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Status of the Appalachian Grizzled Skipper (*Pyrgus centaureae wyandot*) in Virginia

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ABSTRACT

The Appalachian grizzled skipper (*Pyrgus centaureae wyandot*) was documented historically (primarily from shale barren habitats) in 11 counties in Virginia. Between 1992 and 2002, staff of the Virginia Department of Conservation and Recreation, Division of Natural Heritage, conducted 175 surveys for *P. c. wyandot* at 75 sites in 12 counties. The species was observed at only six sites during these surveys, representing two new county records. All observations since 1992 combined account for <80 individuals. Due to forest succession and threats from gypsy moth control measures, all recent sites for *P. c. wyandot* in Virginia may be degrading in overall habitat quality.

Key words: Lepidoptera, *Pyrgus centaureae wyandot*, conservation, shale barrens, Virginia.

INTRODUCTION

The Appalachian grizzled skipper (*Pyrgus centaureae wyandot*) has a rather fragmented range, occurring in northern Michigan as well as portions of Ohio, Pennsylvania, Maryland, West Virginia, and Virginia; isolated historical records are known from Kentucky, New York, New Jersey, North Carolina, and the District of Columbia (Opler, 1998; NatureServe, 2003). Populations are very localized within this range (e.g., Shuey et al., 1987). The Appalachian grizzled skipper was formerly listed as a federal candidate (C2) species (as *P. wyandot* after Schweitzer, 1989) and is now informally regarded as a Species of Concern by the Virginia Field Office of the U.S. Fish and Wildlife Service. The Appalachian grizzled skipper is legally protected in four states within its range. Maryland, New York (no known extant populations; P. Novak, pers. comm.), and Ohio list *P. c. wyandot* as endangered. In 2004, it became listed as state threatened (as *P. wyandot*) in Virginia. Parshall (2002) provides a comprehensive review of the nomenclature and taxonomy of *P. c. wyandot*. Most authors classify this skipper as a subspecies of the Holarctic *Pyrgus centaureae* (e.g., Opler & Krizek, 1984; Iftner et al., 1992; Shuey, 1994; Allen, 1997; Opler, 1998; Glassberg, 1999; Parshall, 2002), although some lepidopterists treat it as a full species (Shapiro, 1974; Schweitzer, 1989; Gochfeld & Burger, 1997).

The Appalachian grizzled skipper is reported from open woodland habitats throughout its range. These habitats include heath-shrub acid barrens, grassy hillsides and open pastures near woods, and scrub oak openings (Opler & Krizek, 1984). Disturbed habitats, such as roadsides and powerline rights-of-way, were observed to support this species in Ohio and Michigan (Shuey, 1994). Adult grizzled skippers are known to nectar around low-growing plants, primarily yellow-flowering species such as *Potentilla canadensis* (dwarf cinquefoil), which also serves as the larval hostplant (Allen, 1997).

In Virginia, the species has been documented from shale barren habitats in the western and northern counties (Schweitzer, 1991). The flight season of *P. c.*

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wyandot is early and relatively short (Allen, 1997; Schweitzer, 1991). Adults have been observed in Virginia between 28 March (Wood & Gottschalk, 1942) and 3 June (Clark & Williams, 1937), although the typical flight period is from mid-April to early May (Schweitzer, 1991). Wood & Gottschalk (1942) reported *P. c. wyandot* from Montgomery and Roanoke counties. Wagner & Showalter (1976) also recorded it from Montgomery County. Clark & Clark (1951) recorded this species from eight Virginia counties: Augusta, Fairfax, Frederick (see also Clark & Clark, 1939), Giles, Highland, Montgomery, Rappahannock, and Roanoke. Schweitzer (1991) indicated that there were records for Albemarle, Augusta, Bath, Bland, Frederick, Giles, Highland, Montgomery, and Pulaski counties, but did not comment on the omission of Fairfax, Rappahannock, and Roanoke counties from his list. The origin of the Pulaski County record is unknown; we believe it is merely the result of a transposition error (for Roanoke County). In addition, Cech (1995) published his observations of *P. c. wyandot* from Rockbridge County; however, this population was first documented based on surveys conducted by DCR-DNH. Thus, available published records have documented this species from 12 counties in Virginia (Fig. 1). Finally, Opler et al. (1995) report a confirmed record for Scott County, but the source and validity of this information is not known to us at this time.

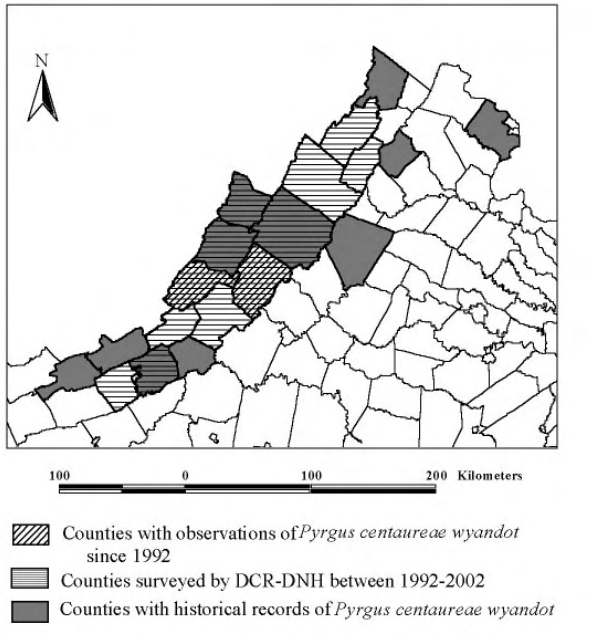

Fig. 1. Historical and recent county records for *Pyrgus centaureae wyandot* in Virginia.

Since 1992, zoological staff of the Virginia Department of Conservation and Recreation, Division of Natural Heritage (DCR-DNH), have surveyed extensively for populations of *P. c. wyandot* in western Virginia. This paper discusses the results of these surveys, and the conservation status of *P. c. wyandot.*

METHODOLOGY AND SURVEY AREA

Surveys by DCR-DNH were conducted primarily on shale barren habitats because of the documented association of *P. c. wyandot* with open, woodland habitats (Opler & Krizek, 1984; Shuey, 1994; Allen, 1997) and the abundance of this habitat in Virginia. The majority of the survey sites were located on the George Washington and Jefferson National Forests (plus several state-owned properties). Additional surveys took place on alternative habitats such as powerline rights-of-way and clearcuts with exposed shale soils. Surveys were also attempted at presumed historical locations (based on literature and museum records) for *P. c. wyandot*. All surveys were conducted during periods of favorable weather in early spring by walking through appropriate habitats.

RESULTS

Between 1992 and 2002, DCR-DNH staff have conducted a total of 175 surveys for *P. c. wyandot* at 75 different sites in 12 counties (Table 1). Four of these counties had documented records for the grizzled skipper prior to 1992, but the species was not found in any of these counties during our surveys. Most historical Virginia localities for *P. c. wyandot* are too vague in description to accurately relocate them for survey. The few available museum records typically include only town or county (or state only) names. Other historical sites have undergone succession and are now inappropriate habitat for the grizzled skipper (Roble, pers. obs.).

The Appalachian grizzled skipper was first discovered by DCR-DNH on 23 April 1993 at the Brattons Run Shale Barren area on the George Washington National Forest (GWNF) in Rockbridge County (this location was later published by Cech, 1995), a new county record for this species. It was also observed here in 1994, 1995, and 1997 by DCR-DNH and other observers, and in 1999 by T. McAvoy and C. Kessler (pers. comm.)(Table 2). No more than one or two individuals were observed during any survey. The species has not been seen there since 1999 despite three recent surveys conducted by DCR-DNH. The Brattons Run Shale Barren area is managed by the United States

Table 1. Total number of surveys conducted by DCR-DNH for *Pyrgus centaureae wyandot* in Virginia between 1992 and 2002. The first number is the total number of surveys conducted at all sites. The number in parentheses indicates the total number of unique sites surveyed. Some sites were visited more than once per year or revisited in multiple years. An asterisk indicates counties with records of *P. c. wyandot* prior to 1992.

Year / County	1992	1993	1994	1995	1997	1998	2001	2002	Total Surveys	Total Sites
Alleghany	1 (1)	1 (1)	5 (4)	6 (5)	8 (6)	7 (5)	15 (6)	15(11)	58	21
Augusta*		3 (3)	3 (3)		2 (2)	5 (4)	1 (1)	1 (1)	15	9
Augusta/Highland					1 (1)				1	1
Bath *		3 (3)	1 (1)	11 (7)	10 (6)	7 (7)	1 (1)	2 (2)	35	17
Botetourt	6 (1)	9 (5)			5 (2)	1 (1)	4 (2)		25	7
Craig		1 (1)	1 (1)				2 (2)	1 (1)	5	5
Highland *		1 (1)	2 (2)		1 (1)			1 (1)	5	3
Montgomery *	1 (1)	1 (1)	2 (2)						4	2
Page		2 (2)		1 (1)		1 (1)			4	2
Pulaski							1 (1)		1	1
Rockbridge		1 (1)	2 (1)	3 (2)	2 (2)	3 (1)	3 (2)	1 (1)	15	2
Rockingham		1 (1)	1 (1)						2	1
Shenandoah		4 (4)				1 (1)			5	4
Total Surveys	8	27	17	21	29	25	27	21	175	75

Forest Service (USFS) and is comprised of several habitats that may be suitable for *P. c. wyandot*, including a small shale barren, a powerline right-of-way, several road cuts, and wildlife openings. The disturbed habitats (roads, powerline, etc.) contain scattered to patchy dwarf cinquefoil, bird's foot violet (*Viola pedata*), and phlox (*Phlox subulata*). The wildlife openings have recently been replanted with buckwheat (*Rumex* sp.), foxtail millet (*Setaria italica*), ladino clover (*Trifolium repens*), and orchard grass (*Dactylis glomerata*) (E. Haverlack, pers. comm.). Old road cuts have either become overgrown or been planted with grasses for erosion control. The shale barren itself remains intact, but the amount of dwarf cinquefoil is limited.

On 28 April 1994, two *P. c. wyandot* adults were observed at Potts Creek Nature Preserve (PCNP) in Alleghany County (Table 2). This is the first confirmed record for this county. This species has not been seen at this location during four subsequent surveys by DCR-DNH. In addition to a large, west-facing shale barren at this location, a small powerline right-of-way with patchy dwarf cinquefoil, and an exposed shale cliff (the result of a road cut) with scattered violet and phlox, may provide habitat for the Appalachian grizzled skipper. In recent years, the amount of violet and phlox may have decreased, but this has not been quantified (Roble, pers. obs.). Similarly, the powerline right-of-way has undergone some successional changes that do not favor the growth of dwarf cinquefoil (Chazal, pers. obs.).

On 2 May 1994, two *P. c. wyandot* adults were observed at Johnsons Creek Natural Area Preserve (owned by DCR-DNH) in Alleghany County (Table 2). A total of three individuals were seen in 1997, and one in 1998. This species has not been observed during six DCR-DNH surveys since 1998. This site has a shale barren and a road cut through shale soils, where the dwarf cinquefoil, violet, and phlox have grown. In recent years, young pines and accumulating leaf litter along the roadside may be shading out these small plants (Chazal, pers. obs.).

Two new populations of *P. c. wyandot* were discovered by DCR-DNH in 2001, both in Alleghany County. On 24 April 2001, a single adult was observed on a USFS Ruffed Grouse Management Area (RGMA) in GWNF. Weather conditions were not favorable on this day (overcast and temperatures falling into the mid-60s), and a return visit on the following day did not produce additional sightings. However, on 3 May with warm temperatures and clear skies, nine observations were made (7-9 individuals were estimated) on the same tract. On 8 May, four individuals were observed. At least one of these individuals looked very worn and

Table 2. Locations and dates of observation of *Pyrgus centaureae wyandot* in Virginia by DCR-DNH between 1992-2002. Some observations from Brattons Run Shale Barren were provided by amateur lepidopterists.

Location	County	Date	Observed? (# sightings)
Johnsons Creek Natural Area Preserve	Alleghany	4 May 1992	N
		2 May 1994	Y (2)
		6-7 May 1997	Y (3)
		24 April 1998	N
		15 May 1998	Y (1)
		5 May 2000	N
		23 April 2001	N
		24 April 2001	N
		8 May 2001	N
		9 May 2001	N
		28 April 2002	N
Mead-Westvaco Tract 704	Alleghany	3 May 2001	Y (2)
		9 May 2001	Y (3)
		23 April 2002	Y (14)
Potts Creek Nature Preserve	Alleghany	28 April 1994	Y (2)
		8 May 1997	N
		23 April 2001	N
		9 May 2001	N
		30 April 2002	N
USFS - Ruffed Grouse Management Area	Alleghany	24 April 2001	Y (1)
		25 April 2001	N
		3 May 2001	Y (7-9)
		8 May 2001	Y (4-7)
		18 April 2002	Y (5)
		19 April 2002	Y (3)
		24 April 2002	Y (17)
		28 April 2004	Y (3)
Forest Road 345	Alleghany	25 April 2002	Y (1)
Brattons Run Shale Barren	Rockbridge	23 April 1993	Y (2)
		24 April 1994	Y (1-2)
		26 April 1994	Y (1)
		26 April 1995	Y (1)
		2 May 1997	Y (1)
		13 April 1998	N
		21 April 1998	N
		29 April 1998	N
		26 May 1999	Y (1)
		25 April 2001	N
		10 May 2001	N
		29 April 2002	N

another looked very fresh. Most of the skippers were observed on dwarf cinquefoil but a few were observed on bird's foot violet, and one was on a vetch (*Vicia* sp.), although it was not observed nectaring on this species.

This area is one of several forest openings created by USFS for the management of Ruffed Grouse (*Bonasa umbellus*). The trees are cut down but not cleared, and natural succession is allowed to occur. The cut was approximately 3-5 years old in 2001, but the dry conditions brought on by the shale soils have hindered regrowth and left much of the soil exposed. Towards the bottom of the northwest-facing slope, dwarf cinquefoil covers an area of approximately 0.1 ha. Also, an intermittent stream at the base of the slope held small pools of water. Other available nectar sources included bird's foot violet, phlox, and blackberry (*Rubus* sp.).

In 2002, more extensive surveys of the RGMA were conducted. A maximum of 14 *P. c. wyandot* adults were counted in the original 2001 location. Five more observations were documented during surveys of surrounding areas up to 1.5 km from the main site. Three of these sightings were made in clearcut areas and two were made along the road. Though not all of the clearcuts were surveyed in 2002, none was found that match the main area for abundance of *Potentilla canadensis* or exposed, shale soils.

A brief visit to the RGMA on 28 April 2004 (included in Table 2, but not in other tables and figures), yielded observations of two *P. c. wyandot* adults (including a female ovipositing on *Potentilla canadensis*) in the main area and a third individual along a forestry road about 0.1 km away. It was noted that young pine trees were beginning to grow in the logging roads, which may cause some decline in the host plant in coming years. Also, in the 0.1 ha area of *P. canadensis*, sapling trees and some forbs (e.g., *Vicia* sp.) were shading out the plant and it did not appear to be as abundant as during previous surveys, but we did not quantify this.

The second site for *P. c. wyandot* discovered in 2001 is located on property owned by a private timber company with many holdings in areas and habitats appropriate for this species. Two individuals were observed on 3 May 2001 within a 5 year-old clearcut, which had been replanted with pine. Most of the shale soils were exposed except in areas closer to the base of the south-facing slope where dwarf cinquefoil covered approximately 0.1 ha. An intermittent stream at the base of the slope was dry at the time of the survey. Three *P. c. wyandot* adults were seen in the same area on 8 May 2001 and one individual was seen in a similar cut area about 700 m from the original site. In addition to the abundance of the host plant, dwarf cinquefoil, nectar sources noted included blackberry, bird's foot violet, and some phlox.

In 2002, further surveys of the area were conducted. Fourteen adult *P. c. wyandot* were observed on 23 April within portions of several 3-5 year-old clearcuts that had been replanted with pine, and along road cuts. In

the young pine stands, much of the shale soil remained exposed with sparse ground cover of *Rubus* sp. and broomsedge (*Andropogon virginicus*). Dwarf cinquefoil grew in scattered thick patches along road cuts and areas where the soil had been heavily disturbed by the timber harvest. Unlike the RGMA site, most *P. c. wyandot* observed at this site were seen nectaring on bird's foot violet. Other potential nectar sources noted included blackberry and some phlox.

On 25 April 2002, one *P. c. wyandot* was observed along Forest Road 345 in Alleghany County. This individual was nectaring on bird's foot violet amid a pine forest with a blueberry (*Vaccinium* sp.) understory with little exposed soil. No *Potentilla canadensis* was found in the immediate vicinity, though it was scattered along the roadside. Likewise, no further appropriate habitat was located in the immediate vicinity of the observation.

DISCUSSION

The Appalachian grizzled skipper is rare in Virginia. Since 1992, the staff of DCR-DNH has made observations of *P. c. wyandot* at only six locations out of 75 sites visited (175 total surveys) in 12 counties. Five of these sites are within 14 km of each other.

The observation of a single *P. c. wyandot* on FR 345 is interesting because it was found in seemingly suboptimal habitat. The nearest *P. c. wyandot* observation was approximately 2 km distant on the timber company property. Both observations were made in 2002. The area between these sites is interspersed with other clearcuts (not yet surveyed by DCR-DNH), a railroad right-of-way, and several old forestry roads, all of which may support dwarf cinquefoil. Schweitzer (1991) suggested that *P. c. wyandot* is a good colonizer and can move fairly widely through marginal habitats as long as the food plant is at least sparsely present. Thus, we do not consider FR 345 as a site which sustains a population of *P. c. wyandot*, but rather a localized observation.

The PCNP observations are within 3 km of the RGMA. However, because PCNP does have suitable habitat to potentially support a population of *P. c. wyandot*, and because of the temporal differences in observations (1994 for PCNP vs. 2001 for RGMA), these sites are considered to be separate populations. It remains possible, however, that if Appalachian grizzled skippers do persist on the PCNP, they may interact with those on the RGMA. Further studies are needed to determine the population dynamics of this species at these two sites.

Thus, excluding the isolated record from FR 345, only five sites in Virginia have verified *P. c. wyandot* observations since 1992. The two sites discovered in 2001 (RGMA and timber company property) are in areas clearcut for management purposes and may be the only sites with established populations (i.e., > 1-2 *P. c. wyandot* observed per survey and with appropriate habitat available). The clearcut/young pine stand habitats allow large areas for dwarf cinquefoil, the host plant of *P. c. wyandot*, to become established. The exposed shale soil in these managed areas may also mimic shale barren habitat, where the other known recent records of *P. c. wyandot* occur.

In addition to the few sites in Virginia that support this species, there are low numbers of individuals. All observations since 1992 combined account for fewer than 80 individuals. We are not aware of any reports of *P. c. wyandot* observations during this time period from amateur or professional lepidopterists at any sites in Virginia other than Brattons Run Shale Barren. The highest number of individuals seen at any one site during a given survey was 14 at both the RGMA (14 of 17 observed in this area on 24 April 2002) and the timber company (23 April 2002) sites. While these sites harbor the largest currently known populations of *P. c. wyandot* in Virginia, these populations are still considered small based on historic information and on other extant populations throughout the species' range (T. J. Allen, pers. comm.; D. F. Schweitzer, pers. comm.).

Of the five known sites in Virginia, most may be undergoing forest succession. The three sites discovered in the early 1990s (BRSB, PCNP, and JCNAP) have all undergone vegetational changes since our initial visits. At BRSB, the USFS has recently made extensive modifications to the numerous small fields in the area by planting for wildlife and old road cuts have either become overgrown or been planted with grasses for erosion control. Although the shale barren is still intact, dwarf cinquefoil is sparse in this habitat. Vegetation in the powerline right-of-way at PCNP has grown up, though there is still an area of exposed shale along the road cut, which is too harsh of an environment for trees to invade. The dwarf cinquefoil at JCNAP was primarily along the road cuts beside the shale barren. In recent years, pine saplings have invaded the road cut and leaf litter has built up along the edges. These have combined to reduce the amount of dwarf cinquefoil along the road. Similarly, during a brief survey in 2004 of the RGMA, it was noted that tree succession may also be starting to affect host plant availability at this site.

The RGMA and timber company sites have suitable habitats that need to be further surveyed or resurveyed to better understand the size and extent of each population. In addition, both of these properties will be undergoing landscape changes in the future. Additional cuts are planned for Ruffed Grouse management purposes on the USFS property (E. Haverlack, pers. comm.), and the timber company tract is an active timber holding.

Currently, we lack an adequate understanding of the role that forest succession plays in the population dynamics of *P. c. wyandot*, and many other questions also remain. For example, does forest succession adversely impact the population? Are populations spatially temporal across the landscape, moving as new openings are created? Our recent observations on clearcuts suggest that this species does well on recently disturbed areas with shale soils (Shuey, 1994). Would efforts to slow or halt succession help *P. c. wyandot* populations to persist?

Another gap in our understanding of the conservation needs of the Appalachian grizzled skipper is how populations respond to gypsy moth suppression activities. If these activities are indeed largely responsible for the observed decline of *P. c. wyandot* in other states (Schweitzer, 1991; Allen, 1997; Gochfeld & Burger, 1997), it is likely that spraying in the northern counties of Virginia has already impacted populations of *P. c. wyandot* prior to the accumulation of baseline abundance data. Most of the Virginia counties with known current or historical occurrences of *P. c. wyandot* have experienced recent gypsy moth infestations and thus are likely to undertake suppression activities. In particular, Alleghany and Rockbridge counties, where the known extant populations of *P. c. wyandot* occur, are now within the gypsy moth quarantine zone. Potential populations of *P. c. wyandot* farther southwest still lie beyond the recent regulated gypsy moth quarantine areas, but could be impacted in the future by the "Slow the Spread" suppression program (Virginia Polytechnic Institute and State University, Department of Entomology, 2001).

Continued surveys for *P. c. wyandot* in Virginia are needed to identify extant populations worthy of protection and to obtain data necessary in understanding the impacts of past and future gypsy moth suppression activities. In 1996, gypsy moth populations in Virginia declined precipitously due to a fungus, *Entomophaga maimaiga*, a natural pathogen to the moth and no detectable defoliation was recorded in the state in 1996, 1997, or 1998 (Virginia Polytechnic Institute and State University, Department of Entomology, 2001). In 2000, a resurgence in the gypsy moth population was detected and continued into 2001. Suppression activities were conducted in 2001 and 2002 (Gypsy Moth Slow the Spread Foundation, 2003). The effects of past suppression activities on historic *P. c. wyandot* sites in Virginia are unknown. Extreme caution should be used when considering suppression activities close to the current known localities, and monitoring of the *P. c. wyandot* populations is critical.

Due to forest succession and threats from gypsy moth control measures, all five sites in Virginia may be degrading in overall habitat quality. Table 3 shows six habitat characteristics thought to be important for areas supporting *P. c. wyandot* (Schweitzer, 1989) and how each of the five known sites in Virginia meet these criteria. All five sites are within the gypsy moth quarantine zone, and may be directly affected by gypsy moth control measures. Four of the five sites are thought to be undergoing forest succession which may be detrimental to *P. c. wyandot* by reducing the amount of *Potentilla canadensis* and other nectar sources. However, neither the stages of succession nor their effects on the host plant or on the butterfly directly have been quantified. The timber company land has not been resurveyed since 2002, thus succession has not been evaluated even anecdotally.

Surveys of additional habitats are warranted to understand the status and conservation needs of *P. c. wyandot* in Virginia. These additional surveys should not only continue to include appropriate shale barren habitats, but also be expanded to include other semi-open woodlands and clearings, such as power- and gas-line rights-of-way where *Potentilla canadensis* is found (Allen, 1997). Surveys of known sites should be continued, to monitor *P. c. wyandot* populations and the effects of succession on these areas. If possible, forest management steps should be taken to set back succession and promote growth of the host plant and nectar. Additionally, surveys should be conducted in the seven Virginia counties with historic records which were not surveyed during the past decade. Any documentation of new *P. c. wyandot* populations would be a significant step toward ensuring the long-term protection and survival of this localized species.

Considering its scarcity with concerted survey effort and based on its declining status rangewide, believed to be due in part to gypsy moth suppression programs (Schweitzer, 1991), *P. c. wyandot* may be a candidate for future listing under the federal Endangered Species Act. Although the taxonomy of the Appalachian populations of *P. c. wyandot* remains unclear and must be resolved, it is evident that the Appalachian grizzled skipper warrants immediate conservation attention and monitoring.

Table 3. Suggested habitat criteria for *Pyrgus centaureae wyandot* (Schweitzer, 1989).

Criteria	Brattons Run	Potts Creek	Johnsons Creek	USFS's RGMA	Timber property
No recent history of gypsy moth spraying	In quarantine area[1]	In quarantine area[1]	In quarantine area[1]	In quarantine area[1]	In quarantine area[1]
Abundant host plant (*Potentilla canadensis*), especially in patches on other-wise bare ground	Not abundant or in patches, scattered along road cuts and PROW[2], may be decreasing with succession	Not abundant or in patches, scattered along road cuts and PROW, may be decreasing with succession	Not abundant or in patches, scattered along road cuts, may be decreasing with succession	Ca. 0.1 ha area covered with *P. canadensis*, also along roads and other openings, may be decreasing with succession	Ca. 0.1 ha area covered with *P. canadensis*, also along roads and other openings
Abundant low-growing nectar flowers (e.g., *Viola* spp., *Phlox subulata*, etc.)	Yes, may be decreasing with succession	Yes, may be decreasing with succession	Yes, may be decreasing with succession	Yes	Yes
S or SW-facing eroding shale slope with much bare ground	E to SE-facing shale barren, road cuts vary, PROW mostly N to NE	W to SW-facing shale barren and road cut, PROW runs NW to SE	SW to S-facing shale barren, road cut varies	W to NW-facing slopes at 'main' area, road cuts and other cuts vary	S-facing slope at 'main' area, road cuts and other cuts vary
Woods within 30 m on at least two sides	Yes	Yes	Yes	Yes	Yes-planted pine, some quite young
Nearby source of moisture, usually damp soil along permanent or temporary streams	Yes	Yes	Yes	Yes	Yes

[1]Based on information from Gypsy Moth Slow the Spread Foundation (2003).
[2]PROW = powerline right-of-way

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LITERATURE CITED

Allen, T. J. 1997. The Butterflies of West Virginia and Their Caterpillars. University of Pittsburgh Press, Pittsburgh, PA. 388 pp.

Cech, R. 1995. Wheeling through West Virginia: definitely not in Brooklyn anymore. American Butterflies 3(2): 12-18.

Clark, A. H., & C. M. Williams. 1937. Records of *Argynnis diana* and of some other butterflies from Virginia. Journal of the Washington Academy of Science 27: 209-213.

Clark, A. H., & L. F. Clark. 1939. Butterflies from Virginia. Proceedings of the Biological Society of Washington 52: 177-184.

Clark, A. H., & L. F. Clark. 1951. The butterflies of Virginia. Smithsonian Miscellaneous Collections 116: 1-239.

Glassberg, J. 1999. Butterflies Through Binoculars: The East. Oxford University Press, New York, NY. 242 pp.

Gochfeld, M., & J. Burger. 1997. Butterflies of New Jersey. Rutgers University Press, New Brunswick, NJ. 329 pp.

Gypsy Moth Slow the Spread Foundation. 2003. 2002 Accomplishments in Slowing the Spread of the Gypsy Moth. http://www.gmsts.org/Reports/2002_accomp.htm Accessed 21 August 2003.

Iftner, D., J. A. Shuey, & J. V. Calhoun. 1992. Butterflies and Skippers of Ohio. Ohio Biological Survey Bulletin 8(1). 212 pp.

NatureServe. 2003. NatureServe Explorer: An Online Encyclopedia of Life. Version 1.8. NatureServe, Arlington, VA. http://www.natureserve.org/explorer. Accessed 20 August 2003.

Opler, P. A. 1998. A Field Guide to Eastern Butterflies. Houghton Mifflin Company, Boston, MA. 486 pp.

Opler, P. A., & G. O. Krizek. 1984. Butterflies East of the Great Plains. The Johns Hopkins University Press, Baltimore, MD. 294 pp.

Opler, P. A., H. Pavulaan, & R. E. Stanford (coordinators). 1995. Butterflies of North America. Northern Prairie Wildlife Research Center, U.S. Geological Survey, Jamestown, ND. http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bflyusa.htm (Version 26JUN2002). Accessed 5 September 2002.

Parshall, D. K. 2002. Conservation assessment for the southern grizzled skipper (*Pyrgus centaureae wyandot*). Report prepared for United States Department of Agriculture – Forest Service Eastern Region. 23 pp.

Schweitzer, D. F. 1989. A review of Category 2 Insecta in USFWS Regions 3, 4, 5. Unpublished report for U.S. Fish and Wildlife Service, Newton Corner, MA. 143 pp. plus appendices.

Schweitzer, D. F. 1991. Appalachian grizzled skipper, *Pyrgus wyandot* (Edwards). Pp. 240-241 *In* K. Terwilliger (coordinator). Virginia's Endangered Species. McDonald and Woodward Publishing Company, Blacksburg, VA.

Shapiro, A. M. 1974. Butterflies and skippers of New York state. Search 4: 1-60.

Shuey, J. A. 1994. Thoughts on the status of *Pyrgus centaureae wyandot*, emphasizing ecological similarities in Ohio and Michigan. Ohio Lepidopterists 16: 17-20.

Shuey, J. A., J. V. Calhoun, & D. C. Iftner. 1987. Butterflies that are endangered, threatened and of special concern in Ohio. Ohio Journal of Science 87: 98-106.

Virginia Polytechnic Institute and State University, Department of Entomology, 2001. The Gypsy Moth in Virginia: http://www.gypsymoth.ento.vt.edu. Accessed 21 August 2003.

Wagner, W. H., & A. H. Showalter. 1976. Ecological notes on *Celastrina ebenina* (Lycaenidae). Journal of the Lepidopterists' Society 30: 310-312.

Wood, C. E., Jr., & C. W. Gottschalk. 1942. The butterflies of Roanoke and Montgomery counties, Virginia (Lepid.: Rhopalocera). [part 3]. Entomological News 53: 191-197.