

Species: Northeastern Pine Zale (*Zale curema*)  
Global Rank: G3G4  
State Rank: S1  
State Wildlife Action Plan: Immediate Concern Species  
Climate Change Vulnerability: Not Vulnerable/Presumed Stable  
Confidence: Low

Habitat:

The northeastern pine zale is a moth of barrens habitats and pitch pine areas in eastern Pennsylvania. It is currently known from three sites in Pennsylvania, two in the southeast and one in the northeast. Northeastern pine zale can utilize a variety of pitch pine barrens, woodlands, and pine-oak forests. The larval food plant in Pennsylvania is pitch pine (*Pinus rigida*). The species is best collected at bait. More surveys are needed in pitch pine areas in appropriate habitat in the Appalachian Mountains and eastern Pennsylvania during the spring flight period (mid May to mid June).

Current Threats:

Fire is a potential threat to this species especially in June and July during the egg and active larval stages. However, fire is often necessary for maintaining open barrens. However, this species does not appear to require pristine pine barrens. It also does well in pitch pine woodlands or pine-oak forests.

Spraying to control gypsy moths may negatively affect the species depending on the life stage of the species, type of spray used, timing of spraying activities, and number of applications. Two sprays, diflubenzuron (trade name Dimilin) and *Bacillus thuringiensis* var. *kurstaki* (Btk), are commonly used for gypsy moth control. Diflubenzuron is a broad-spectrum insecticide universally toxic to several types of arthropods including butterfly and moth caterpillars. Diflubenzuron could be more problematic to northeastern pine zale larvae because it persists on treated foliage until leaf drop in the fall. When leaves fall on the forest floor, the chemical becomes part of the leaf litter and may enter forest streams via surface runoff (Butler 1998). Btk is commonly used in Pennsylvania to control gypsy moths because it targets butterfly and moth caterpillars and is not toxic to a wider spectrum of arthropods outside of the Order Lepidoptera. Btk also does not persist in the environment since it breaks down within ten days (Butler 1998.) Where gypsy moth outbreaks are particularly severe and pitch pines are expected to be completely defoliated, the loss of host plants would be more detrimental than the use of Btk (Schweitzer 1995). A small percentage of larvae would be at risk in May when spraying occurs, with greater mortality expected with use of Dimilin than with Btk.

Main factors Contributing to Vulnerability:

The main factors contributing to climate change vulnerability are large scale changes in the amount and seasonality of soil moisture, the northeastern pine zale's restricted range in Pennsylvania, and its dependence on one host plant during the larval stage.

Anthropogenic barriers (agricultural, residential, and urban development) block dispersal to the north for the populations in southeastern Pennsylvania. Mitigating factors include the ability of adults to disperse relatively easily through suitable habitat, and the species is not restricted to particularly specialized habitats.

The regions of Pennsylvania where northeastern pine zale occurs have experienced lower than average precipitation variation in the past 50 years, making populations more vulnerable to future changes in precipitation. 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). The widespread burning of occupied habitats at the wrong time of year (June-July) could be devastating to local populations, especially those located in smaller habitat patches such as the serpentine barrens of southeastern Pennsylvania. Fire-related mortality at this time of year would be expected to be near 100% because the eggs and/or actively feeding larvae are very vulnerable to fire. The pupal stage takes place on the ground in humus and leaf litter and so is also very vulnerable to fire. Nevertheless, forest fires are a process that helps to maintain northeastern pine zale habitat. Small, patchy, controlled burns can be a useful tool in barrens habitat management.

*Dispersal and movements:* NatureServe assigned northeastern pine zale to the 'Forest, Woodland and Shrub Noctuidae' moth group. Moths assigned to this group are moderately to very strong fliers and many live from a week to a month as adults. These moths are typically found in extensive tracts of appropriate habitat but they can persist in somewhat fragmented patches. Within suitable habitats, these species are usually widespread and are likely able to traverse distances up to 10 km. Suitable habitat for northeastern pine zale, which feeds solely on pitch pine, should have a food plant density of three mature trees per hectare (NatureServe 2008).

Moths in the Forest, Woodland and Shrub Noctuidae group can be expected to travel and disperse through marginal woodland and scrub habitats. However, these species would not be expected to travel more than 2 km across unsuitable habitats, such as treeless landscapes, or residential or urban areas that have trees but not the appropriate food plant or other essential features (NatureServe 2008).

#### References:

Butler, L. 1998. Nontarget Impacts of Gypsy Moth Insecticides. Center for Agriculture, Natural Resources, and Community Development, West Virginia University Extension Service.

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).

Schweitzer, D.F. 1985. Risk assessment of impacts gypsy moth defoliation and Bt and Dimelin spraying with some general considerations. Memorandum for the Eastern Heritage Task Force Files, The Nature Conservancy, Boston, MA.

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.