resulted in higher species richness and abundance of butterflies on road verges in Europe (Valtonen et al. 2006). Mowing no more than once a year after the adult flight resulted in the persistence of two endnagered butterfly species across multiple meadows, but only if mowing was done every second or third year did both species persist at the local level (Johst et al. 2006). Leaving an unmown grass refuge within hay meadows resulted in a higher abundance of buttreflies (Kuhne et al. 2015).

Habitat impacts from roads (limited dispersal) (Threat Rank: Medium)

Paved surfaces generate substantial heat during hot summer months; this heat combined with lack of herbaceous habitat limits the dispersal of butterflies across these surfaces between habitat patches.

Found no evidence of mortality associated with roads, but the distribution of the species was influenced by roads and other paved areas (Fuller 2008). Evidence from the work supported the barrier hypothesis that paved areas are barriers inhibiting flight, and adjacent areas become congested with individuals. Overtime selection for non-dispersive individuals may occur (Leimar and Norberg 1997).

Mortality of lupine, other plants, eggs and larvae from vehicles or equipment (Threat Rank: Medium)

Open space areas in the City of Concord are limited. Powerline ROW often serve as corridors for ATV use across the landscape.

OHRV traffic in lupine patches could result in direct loss of larvae or depletion of lupine available.

Species impacts from competition (aphids, blister beetles) (Threat Rank: Medium)

Large outbreaks of aphids in lupine patches of the conservation area result in early decline of the plants limiting the quallity and quantity of food available for developing larvae. Outbreaks of beetles on lupine habitat may alter adult butterfly behavior such as oviposition in Karner blue butterflies (Swanson and Neff 2007), there may be a similar behavior disruption in Frosted elfins.

List of Lower Ranking Threats:

Mortality from herbivory (deer and woodchuck feed on lupine and ingest larvae)

Habitat degradation due to invasive or introduced plants

Mortality from the collection of individuals from the wild

Actions to benefit this Species or Habitat in NH

Habitat management and restoration.

Primary Threat Addressed: Habitat degradation from lack of high intensity disturbance

Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:

General Strategy:
Habitat management will increase the availability of suitable habitat for Frosted elfins by converting closed-canopy stands to an early-sucessional structure. Standard habitat management techniques including forestry, fire, and herbicide have well-documented efficacy in reducing the cover of canopy-forming, shade-tolerant, and fire-sensitive species. The technique, frequency, and intensity of management will be prescribed to increase light reaching the herbaceous strata, to create soil disturbances, and to connect existing blue lupine populations. Open-canopy corridors will offset failed dispersal and foraging in impermeable and/or unsuitable landscapes, such as the edges of runways and roads.

Political Location:
Merrimack County

Watershed Location:
Merrimack Watershed

Monitor OHRV activitiy in occupied areas.

Primary Threat Addressed: Mortality of lupine, other plants, eggs and larvae from vehicles or equipment

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

General Strategy:
Maintain signs posting sensitive habitat for Frosted elfins. Monitor OHRV activity, especially in spring and summer where the most impact can occur. Provide information to law enforcement upon detection to facilitate issuance of a citation.

Political Location:
Merrimack County

Watershed Location:
Merrimack Watershed

Coordinate annual mowing with Concord Airport.

Primary Threat Addressed: Mortality caused by mowing activity

Specific Threat (IUCN Threat Levels): Transportation & service corridors

Objective:

General Strategy:
Coordinate maintenance in operational area to comply with safety requirements, while minimizing

negative impacts to Frosted Elfin.

Political Location:
Merrimack County

Watershed Location:
Merrimack Watershed

Conserve remaining pitch pine barrens in Concord to increase habitat available for the species.

Primary Threat Addressed: Habitat conversion and mortality due to development (conversion to pavement or infrastrucure)

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

Objective:

General Strategy:
Maintain the current conservation agreement with the City of Concord and conservation partners to protect habitat for Frosted elfin and Karner blue butterfly. Look for additional opportunities to conserve the limited remaining patches of pine barrens nearby to increase habitat availability.

Political Location:
Merrimack County

Watershed Location:
Merrimack Watershed

Monitor population periodically for health and trend.

Objective:

General Strategy:
Perform population surveys every 2-4 years to monitor status of the species. Determine most resource efficient method for adequately detecting sugnificant changes in the population.

Political Location:

Watershed Location:
Merrimack Watershed

Research impacts of climate change and potential management actions.

Objective:

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources
Sources of information include field reports, agency data, scientific journal articles, and element

occurrence databases.
Information on habitat protection and management was obtained from Concord pine barrens recovery and management plans.

Data Quality

Lepidoptera surveys are conducted annually at the Concord Pine Barrens, and frosted elfin have been seen every year. Other areas where pine barrens habitat occurs have not been surveyed for frosted elfin or locations that support Baptisia tinctoria an alternative host plant for the species.
The frosted elfin has been monitored frequently during the past 10 years. Wild lupine has been mapped and/or monitored for almost 20 years.

2015 Authors:

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2005 Authors:

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