

Species: Northern Barrens Tiger Beetle (*Cicindela patruela*)
Global Rank: G3
State Rank: S2S3
State Wildlife Action Plan: Immediate Concern Species
Climate Change Vulnerability: Not Vulnerable/Presumed Stable
Confidence: Very High

Habitat (adapted from Pearson et al. 2006; NatureServe 2008):

The northern barrens tiger beetle is specific to sandy/coarse gravel or eroding sandstone substrates throughout its range. It may have more specialized habitat requirements within a given geographic region. The associated plant community is usually pine barrens or open mixed or deciduous (mainly oak) woodlands and shrublands. The beetle utilizes patches of open ground, such as along trails, on outcrops, scree or talus slopes, or on ridge summit openings dominated by lichens and dry mosses. In much of its range, the northern barrens tiger beetle is associated with coarse grained sand or eroding sandstone. Larvae construct burrows in open patches of stabilized and compact sandy soils, often associated with mosses, lichens, and other low vegetation. Populations are typically scattered and low density. Small individual colonies can occur on sites less than a hectare, but populations typically function as metapopulations across forested landscapes of 100 or more hectares with scattered patches of suitable habitat.

Current Threats (adapted from NatureServe 2008):

The main threat to this species is habitat destruction due to development, deforestation, and fire suppression (fire suppression and ecological succession may eliminate some habitats). At the same time, human activities (e.g., soil disturbance) may be vital for the creation of suitable habitat. Most authors mention that this species will occupy little used forest roads. Heavy use of these by ATVs or other motorized vehicles, and improvements to remote sandy roads on state lands could impact occurrences in some locations. More research is needed to determine the extent to which sandy roads are breeding areas, and the threat potentially posed by the use and maintenance of such roads.

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 and the physical habitat specificity of the northern barrens tiger beetle. Main mitigating factors are the ability of adults to disperse relatively easily through suitable habitat and the likelihood that natural disturbances (e.g., fire) and alternative energy development (e.g., natural gas infrastructure) will increase the amount of potential habitat for this species.

The regions of Pennsylvania where the northern barrens tiger beetle is known to occur has experienced slightly lower than average precipitation variation in the past 50 years, making populations somewhat 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). This species is fairly well adapted to fire, and forest fires could benefit the species by creating new habitat and resetting succession. Adults emerge in the spring (typically late April to June) and again from mid August into September (late summer eclosions may be sporadic). Adults may be able to escape fires, and the larval life cycle is two years so that there are always larvae present and somewhat protected in burrows in the substrate (Pearson et al. 2006; NatureServe 2008). For these reasons, the northern barrens tiger beetle was ranked as 'Somewhat less vulnerable' in regards to reliance on a specific disturbance regime (fire) that is expected to increase in frequency, severity, or extent with climate change and would increase the species' habitat quality.

Right-of-way infrastructure supporting alternate energy sources such as wind energy and natural gas may create many acres of disturbed land in forested habitats. Under certain conditions of soil, bedrock, moisture, and aspect, newly disturbed lands could become potential habitat for the northern barrens tiger beetle. Recent collection sites indicate that disturbed right-of-ways such as powerline rows, logging access roads and pipelines, oil and gas well openings, etc. can provide suitable habitat. Right-of-ways may assist the species in finding suitable disturbed sites as they become naturalized with mosses, lichens, and other low vegetation. Maintaining a forest matrix around disturbed areas is important, as is preventing ATVs and other vehicular traffic from utilizing access roads and disturbed areas. Frequent road usage and improvement could be harmful (NatureServe 2008), particularly to the larvae as they develop in burrows in sandy soils. Infrastructure development may not require considerable planning and management in order to maximize the potential benefit for this species, therefore predicted impact of land use changes was ranked as 'Decrease Vulnerability'.

Changes in temperature and precipitation, moisture, or hydrological regime on a microhabitat scale are certain to be important factors for predicted sensitivity. This species is well adapted to hot microhabitats (eroded sandstone clearings), but details on the optimal range and seasonality of soil temperature and moisture for the development of larvae and pupae are not known. For the CCVI the microhabitat temperature and moisture were ranked as 'Unknown' which leads to an overall rating of Presumed Stable/Not Vulnerable. Selecting 'Somewhat Increases Vulnerability' for these two factors did not lead to a change in overall vulnerability rating.

Dispersal and movements (adapted from NatureServe 2008): Quantitative information on tiger beetle movements in barrens and shrubland habitats are few and mostly anecdotal. However, tiger beetles of these habitats are known to be good colonizers capable of flying a few kilometers (apparently sometimes at night).

References:

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Pearson, D.L., C.B. Knisley, C.J. Kazilek. 2006. A Field Guide to the Tiger Beetles of the United States and Canada: Identification, Natural History, and Distribution of the Cicindelidae. Oxford University Press, New York.

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.