Species: Grizzled Skipper (*Pyrgus wyandot*)
Global Rank: G1G2Q
State Rank: S1
State Wildlife Action Plan: Immediate Concern Responsibility Species
Climate Change Vulnerability: Highly Vulnerable
Confidence: Very High

Note: This assessment is expected to be similar for other butterflies of specialized or moderately specialized forest clearing habitats, with specific food plants, habitats exposed to gypsy moth spray; and lacking a fire resistant dormant stage (larval and/or pupal). Some examples:

- Frosted Elfin (*Callophrys irus*); Global Rank G3, State Rank S2; Caterpillar hostplant Wild Indigo (*Baptisia tinctoria*); Habitat typically grassy (*Andropogon* spp.) openings in oak habitats on sandy rocky soils; sometimes found in disturbed areas with hostplant such as powerline right-of-ways.
- Persius Duskywing (*Erynnis persius*); Global Rank G5T1T3, State Rank S1; Caterpillar hostplant Wild Indigo (*Baptisia tinctoria*); Habitats include pitch pine-scrub oak barrens, scrubby ridgetops, or powerline right-of-ways within such settings with sandy-gravelly soils.
- Northern Metalmark (*Calephelis borealis*), Global Rank G3G4, State Rank S2; Caterpillar hostplant Round-leaved Ragwort (*Senecio obovatus*); Habitats are openings within forested or wooded areas such as natural outcrops, shale or limestone barrens, glades or powerline right-of-ways.

Habitat (adapted from NatureServe 2008 and Schweitzer 1989):

The Grizzled Skipper butterfly is an Appalachian Mountain habitat specialist that requires shale barren habitats with abundant exposed crumbly rock or soil. Shale barrens are semi-open shale slopes with sparse herbaceous vegetation and tend to be surrounded by scrubby oak or oak-hickory woodlands, often with a component of Virginia Pine (*Pinus virginiana*). A natural area which meets the habitat requirements should maintain itself as a shale barren. These dry, shale slopes should favor plentiful growth of the larval hostplant, Canada Cinquefoil (*Potentilla canadensis*) and tufted grasses like Broom-sedge (*Andropogon virginicus*). Occupied sites also support a variety of spring plants such as Spring Beauty (*Claytonia* spp.), Phlox (*Phlox subulata*) and Birdsfoot Violet (*Viola pedata*) which provide nectar food for adults.

The caterpillars feed upon Canada Cinquefoil, which is a very common species that can be found growing in lawns. However the Grizzled Skipper is restricted to a narrow range of very hot rock outcrop habitats with the host plant. Grassy roads, right-of-ways, and other disturbed areas on south- or west-facing slopes over shale substrates can be suitable habitat if they maintain the appropriate plant community structure with Canada cinquefoil as a primary component. Occupied sites are always in close proximity (within 30 m or 100 ft) of densely wooded areas. Adults seldom occur more than about 30 meters from woods even if the hostplant extends far out in the open. Another key site characteristic is presence of a source of moisture such as a temporary or permanent streamlet, or even

muddy puddles in deep wheel ruts. Perhaps for this reason the Grizzled Skipper is not typically found on ridges, but more often occurs along the bases of slopes.

Threats (adapted from NatureServe 2008 and Schweitzer 1989):

The Grizzled Skipper is extremely vulnerable to gypsy moth spraying. Gypsy moth spraying eliminated most known Appalachian populations from about 1985-1992, and all known ones in NJ about 1958-1960. Grizzled Skipper habitat is located on oak-dominated ridges which are often treated for gypsy moth damage. Eggs are laid on the host plant in open habitats, but always near the edge of woods. Larvae feeding on cinquefoil plants at these woodland edges and openings are therefore unprotected by the tree canopy and are positioned to have direct contact with gypsy moth spray. The larvae would all be hatched and feeding as early instars by or just after a typical spray date in mid-May which greatly increases their vulnerability to applications of *Bacillus thuringiensis* (Bt). Peacock et al. 1998 found that among 42 tested species of native butterflies and moths, all 1st and 2nd instar caterpillars had 90-100% mortality from Bt application regardless of the species. Grizzled Skipper caterpillars also feed over most of the summer, which increases their exposure to persistent toxins sometimes used to control gypsy moths (e.g. Diflubenzuron). Diflubenzuron is a broad-spectrum insecticide universally toxic to several types of arthropods, while Bt targets butterfly and moth caterpillars (Order Lepidoptera). Bt does not persist in the environment since it breaks down within ten days, while Diflubenzuron persists on treated foliage until leaf drop in the fall, after which the chemical can move into the leaf litter layer and into forest streams (Butler 1998). Large open areas known to support Grizzled Skippers could be excluded from spray programs, but smaller openings or undocumented sites are unlikely to be avoided. Populations appear to be so small or sparse such that recovery is far less likely than with more abundant species of butterflies and moths.

Population numbers are now so low that additional threats are exacerbated. Minor fluctuations in the environment could cause colonies to "wink out". Low numbers and fragmentation greatly increase this threat, and the Grizzled Skipper probably cannot survive unless some metapopulation function is restored. Broadcast herbiciding of powerlines would also be a very potent threat considering that powerline corridors were major habitats in the 1980s and will almost certainly be important if the Grizzled Skipper ever recovers. Powerlines appear to be a better dispersal corridor than any kind of natural feature. Even collectors may constitute a threat to remaining colonies, although collecting was not a factor in the crash.

Main factors Contributing to Vulnerability Rank:

The main factors contributing to climate change vulnerability are large scale changes in the amount and seasonality of soil moisture, the physical habitat specificity of the Grizzled Skipper, and its dependence upon one hostplant during the larval stage. A mitigating factor is the ability of adults to disperse relatively easily through suitable habitat. The region of Pennsylvania where *Pyrgus wyandot* still occurs 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 Grizzled Skipper caterpillars, pupae, and the Canada Cinquefoil hostplant. However without more data on the microhabitat requirements of the Grizzled Skipper, the direction of effects on microhabitat (positive, negative, or neutral) cannot be predicted at this time. These factors are further discussed below.

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 set-back succession, which is thought to threaten some populations in New York, Virginia, and Michigan. However known extant habitat in Pennsylvania is shale barrens and openings, which do not require disturbance to remain open, and burning of small shale barrens habitats could extirpate local populations. Fire-related mortality would be expected near 100% because the larvae and pupae are above the soil surface year-round (Allen 1997) and therefore very vulnerable to fire.

Right-of-way infrastructure supporting alternate energy sources such as wind energy and natural gas are going to create many acres of disturbed land in forested habitats. Under certain conditions of soil, bedrock, moisture, and aspect, these disturbed lands could become potential habitat for *Pyrgus wyandot*. They may also play an important role in assisting with species dispersal, especially if climate change causes dry oak woodlands to leaf out earlier in the season, potentially blocking adult movement (see comments under migrations and movements). These developments would require considerable investment in planning and resources to maximize the potential benefit for this species, therefore predicted impact of land use changes was ranked as 'Unknown'. Infrastructure development could easily have negative impacts as well. Undocumented populations and currently unoccupied (but ultimately recolonizable) habitat could be inadvertently destroyed in the development process. Pre-development surveys to look for potential habitat would be needed to avoid destruction of occupied or potentially occupied habitats.

This species is well adapted to hot microhabitats (shale barrens). But details on the optimal range and seasonality of soil temperature and moisture for the development of larvae and overwintering pupae are not known. The larvae live in leaf shelters created by rolling a hostplant leaf with silk. Larvae pupate in late summer and spend the winter in leaf shelters created by tying together several leaves of the host plant or of a nearby plant (Allen 1997). Soil moisture is also important for the hostplant Canada Cinquefoil, which can suffer under drought conditions. For example, a decrease in the abundance of host plants on some historic West Virginia sites was attributed to drought (NatureServe 2008).

Migration and Movements (adapted from NatureServe 2008): While adults seem to be reluctant to move far from woods or to leave their edaphic habitat, they can be dispersive within ridge systems, especially along powerlines and dirt roads. There are no good movement data but prior to large scale gypsy moth spraying few suitable habitat patches within occupied edaphic features were regularly vacant and this was still true of unsprayed ones in Pennsylvania, Maryland and West Virginia in the mid 1980s (see

Schweitzer, 1989 report on Candidate Insecta to USFWS) even though by the 1990s nearly all suitable habitats were vacant.

The oak woodlands on dry shale ridges surrounding Grizzled Skipper habitats leaf-out late in the spring, usually after the Grizzled Skipper flight season. Prior to leaf-out in the spring, it is very likely that adults move through the forest understory. Teneral adults (freshly emerged) have been found in forested areas indicating some oviposition occurs there. Grizzled Skipper habitat therefore may not be quite as discrete as it appears and the foodplant is rarely confined only to the main breeding sites. While there are no precise data, it is obvious this species used to move fairly widely through suitable or marginal habitats and was a good colonizer within its small range. Metapopulation dynamics are likely important for *Pyrgus wyandot*; it may require 50 acres (20 ha) or more for population maintenance, with suitable breeding habitat scattered throughout.

Literature Cited:

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

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)

Peacock, J. W., D. F. Schweitzer, J. L. Carter, N. R. DuBois. 1998. Laboratory Assessment of the Effects of *Bacillus thuringiensis* on Native Lepidoptera. Environmental Entomology 27(2):451-457.

Schweitzer, D.F. 1989. A review of Category 2 Insecta in USFWS regions 3, 4, 5. Prepared for the United States Fish and Wildlife Service. 150 pp.