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

Habitat (adapted from Schweitzer 1989 and NatureServe 2008):

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*). These dry, shale slopes should favor plentiful growth of the larval host plant, 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 on 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) of densely wooded areas. Adults seldom occur more than about 30 m from forested areas even if host plants occur in open canopy areas adjacent to the forest edge. Another key site characteristic is the presence of a source of moisture, such as temporary or permanent streamlets, 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.

Current 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 and the New Jersey ones as well. Grizzled skipper habitat is located on oak-dominated ridges which are often sprayed for gypsy moth control. 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* var. *kurstaki* (Btk). Peacock et al. (1998) found that among 42 tested species of native butterflies and moths, all first and second instar caterpillars had 90-100% mortality from Btk 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 Btk targets butterfly and moth caterpillars (Order Lepidoptera). Btk does not persist in the environment since it breaks down within 10 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 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 disappear. 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 has not been linked to the overall population decline.

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 physical habitat specificity of the grizzled skipper, and its 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 *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 host plant, Canada cinquefoil.

The impacts of climate change on grizzled skipper microhabitat (positive, negative, or neutral) cannot be predicted at this time without more data on microhabitat requirements of the species. 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 succession, which is thought to threaten some grizzled skipper 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 of near 100% would be expected because the larvae and pupae remain above the soil surface year-round (Allen 1997) and therefore are very vulnerable to fire.

Infrastructure development 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, and with proper type and timing of vegetation management, these disturbed lands could become potential habitat for the species. Grizzled skippers could be encouraged with plantings of Canada cinquefoil and other native nectar plants. Right-of-way corridors could then play an important role in providing habitat and promoting species dispersal, especially if climate change causes dry oak woodlands to leaf out earlier in the season, potentially blocking adult movement (see comments under dispersal and movements).

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 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 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 unknown. The larvae live in leaf shelters created by rolling a host plant 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 host plant 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).

Dispersal and movements: While adults seem to be reluctant to move far from woods or to leave their edaphic habitat, they can disperse within ridge systems, especially along powerlines and dirt roads. No good movement data exists, but prior to large scale gypsy moth spraying, few suitable habitat patches within occupied edaphic features were regularly vacant. This was still true of unsprayed areas in Pennsylvania, Maryland and West Virginia in the mid 1980s (see Schweitzer (1989) report on Candidate Insecta to USFWS), although, 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 main breeding sites are rarely confined to where the food plant occurs. 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 the grizzled skipper; it may require 50 acres (20 ha) or more for population maintenance, with suitable breeding habitat scattered throughout.

References:

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