

Species: Frosted Elfin (*Callophrys irus*)  
Global Rank: G3  
State Rank: S1S2  
State Wildlife Action Plan: Immediate Concern Species  
Climate Change Vulnerability: Not Vulnerable/Presumed Stable  
Confidence: Very High

Habitat (adapted from NatureServe 2008):

Historically the natural habitat for this species was grassy openings dominated by *Andropogon* spp. and burned areas in oak barrens and savannas with sandy/rocky soils. Today, the species occurs mostly in open habitats created and maintained by human activities such as powerline and railroad right of ways, along sand or gravel roads in dry woods and barrens habitats, and around rock outcrops and old gravel pits. Active roadways with host plants are not good habitat because annual spring mowing will kill the larvae, and vehicle traffic will drive off adults.

Nearby tree cover is an important habitat component, because it provides shelter from the wind and sun. Adult males tend to congregate in open grassy areas with food plants in cool to moderate weather where they defend grass clumps, but they often move to shady woodland edges at about 82°F.

Frosted elfins occur in two population types, one with caterpillars that feed on lupine (*Lupinus perennis*), and the other with caterpillars that feed on wild indigo (*Baptisia tinctoria*). All populations in Pennsylvania are thought to be wild indigo feeders, even if lupine is also available. Adults are usually found very close to wild indigo plants (e.g., within 20 m).

Current Threats (adapted from NatureServe 2008):

The main threats in Pennsylvania are loss of wild indigo to natural succession of open habitats and deer herbivory, plus habitat fragmentation and destruction. Overuse of prescribed burning (in extent and/or frequency) may eradicate populations. Gypsy moth spraying with *Bacillus thuringiensis* var. *kurstaki* (Btk) is a threat, especially to smaller populations. A strong population could probably survive one Btk application since larval emergence is staggered and later ones would not be exposed. Applications of more persistent toxins like Diflubenzuron are more likely to eradicate an occurrence (Schweitzer, 2004). Most frosted elfin populations are now dependent upon human management to maintain their habitat. This makes populations vulnerable to sudden changes in management practices, such as a switch from winter mowing to disking and herbiciding.

Frosted elfins seem to tolerate dormant season or late summer mowing very well and will colonize wildfire scars once the host plant moves in. However, frequent prescribed burning can have deleterious effects according to research on the lupine feeder conducted

by Ann Swengel (1998). Little is known about the role of fire in the ecology of the wild indigo feeder. Larvae feeding on wild indigo plants and chrysalids hibernating in loose cocoons in the litter beneath host plants are both vulnerable to fires.

#### Main factors Contributing to Vulnerability:

The main factors contributing to climate change vulnerability in the frosted elfin are changes in the amount and seasonality of soil moisture and the species dependence upon one host plant during the larval stage. A mitigating factor is the ability of adults to disperse relatively easily through suitable habitat. The region of Pennsylvania where frosted elfin occurs (currently or historically) has experienced slightly lower than average precipitation variation in the past 50 years, making populations somewhat vulnerable to future changes in precipitation. The impacts of development of alternative energy sources, and microhabitat changes in seasonal soil moisture levels and temperatures, are expected to be especially important for frosted elfin caterpillars, pupae, and the wild indigo host plant.

The impacts of climate change on frosted elfin microhabitats (positive, negative, or neutral) cannot be predicted at this time without more data. This species appears to be adapted to warmer microhabitats, but details on the optimal range and seasonality of soil temperature and moisture for the development of frosted elfin pupae overwintering in the leaf litter are unknown. Increased summer soil droughts are predicted by climate models, and could lead to an increase in the amount and severity of forest fires (Shortle et al. 2009). Forest fires could create new habitat and reset habitat succession thus creating frosted elfin habitat. However, fire-related mortality over occupied habitats during burns would be expected near 100% because the larvae and pupae are above the soil surface year-round (Allen 1997) and are therefore very vulnerable to fire. While frosted elfin is a rapid flier and good colonizer (Allen 1997), colonies tend to be small and suitable habitats are increasingly isolated in Pennsylvania. Therefore, loss of individual colonies may cause localized extinctions at sites that will not be recolonized naturally.

Infrastructure development supporting alternate energy sources such as wind energy and natural gas are likely to create many acres of disturbed land in forested habitats. Under appropriate soil conditions and with proper types and timing of vegetation management, these disturbed lands could become potential habitat for frosted elfins. The species could be encouraged with plantings of wild indigo and other native nectar plants. Right-of-way corridors could then play an important role in providing habitat and promoting species dispersal.

These developments would require considerable investment in planning and resources to maximize the potential benefit for this species. Therefore, the impacts of predicted land use changes could range from somewhat decreasing to somewhat increasing vulnerability. Infrastructure development could easily have negative impacts as well. Broadcast herbiciding or disking of rights-of-ways would eliminate their usefulness as habitat corridors. Undocumented populations and currently unoccupied (but ultimately recolonizable) habitat could be inadvertently destroyed in right-of-way development.

Pre-development surveys for potential habitat would be needed to avoid destruction of occupied or potentially occupied habitats.

*Dispersal and movements (adapted from NatureServe 2008):* There are no known published studies on the dispersal capabilities of frosted elfin. However, anecdotal evidence suggests that the species is regularly capable of dispersal of over a kilometer across open landscapes or along corridors. Frosted elfins tend to occur in small local populations in appropriate pockets of habitat. Populations located within several kilometers of one another are connected into larger metapopulations when adults are able to disperse through fairly open habitat or along linear rights-of-ways.

Note: This assessment is expected to be similar for the Persius Duskywing (*Erynnis persius*); Global Rank G5T1T3, State Rank S1; Caterpillar host plant wild indigo; Habitats include pitch pine-scrub oak barrens, scrubby ridgetops, or powerline right-of-ways within such settings with sandy-gravelly soils.

#### References:

Allen, T. 1997. The Butterflies of West Virginia and Their Caterpillars. University of Pittsburgh Press, Pittsburgh.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: July 17, 2008)

Swengel, A.B. 1998. Effects of management on butterfly abundance in tallgrass prairie and pine barrens. *Biological Conservation* 83(1):77-89.

Schweitzer, D.F. 2004. Gypsy Moth (*Lymantria dispar*): impacts and options for biodiversity-oriented land managers. NatureServe, Arlington, Virginia. NatureServe Explorer. Online. Available: <http://www.natureserve.org/explorer/>.

Shortle, J.S., D. Abler, S. Blumsack, R. Crane, Z. Kaufman, M. McDill, R. Najjar, R. Ready, T. Wagener, and D. Wardrop. 2009. Pennsylvania Climate Impact Assessment: Report to the Department of Environmental Protection. Report number 7000-BK-DEP4252. Prepared by the Environment and Natural Resources Institute, The Pennsylvania State University.