U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Oarisma poweshiek* (Parker), 1870

COMMON NAME: Poweshiek skipperling

LEAD REGION: 3

INFORMATION CURRENT AS OF: 26 May 2011

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
_X_ New candidate
___ Continuing candidate
___ Non-petitioned
___ Petitioned - Date petition received:
__ 90-day positive - FR date:
__ 12-month warranted but precluded - FR date:
__ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)?
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions?
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

___ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined):
___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Insecta (Lepidoptera), Hesperiidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin; Canada (Manitoba)

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin; Canada (Manitoba)

LAND OWNERSHIP

Landowner	Total
State Conservation Agency	86
Private Landowner	67
Private Organization	37
U.S. Fish and Wildlife Service	31
Unknown	31
Sisseton-Wahpeton Sioux Tribe	11
State Highway Department	7
County	6
Local Government	2
U.S. Forest Service	2
South Dakota State University	1
Total	**281**

The data above include sites where Poweshiek skipperling has been recorded at least once since 1985. It includes sites where the species is possibly extirpated.

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LEAD FIELD OFFICE CONTACT: Twin Cites (MN) Field Office, Phil Delphey, (612)725-3548 ext. 206

BIOLOGICAL INFORMATION

Species Description

1. General Description

Poweshiek skipperlings are small and slender-bodied, with a wingspan ranging from 2.3 to 3.0 centimeters (cm) (0.9 to 1.2 inches (in)) (Royer & Marrone 1992, p. 3). The upper wing surface is dark brown with a band of orange along the leading edge of the forewing. Ground color of the lower surface is also dark brown, but the veins of all but the anal third of the hindwing are outlined in hoary white, giving an overall white appearance to the undersurface.

The Poweshiek skipperling is most easily confused with the Garita skipperling. Garitas can be distinguished by their smaller size, quicker flight and overall golden-bronze color (Royer & Marrone 1992, p. 3). Another diagnostic distinguishing feature is the color of the anal area of the ventral hindwing (orange in Garita; dark brown in Poweshiek). Unfortunately, this is not always visible in the field. Garita skipperling generally occurs west of Poweshiek skipperling although there are records of both species from two counties in southeastern North Dakota and one county (Kittson) in northwestern Minnesota (Montana State University – Big Sky Institute. 2006. Butterflies of North America. < http://www.butterfliesandmoths.org/>. Accessed 9/28/06; Minnesota Department of Natural Resources. 2006. Rare features database. Accessed 9/28/06).

2. Technical Description

Parker (1870, p. 271-272) provided the original description of this species from his type series collected near Grinnell, Iowa. It is difficult to improve on his thorough technical description of the adults and the publication containing the description is not readily available. Therefore, it merits reproduction in its entirety here:

> Expands 1.16-1.26. Primaries trigonal, the edges nearly straight, angles but slight rounded, and the length of the costal border to the internal as 68 to 40. Secondaries more rounded. Ground color of both wings, above and beneath, silky dark brown, with purplish gloss. Primaries are ochre between the costal edge and subcostal nerve, the color narrowing and shading off near the apex, where it appears mostly, if at all, on the nervules. . . . Sometimes the yellow scales encroach on the interspaces. . . .
>
> The underside of the primaries has the costal color somewhat narrower and paler, and the color is still paler as it is carried around the apex, whence it extends, most often narrowly, two-thirds the length of the external edge, shading into the ground color towards the disk; and there is a similar but lighter color on the branches of the subcostal and median nerves, sometimes almost gray. The underside of the secondaries is occupied by ochrey hairs and scales between the costal edge and the costal nerve, and has a thick sprinkling of either pale yellow or hoary white (variable) in all the interspaces except a segment between the internal nerve and the second nervure therefrom, widening of course from the base to the exterior edge, where it occupies one-third of the marginal length; this space is wholly dark brown. All the other nervures are conspicuous with hoary white, and the internal border likewise. At a little distance, the surface generally seems to be nearly white.

> The body, of the same length as the secondaries, is of the ground color above, with profuse yellow hairs on the sides of the thorax and top of the head, and is white and hairy beneath. The hairy palpi, the antennae and the legs simply *correspond* in all particulars with the coloring of the body, above, laterally and beneath, with the exemption that the legs have not a dark shade of brown, and the antennae, which are clubbed only, show mostly the yellow, and are not annulated. On the posterior legs are two pairs of short spurs, the lower equal, the upper differing in length by one-fourth. White encircles the eyes, obscurely so above.
>
> Females differ from the males in a larger proportion of light color in the fringe, above and beneath. In both, on the inferior surface, the basal half of the fringe is ashy white, then nearly black, and barely tipped with yellowish white. Female antennae show annulations.

The size of Poweshiek skipperlings appears to vary somewhat across their range. Royer and Marrone (1992, p. 3) give a general range for the wingspan of 2.3 to 3.0 cm (0.91 to 1.18 in) for the species. They state that North and South Dakota specimens tend to be slightly smaller than the 2.9 to 3.2 cm (1.14 to 1.26 in) range given by Parker (1870) for the type series from Grinnell, IA. A sample of Richland County, North Dakota specimens from Royer's collection had an average wingspan of 2.8 cm (1.10 in) for males and 3.0 cm (1.18 in) for females. South Dakota specimens in Marrone's collection had an average wingspan of 2.6 cm (1.02 in) for males and 2.7 cm (1.06 in) for females.

McAlpine (1972, p. 85-92) described the various life history stages based on observations made in 1944-1945 of individuals from the Lamberton Lake and Button Lake populations in Kent County, Michigan. The eggs are described as pale yellowish green, mushroom shaped with a flattened bottom and slightly depressed micropyle (pore in the egg's membrane through which the sperm enter), and with a smooth surface. They were 0.8 millimeters (mm) (0.031 in) long, 0.7 mm (0.028 in) wide and 0.5 mm (0.020 in) high. The overall color of the head and body of the larvae is pale grass green, with a distinctive darker green mid-dorsal stripe and seven cream colored stripes on each side. First instars were 1.8 mm (0.071 in) at hatching, and the lone 7th instar survivor was 23.6 mm (0.929 in) near the end of that stage. Unfortunately, McAlpine's records were incomplete and no further data were available. He assumed that there should be one or two additional instars.

Taxonomy

Class:	Insecta (Insects)
Order:	Lepidoptera (Butterflies and Moths)
Superfamily	Hesperioidea (Skippers)
Family:	Hesperiidae (Skippers)
Subfamily:	Hesperiinae (Grass or Branded skippers)
Genus:	*Oarisma* Scudder, 1872
Specific Name:	*poweshiek* (Parker), 1870
Scientific Name:	***Oarisma poweshiek***

Common Name: **Poweshiek skipperling**
Controversial or Unresolved Taxonomy: NONE

Common Name (and other common names)

Poweshiek skipperling

This is the common name proposed by both Miller (1992, p. 20) and North American Butterfly Association (NABA, Checklist of North American Butterflies Occurring North of Mexico. 2001. http://www.naba.org/pubs/enames2.html; accessed 23 May 2011) in recent independent efforts to establish standardized butterfly common names.

Miller (1992, p. 20) summarized the common names used historically and the authorities that used them. She did not, however, distinguish between different spellings for the species name (e.g. Powesheik vs. Poweshiek) that have been carried over to the common names. Names listed by Miller (1992, p. 20) plus the alternate spellings used by various authorities are summarized below:

Poweshiek skipperling:	Brock & Kaufman (2003, p. 306); Glassberg (1999, p. 167); Layberry et al. (1998, p. 48); Miller (1992, p. 20); NABA (Checklist of North American Butterflies Occurring North of Mexico. 2001. http://www.naba.org/pubs/enames2.html; accessed 23 May 2011); Opler et al. (1998, p. 363)
Powesheik skipperling	Holland (1931); Opler & Malikul (1992, p. 275)
Powesheik skipper	Klots (1951, p. 231); Miller (1991); Opler & Krizek (1984); Tilden & Smith (Tilden & Smith 1986)
Eastern skipperling	Scott (1986, p. 431)
Parker's broad wing	Miller (1992, p. 20 - no references listed)
Iowa dunn	Miller (1992, p. 20 - no references listed)

Scientific Name (and other scientific names)

Oarisma poweshiek (Parker, 1870)

The Poweshiek skipperling was first described by Parker (1870, p. 271-272) from specimens collected at Grinnell, Iowa on June 21, 1870. It was named for the county in which it was found (Poweshiek County), but it was misspelled, *powesheik*, in the original description. This spelling was retained by most early authorities (Holland 1931; Lindsey 1922, p. 61). Miller and Brown (1981) used the corrected spelling, *poweshiek*, but then Miller and Ferris (1989) changed it back in their supplement. Current usage is mixed, with many authorities retaining the original spelling (e.g., Miller 1992, p. 20) while others have opted for the corrected spelling (Brock & Kaufman 2003, p. 306; Glassberg 1999, p. 167; Layberry et al. 1998, p. 48; Opler et al. 1998, p. 363). Layberry et al. (1998, p. 48) state ". . . since it is a clear case of an original incorrect spelling it can be corrected [rule 32(c)ii of the International Code of Zoological Nomenclature]."

Controversial or unsettled taxonomic issues

There are no current or unsettled taxonomic issues.

Scott (Scott 1986, p. 431) raised the possibility that *O. poweshiek* could be a subspecies of *O. garita* (Garita skipperling) based on the apparent overlap of their range in southeastern North Dakota, but no unequivocal proposals have been made to establish their conspecificity (Royer & Marrone 1992, p. 2, R. Royer, Minot State University, pers. comm. 2004). This possibility has been rejected based on differences in habitat preference, phenology and genitalia (McCabe & Post 1977, p. 38) and differences in flight characteristics (Royer & Marrone 1992, p. 2). *O. poweshiek* is considered to be a valid species by most authorities (R. Royer, pers. comm. 2004).

Habitat/Life History

Biology and natural history

Poweshiek skipperlings are univoltine (having a single flight per year), with an adult flight from about the middle of June through the end of July. The actual flight period varies somewhat across the species' range and can also vary significantly from year-to-year depending on weather patterns. Females emerge slightly later than males. In Iowa and Minnesota their emergence appears to be closely synchronous with the Dakota skipper (*Hesperia dacotae*), regal fritillary (*Speyeria idalia*), and wood nymph (*Cercyonis pegala*) at sites where they occur together. The Michigan fen populations co-occur with Mitchell's satyr (*Neonympha mitchellii mitchellii*) and swamp metalmark (*Calephelis muticum*), which emerge slightly before and after, respectively, the Poweshiek [D. Cuthrell, Michigan Natural Features Inventory (MNFI), pers. comm. 2005].

Description of life history stages

McAlpine (1972, p. 85-93) described the various life history stages based on observations made in 1944-1945 of individuals from the Lamberton Lake and Button Lake populations in Kent County, Michigan. Eggs from captive females were hatched, and then the larvae were reared on what he referred to as lawn grass, probably a *Poa* sp. Most of the larvae refused to eat the lawn grass, but a few did and he was able to follow two of them through most of the developmental stages. Unfortunately, his records were incomplete and he did not have any observations past the 7^{th} instar (the stage between successive molts, the first instar being between hatching and the first molt). He believes there should have been one or two additional instars, followed by the chrysalis (pupa) and then the imago (adult) stages. His physical descriptions of the eggs and larvae were included in the technical description above. His observations on the developmental chronology follow:

Eggs laid: 4-5 July 1944
Egg stage: about 9 days
Larval stages (based on observations of two larvae)
1st Instar: 1.8 – 4.0 mm; 11 days
2nd Instar: 4.0 – 7.0 mm; 9 days
3rd Instar: 6.5 – 8.8 & 9.3 mm; 16 days
4th Instar: 8.8 – 10.0 mm & 9.3 – 11.5 mm; about 25 days
5th Instar: 10.0 mm & 11.5 mm
Diapause initiated latter part of September
Feeding initiated again 29 March – 1 April
Fifth molt 12 & 16 April
6th Instar: 16 mm & 19 mm; 32 or 28 days (records incomplete)
Sixth molt 14 May for one (other larva died)
7th Instar: 19 mm on 14 May; 23.6 mm on 30 May (possibly near end of 7th instar)
(no additional data – records lost or misplaced)
Should have one or two additional instars, followed by chrysalis and imago stages

Principal nectar plants

Preferred nectar plants vary across the geographic range of Poweshiek skipperlings. Smooth ox-eye (*Heliopsis helianthoides*) and blacksamson echinacea (*Echinacea angustifolia*) were the favorite nectar plants during surveys conducted in Iowa, Minnesota and North Dakota from 1990-1997 (Swengel & Swengel 1999, p. 280). Other species used, in descending order of number of observations, were stiff tickseed (*Coreopsis palmata*), blackeyed susan (*Rudbeckia hirta*), and palespike lobelia (*Lobelia spicata*) (Swengel & Swengel 1999, p. 280). On drier prairie habitats in Iowa and Minnesota, blacksamson echinacea is used almost exclusively of other species and the emergence of the adults corresponds closely to the early maturity of this species' disk florets (Selby 2005, p. 5). On the wetter prairie habitats of Canada and the fen habitats of Michigan, favorite nectar plants are blackeyed susan, palespike lobelia, sticky tofieldia (*Triantha glutinosa*), and shrubby cinquefoil (*Dasiphora fruticosa ssp. floribunda*) (Bess 1988, p. 13; Catling & Lafontaine 1986, p. 65; Holzman 1972, p. 111; Nielsen 1970, p. 46; Summerville & Clampitt 1999, p. 231).

Larval food plants

The availability of larval food plants is likely a factor of major importance to the conservation of Poweshiek skipperling populations. The requirements of immature stages "define habitat quality in most temperate insects species studied and adult resources are seldom limiting" (Thomas et al. 2001, p. 1794). Until recently, the larval food species was presumed to be elliptic spikerush (*Eleocharis elliptica*) or sedges, but this was based on limited observations, mostly from the Michigan populations (e.g, Holzman 1972, p. 113). More recent observations have shown that for some populations the preferred larval food plant is prairie dropseed (Borkin 1995, p. 6); larval feeding has also been observed on little bluestem (*Schizachyrium scoparium*) (Borkin 1995, p. 5-6) and sideoats grama (*Bouteloua curtipendula*) (R. Dana, Minnesota Department of Natural Resources, pers. comm. 2005).

Until a careful study of larval food plants is done for Poweshiek skipperling, information obtained from observations of egg-laying (oviposition) and larval feeding behavior should be

interpreted with caution. McAlpine's (1972) notes on feeding behavior of captive-reared larvae, for example, may be of limited use for determining the species' feeding behavior in the wild. In 1970, Holzman observed oviposition of a single egg on elliptic spikerush and saw identical eggs on other spikerushes nearby; in 1971 he observed two ovipositions on an "unidentified sedge" (Holzman 1972, p. 113). In North Dakota McCabe observed oviposition and subsequent feeding on a sedge (*Carex* sp.) "sprout" that was embedded in a clump of fowl bluegrass (*Poa palustris*), which the larvae would not feed on (McCabe & Post 1977, p. 38).

The observations summarized above seem to have led to premature acceptance that the preferred larval food plants are spikerushes, especially elliptic spikerush, or sedges (Catling & Lafontaine 1986, p. 66; COSEWIC 2003, p. 11) – conclusions that may have been reinforced by the juxtaposition of wetland habitats containing spikerushes with many Poweshiek skipperling populations. Borkin (1995, p. 6) found, however, that prairie dropseed is the primary larval food plant for Powekshiek skipperling at the two Waukesha County, Wisconsin sites. Prairie dropseed frequently occurs in drier areas near wetlands containing spikerush and is a frequent to dominant member of prairie fen plant communities in Michigan (Michigan Natural Features Inventory 2000, p. 2). David Cuthrell (Michigan Natural Features Inventory, pers. comm. 2008) has also observed oviposition on mat muhly (*Muhlenbergia richardsonis*), a grass that often forms a "dense turf with other prairie grasses" in Michigan's prairie fens (Penskar & Higman 1999, p. 1).

In southwestern Minnesota dry hill prairies Robert Dana (Minnesota Department of Natural Resources, pers. comm. 2005) observed oviposition on prairie dropseed, little bluestem, big bluestem (*Andropogon gerardii*), porcupine grass (*Stipa spartea*), and a couple unidentified species; he also observed a larva feeding on sideoats grama (R. Dana, pers. comm. 2005). Susan Borkin (pers. comm., 10 July 2009) also observed Poweshiek skipperling oviposit on big bluestem. Dana noted that larvae and ovipositing females appeared to have a preference for "very fine, threadlike structures" and hypothesized that Poweshiek skipperling may lack specific host requirements and may adapt to the range of acceptable plant species at a site (R. Dana, pers. comm. 2005).

Without more specific information regarding larval food plants, it seems important to manage Poweshiek skipperling habitats to maximize the availability of native, fine-stemmed grasses and sedges, especially those on which oviposition or larval feeding has been observed in the wild.

Habitat requirements

The full range of habitat preferences for Poweshiek skipperling includes prairie fens, grassy lake and stream margins, moist meadows, and wet-mesic to dry tallgrass prairie. McCabe and Post (1977, p. 38) describe their habitat in North Dakota as ". . . high dry prairie and low, moist prairie stretches as well as old fields and meadows." Where Garita and Poweshiek skipperlings occur together, Garita is found on the dry knolls and Poweshiek is found in the moister valleys, although Poweshiek does inhabit dry habitats further east where Garita is absent. Royer and Marrone (1992, p. 12) describe Poweshiek skipperling habitat in North and South Dakota as "undisturbed native tallgrass prairies" and that it favors "moist ground in such prairies", but "is occasionally found in high, dry sites." In Iowa and Minnesota the habitat description of McCabe and Post (1977, p. 38) seems most appropriate, with good representation of both "high dry" and

"low wet" prairie populations throughout both states. The only documented Illinois record was associated with "high rolling prairie" (Dodge 1872, p. 218); the only documented Indiana record was from "marshy lakeshores and wetlands" (Blatchley 1891, p. 398; Shull 1987).

The disjunct populations of Poweshiek skipperlings in Michigan have more narrowly defined habitat preferences. Their habitat is variously described as wet marshy meadows (Holzman 1972, p. 114), bog fen meadows or carrs (Shuey 1985, p. 181), sedge fens (Bess 1988, p. 13), and prairie fens (Michigan Natural Features Inventory, unpubl. data). Prairie fen seems to be the most appropriate and currently accepted name for this habitat type. At the Liberty Fen site in Jackson County, Bess (1988, p. 13) found them primarily in the drier portions of the fen dominated by low sedges and an abundance of nectar sources. Summerville and Clampitt (1999, p. 231) noted that the population was concentrated in areas dominated by spikerush and that only 10-15 percent of the fen area was occupied despite the abundance of nectar sources throughout. David Cuthrell, who is currently working with Poweshiek skipperling in Michigan, typically finds them in "peat domes within larger prairie fen complexes in areas co-dominated by" mat muhly and prairie dropseed (D. Cuthrell, pers. comm. 2011) and often in association with the butterflies, Mitchell's satyr and swamp metalmark (D. Cuthrell, pers. comm. 2005).

Poweshiek skipperling populations in Wisconsin are also disjunct from the core population to the west and are associated with areas that contain intermixed wet, mesic and dry mesic prairie habitats (Borkin 1995, p. 6). The dry mesic habitats contain "extensive patches of prairie dropseed and little bluestem grasses" (Borkin 1995, p. 7). Survival in wetter areas, which tend to burn cooler and less completely, coupled with low recolonization rates, or the disproportionate loss of wet vs. dry prairie could give the false impression that the wet areas were their preferred habitat (Borkin 1995, p. 7).

Canadian populations of Poweshiek skipperlings are restricted to a single 2,300-hectare (ha) [5683 acres (ac)] area in southeastern Manitoba (COSEWIC 2003, p. 5). The wet to mesic tallgrass prairie in this area is characterized by low relief [1-2 meters (m) (3.28-6.56 feet (ft)], with alternating lower wetter areas and higher drier prairie; Poweshiek skipperlings tend to be concentrated on or near the edge of the higher drier prairie (COSEWIC 2003). Spikerush is frequent in the wetter areas and prairie dropseed, blackeyed susan, and palespike lobelia are frequent in the drier areas (COSEWIC 2003, p. 7-8).

Historical and Current Species Range/Distribution

Poweshiek skipperling is a habitat specialist typically associated with high quality native prairie and prairie fens. It once ranged widely over the native wet-mesic to dry tallgrass prairies from the eastern Dakotas (Royer & Marrone 1992, p. 4-5) through Iowa (Nekola & Schlicht 2007, p. 7) and Minnesota (Minnesota Department of Natural Resources, Division of Ecological Resources, unpubl. data), with occurrence also documented in northern Illinois (Dodge 1872, p. 218), Indiana (Blatchley 1891, p. 898), Michigan (see below), and Wisconsin (see below). The relatively recent discovery of Poweshiek skipperling populations in the Canadian province of Manitoba further extended its northern distribution.

Local extinctions of Poweshiek skipperling on isolated habitat fragments are likely permanent unless one or more populations within 1-2 kilometer (km) (0.62-1.24 miles) are large enough to produce enough immigrants to reestablish populations or if the capability to artificially rear the species is developed. Human fragmentation of tallgrass prairie began in about 1830 and approximately 99 percent of the original prairie is now gone across the species' range (Table 1, adapted from Samson & Knopf 1994, p. 419). This has generally left Poweshiek skipperling populations scattered amongst fragments of this once vast ecosystem. Additional historic accounts of Poweshiek skipperling from the States of Montana, Colorado and Nebraska are likely misidentifications of its western congener, the Garita skipperling.

Table 1. Tallgrass Prairie loss in seven U.S. states (adapted from Samson & Knopf 1994, p. 419) and one Canadian province (COSEWIC 2003) that contain Poweshiek skipperling records. Data for Michigan were not available. E = listed by state as Endangered; T = listed by state or province as Threatened; SC = listed by state as Special Concern.

State/Province	Historical (ha)	Current (ha)	Decline (%)	NatureServe/State Status
Manitoba	600,000	5,000	99.17	Critically Imperiled/T
Wisconsin	971,000	4,000	99.59	Critically Imperiled/E
North Dakota	1,200,000	1,200	99.90	Not Ranked/No State List
Indiana	2,800,000	404	99.99	Possibly Extirpated
South Dakota	3,000,000	449,000	85.03	Imperiled/Not Listed
Minnesota	7,300,000	30,350	99.58	Vulnerable/Special Concern
Illinois	8,900,000	930	99.99	Possibly Extirpated
Iowa	12,500,000	12,140	99.90	Critically Imperiled
Total	37,271,000	503,024	98.65	

United States of America

Illinois

Poweshiek skipperling occurrence is considered rare to the state of Illinois, with one supported and two suspected historical occurrences. In the early 1870s, Dodge (1872, p. 218) reported abundant Poweshiek skipperling occupying "the high rolling prairie that forms the divide between the Illinois and Rock rivers" in Bureau County, Illinois. In addition to Bureau County, the website *Butterflies and Moths of North America* lists Poweshiek skipperling occurrence for Lake and Mason Counties (http://www.butterfliesandmoths.org/species/Oarisma-poweshiek; accessed 26 May 2011). The website maintains a verifiable database on species occurrences, but the Illinois state butterfly coordinator for the website did not have access to the supporting data for Lake and Mason Counties records (Doug Taron, Chicago Academy of Sciences, pers. comm. 2005). At present, there are no data to support continued existence of Poweshiek skipperling in the state. NatureServe describes the species' status as "possibly extirpated" in the State of Illinois (http://www.natureserve.org/; accessed 26 May 2011).

Indiana

Poweshiek skipperling occurrence is also considered rare to the state of Indiana, with only one supported historical occurrence. Blatchley (1891, p. 898) remarked, "It is a western species not before recorded east of Illinois" upon reporting "small numbers" of Poweshiek skipperling near Whiting, Indiana. Shull (1987, p. 49) expressed confidence that this record is authentic, stating that "It is unlikely that he would have confused this distinctly marked skipper with any other species." At present, there are no data to support continued existence of Poweshiek skipperling in the state. NatureServe describes the species' status as "possibly extirpated" in the State of Indiana (http://www.natureserve.org/; accessed 26 May 2011).

Iowa

Records provide evidence for Poweshiek skipperling occurrence on 48 sites in 13 counties in the state of Iowa (Nekola & Schlicht 2007, p. 7; Saunders 1995, p. 27-28) (Nekola 1995; Saunders 1995; Iowa Department of Natural Resources, unpubl. data 2010). Early reports from Parker (Parker 1870, p. 271) described Poweshiek skipperling as abundant on a prairie slope at Grinnell, Iowa, while Lindsey (Lindsey 1917; 1920, p. 320) noted additional rare occurrences in Story, Dickinson, Poweshiek, and Woodbury Counties, Iowa. Habitat has been long since been destroyed where the species was recorded in Poweshiek, Story, and Woodbury Counties.

Recent (post-1985) occurrence data for Iowa is based primarily on surveys conducted in 1993-1994 by Saunders (1995), in 2000 by Selby (Selby 2000), in 2007 by Selby and Olsen (Selby 2008), and in 2009 by Selby (2009b). Saunders' (1995, p. 7-8) 1993-1994 surveys were extensive, including 65 sites in 17 counties where Dakota skipper or Poweshiek skipperling had been previously recorded or where prairie and butterfly surveys or infra-red photography suggested the presence of Poweshiek skipperling habitat. Among the 65 sites surveyed, he found Poweshiek skipperling at 29 sites in ten counties (Saunders 1995, p. 27).

Another comprehensive survey for Poweshiek skipperling in Iowa was not completed again until 2007. Before that, Selby surveyed six sites in 2000 that were in and near Cayler Prairie and Freda Haffner Kettlehole state preserves in Dickinson County. Poweshiek skipperling had been previously recorded at each of these sites and he found "good populations" at most of them (Selby 2000, p. 19). Follow-up surveys of this complex in 2004, 2005, and 2007, however, produced no confirmed sightings (Selby 2010, p. 6), hinting at the decline that was also becoming evident in Minnesota.

In 2007, Selby and Olsen carried out extensive surveys to reassess the status of the species in the state. It included 38 of the 44 sites in the state with modern day records. They found the species at only two of the 38 sites surveyed – Hoffman Prairie State Preserve in Cerro Gordo County and Highway 60 Railroad Prairie in Osceola County (Selby 2008). Five of the six sites skipped by the 2007 surveys were either near sites that were surveyed (in the Cayler Prairie/Freda Haffner Kettlehole complex) or now contain "very little quality prairie" (J. Selby, pers. comm. 2 Nov 2010).

Selby found four Poweshiek skipperlings at Hoffman Prairie in 2008 (Selby 2009b, p. 3), but could not find it during repeated surveys in 2009 (Selby 2009b, p. 7) or 2010 (J. Selby, pers. comm., 6 July 2010). Supplementary surveys conducted further west along U.S. Highway 18 in Hancock County also produced no confirmed sightings. There have been no surveys at Highway 60 Railroad Prairie since 2007 (J. Selby, pers. comm. 2 Nov 2010).

Michigan

In Michigan, Poweshiek skipperlings inhabit "peat domes within larger prairie fen complexes in areas co-dominated by" the grasses, mat muhly and prairie dropseed (D. Cuthrell, pers. comm. 2011). The species was first recorded in Michigan in 1893 at Lamberton Lake near Grand Rapids in Kent County (Holzman 1972, p. 111) and then at nearby Emerald Lake Fen in 1944 (McAlpine 1972, p. 83). Shrubs have invaded both sites, however, and no Poweshiek skipperlings have been found at either of these two western Michigan sites since 1944 and 1968, respectively (MNFI, unpubl. data 2011). Holzman (1972) documented the species in Oakland County in 1970, which he described as a "range extension" to the east of Lamberton Lake. The species has since been found at a total of fourteen locations in eastern Michigan (Table 2). Their local extinction from the two Kent County sites indicates that they are possibly extirpated from western Michigan.

MNFI estimates the viability of only four of Michigan's sixteen Poweshiek skipperling occurrences as good or better (Table 2). Three of these are within 20 km (12.43 mi) of one another in Oakland County and the fourth is about 100 km (62.12 mi) away in Jackson County. The species is possibly extirpated from six of the state's 16 occurrences. Small populations, significant and immediate threats, or both limit the viability of the remaining six occurrences (Table 2).

Table 2. Summary of Poweshiek skipperling records in Michigan. EO Ranks are Michigan Natural Features Inventory (MNFI) element occurrence ranks: A – Excellent estimated viability; B – Good estimated viability; BC – Good or fair estimated viability; C – Fair estimated viability; E – Verified extant (viability not assessed); F – Failed to find; and, H – Historical. We assume that the species is extant at the ten sites where ranks are neither F nor H.

Site Name	County	EO Rank	Last Observed	Site Owner	MNFI Comments
Grand River Fen (Liberty Fen)	Jackson	A	2010	The Nature Conservancy	54 recorded during three hour survey in 2010; glossy buckthorn present but "having minimal impact" on Poweshiek skipperling
Brandt Road Fen (Holly Fen)	Oakland	A	2010	Michigan Department of Natural Resources	115 adults recorded during two-hour survey in 2010; "glossy buckthorn and gray dogwood encroachment is a major problem" that is being managed (D. Cuthrell, pers. comm. 2011)
Long Lake Fen	Oakland	A	2010	Springfield Township/Private	190 and 112 counted during 2009 and 2010 surveys, respectively; located in part of Oakland Co. under intense development pressure
Buckhorn Lake	Oakland	B	2010	Michigan Nature Association	Glossy buckthorn present but exceptionally rare; 84 adults counted in 2010
Little Goose Creek Fen	Lenawee	BC	2010	Michigan Nature Association/Private	One and two observed during 2-hour surveys in 2009 and 2010, respectively; large area of habitat, but small number of adults; some ORV damage; invasive plant removal recommended; most of site owned by Michigan Nature Association
Rattalee Lake Fen	Oakland	BC	2009	Michigan Nature Association	Large area of habitat, but few adults - a maximum of four recorded during annual surveys conducted since 2007 - zero recorded in 2010; invasive species removal recommended
Halstead Lake Fen	Oakland	BC	2008	Michigan Department of Natural Resources	Glossy buckthorn seedlings were observed at the site and should be controlled; 1-17 adults counted during surveys conducted in four recent years (2003-2008)
Park Lyndon	Washtenaw	C	2010	Washtenaw Co.	Good quality fen, but "small" area of habitat; a total of 8 adults observed during a 2 hour survey in 2010
Snyder Lake Fen West	Washtenaw	C	2007	Washtenaw Co./Private/State	No surveys between 1995 and 2007; in 2007 one adult recorded during 15 min. survey; may be connected to Park Lyndon site, which is about 0.5 mile away; some ORV use
Liberty Bowl Fen	Jackson	E	1996	Private	
Bullard Lake	Livingston	F	2007	Michigan Nature Association/PRV	Site needs removal of glossy buckthorn; one Poweshiek skipperling recorded in 2007, but none found during 2.5 hour surveys in 2008 and 2009, respectively
Whalen Lake	Livingston	F	1998	Private	Recent annual surveys (2007-2009) all negative; degradation of site noted as early as 1990
Emerald Lake Fen	Kent	H	1944	Private	No Poweshiek skipperling found during last survey in 1986; heavy shrub invasion except for small area
Lamberton Lake Fen	Kent	H	1968	Private	Species most likely extirpated here; low species diversity; glossy buckthorn invasion a huge problem
Fenton Road	Oakland	H	1973	Private	
Rattalee Road	Oakland	H	1970	Private/Oakland Co./Consumers Energy	

The results of recent surveys in Michigan do not reflect the sharp and broad declines documented west of the Mississippi River, which have elevated the importance of the species' status in the state. In 2010 surveyors counted 84 Poweshiek skipperlings within two distinct 'colonies' at Buckhorn Lake and more than one hundred at the two other Oakland County sites ranked by MNFI as good or excellent (Table 2; MNFI, unpubl. data 2011). Numbers counted at Liberty

Fen in Jackson County – the fourth site ranked good or better by MNFI – are more modest – "dozens" in 2007; 25 in 2008; 31 in 2009; and 54 in 2010 (MNFI, unpubl. data 2011). Shuey (1985, p. 180) had first discovered Poweshiek skipperling in 1983 at Liberty Fen. In 1988 Bess (1988, p. 24) described a "large population" occurring in "isolated pockets throughout much of the fen." Based on a 1997 survey, Summerville and Clampitt (1999, p. 231) estimated the populations of Poweshiek skipperling "to be greater than 100 individuals", but found that it occupied only about 10-15 percent of the 200 ha (494 ac) fen – MNFI estimates the extent of the species' occurrence there to be about 9 ha (22 ac) (MNFI, unpubl. data 2011).

Invasive species, especially glossy buckthorn (*Frangula alnus*) and narrowleaf cattail (*Typha angustifolia*), are threats to Poweshiek skipperling at all ten sites where the species is presumed extant in Michigan. The magnitude of this threat, however, varies among sites. At Grand River Fen, for example, glossy buckthorn "is present but having minimal impact" (MNFI, unpubl. data 2011), but it and gray dogwood are "a major problem" at Brandt Road (Holly) Fen. The latter is of special concern due to the importance of Brandt Road Fen to the conservation of Poweshiek skipperling in the state. Glossy buckthorn is also "present but exceptionally rare" (MNFI, unpubl. data 2011) at Buckhorn Lake, another of the four major sites in the state. MNFI does not note any threat from invasive species at Long Lake Fen. Among the six sites with less viable Poweshiek skipperling populations (Table 2), MNFI recommends control of invasive species at three sites. MNFI also recommends control of invasive species at Bullard Lake, but the species may already be extirpated there. Long Lake Fen is in a part of Oakland County that is "under intense development pressure." Urban development threatens to disrupt groundwater flow (Spieles et al. 1999, p.1), which may reduce the ability of fens to resist invasion by glossy buckthorn (Fiedler and Landis, in prep.).

The Poweshiek skipperling populations at five of the extant sites are threatened by isolation from other populations. Poweshiek skipperlings at Little Goose Lake Fen, for example, are separated from other populations by at least eight km (5 mi) – too far for immigrants to repopulate the site in the event of the species' local extinction. Two-hour surveys in 2009 and 2010 recorded only one and two Poweshiek skipperlings, respectively at Little Goose Lake Fen. MNFI estimates the viability of Grand River Fen as "excellent" (Table 2, MNFI unpubl. data 2011), but there are no reliable source of immigrants to repopulate the site if Poweshiek skipperlings are extirpated. The viability of the nearest site – Liberty Bowl Fen – is unknown and the next nearest site – Little Goose Lake Fen – is likely too far and isolated from Grand River Fen and may contain too few Poweshiek skipperlings to generate significant numbers of immigrants.

Minnesota

Until about 2003, Poweshiek skipperling was regarded as "the most frequently and reliably encountered prairie-obligate skipper in Minnesota" (Dana 2008, p. 1). The Minnesota Department of Natural Resources Rare Features database (polygon dataset) contains 178 Poweshiek skipperling occurrence records in 32 counties. Clusters of records occur within five general areas from the state's southwest corner to near the Canadian boundary in the north.

Signs of Poweshiek skipperling's decline in Minnesota were noted as early as 2003 when Selby found sharply lower numbers in and near Glacial Lakes State Park (Selby 2005, p. 20) compared

to those observed in 2001 by Skadsen (2001b). For example, numbers recorded along four transects that were surveyed in both years decreased from 104 to 2 (Selby 2006, Appendix 2, p. ii). In 2004 and 2005, Selby did not record a single Poweshiek skipperling on any of these transects during eleven separate surveys (Selby 2006, Appendix 2, p. 2).

To determine whether these results were indicative of a broader decline in Minnesota, an extensive survey effort was conducted in 2007 and 2008 throughout most of the species' known range in the state (Selby 2009a). Sites with previous Poweshiek skipperling records that were considered to have the greatest conservation importance to the species (e.g., large, high-quality prairie remnants) were surveyed along with sites with no previous records that appeared likely to support the species (Selby 2009a). In 2007, 70 sites in 15 counties were surveyed, including 26 sites with previous Poweshiek skipperling records (Selby 2009a, p. 1 and 6). In 2008, 56 sites were surveyed in 13 counties, including 21 sites with prior records (Selby 2009a, p. 1 and 6). Thirty-four sites with previous Poweshiek skipperling records were surveyed in both years combined.

The 2007 survey produced disquieting results, with Poweshiek skipperling presence recorded on only three sites out of 70 surveyed (Selby 2009a, p. 1). Moreover, each of these three sites had just one confirmed individual (Appendix A). The 2008 survey provided equally troubling results, with no Poweshiek skipperlings recorded on any of the 58 sites surveyed (Selby 2009a, p. 1). These results should be compared with those of similar survey work in 1993 and 1994 (Schlicht & Saunders 1994and see Appendix B). Although Poweshiek skipperling was absent from most sites surveyed, the proportions of sites where the species was present in 1993 and 1994 – 30 percent and 39 percent, respectively (Schlicht & Saunders 1995, p. 5-7) – were markedly higher than in 2007 and 2008 (4 percent and 0 percent, respectively, see above). These surveyors typically found low numbers of Poweshiek skipperlings, but numbers were "significant" at three sites (Schlicht & Saunders 1995, p. 4). At one of these sites, Glynn Prairie, twenty-five Poweshiek skipperlings were recorded during a 50-minute survey in July 1993 (Schlicht & Saunders 1995, data sheet) but no Poweshiek skipperlings were observed at this site during the 2007 survey, which was conducted under "good" conditions (zero cloud cover, 78° F, 2-3 mph wind) (Selby 2009a, p. xxxv).

Further evidence of the decline comes from a separate 2007 study by Dana, who conducted multiple transect counts of several prairie specialist butterflies in four sites with previously well-established Poweshiek skipperling populations (Dana 2008). From 22 June to 7 July he walked transects totaling 52,985 m (32.9 mi) without observing a single Poweshiek skipperling (Dana 2008, p. 5). Some of these transects (totaling 20,959 m (13.0 mi) were in Prairie Coteau Scientific and Natural Area where in 1990 Selby recorded 116 Poweshiek skipperlings during the flight peak (Selby & Glenn-Lewin 1990, p. 19-20) along a total of about 6250 m (3.9 mi) of transects (Dana 2008, p. 16).

The significance of these apparent declines seems great. Nearly half of all documented Poweshiek skipperling occurrences are recorded in Minnesota. The apparent collapse of large numbers of Poweshiek skipperling populations across the state may pose a significant challenge for the long-term existence of this species. Although there remains the possibility that the species is extant at some sites where recent (2007-) surveys were negative, it seems unlikely that

it is present at those sites in any significant numbers. Extensive surveys in 1993/1994 documented the species at about 35 percent of all sites, whereas the 2007/2008 effort found them at only about 2 percent of all sites surveyed, with none detected in 2008 (Dana 2008; Selby 2009a). Intensive surveys of some of the state's best prairie habitats in 2007 were consistent results of extensive surveys carried out by him and others from 2006 through 2008 (Dana 2008, R. Dana, pers. comm. 2009; Selby 2009a).

North Dakota

These recent survey results illustrate the precarious state of Poweshiek skipperling in the State of North Dakota. With no known observations or surveys performed since 2003, Poweshiek skipperling may be extirpated from most of its known sites in the state, if not from the entire state (Selby 2005, p. 21).

When Royer and Marrone (1992, p. 8-9) reviewed the status of Poweshiek skipperling in North Dakota in 1992, they could document extant populations at only two sites – both in the state's southeastern corner. They also described three records represented by only incomplete or ambiguous locality data (Royer & Marrone 1992, p. 10-11) and one site – McLeod Prairie in Ransom County – where they assumed the species had been extirpated. At McLeod Prairie McCabe and Post (1977, p. 38) had earlier found Poweshiek skipperling to be abundant, stating that they could "be collected two at a time on the blossoms of Long-headed coneflower (*Ratibida columnifera*)…" In six years of monitoring (1986-1991), however, Royer failed to find a single Poweshiek skipperling at the site after it was converted to a cattle-loading area (Royer & Marrone 1992, p. 10). Even at the sites where the authors assumed the species to be extant, its status seemed tenuous. At the West Prairie Church site, along the Cass/Richland County boundary, numbers of the species recorded during surveys plummeted from hundreds in 1986, to four in 1990, and to zero in 1991 (Royer & Marrone 1992, p. 8). At the McLeod East site in Richland County only a single specimen was confirmed in 1991 (Royer & Marrone 1992, p. 9).

Surveys conducted in the state after 1992 documented additional populations, but the most recent surveys at these sites are mostly negative. Orwig discovered eight new populations of Poweshiek skipperling (six in Richland County and two in Sargent County) during three years of survey work in southeast North Dakota (Orwig 1995; Orwig 1996; Orwig 1997). In 1997 – the last year of this study – he found the species at only two of the eight sites. Spomer discovered a new population in Ransom County in 2001, but detected none during follow-up surveys in 2002 and 2003 (Spomer 2001, p. 9; 2002, p. 3; 2004, p. 36).

South Dakota

Poweshiek skipperling has been documented at about 70 sites in South Dakota (Selby 2010, p. 19). Based on changes in land ownership boundaries and the proximity of some sites to one another (D. Skadsen, pers. comm. 2010), there appear to be 68 distinct site records. For the purposes of this summary, we presumed the species to be extant where the last effective survey was carried out in 1985 or later and recorded at least one Poweshiek skipperling. If the latest effective survey [carried out under appropriate weather conditions, date(s), etc.] took place in 1985 or later and resulted in the detection of no Poweshiek skipperlings, we ranked the occurrence as, "Failed to Find." We consider occurrences to be Historical if the species has not

been recorded since 1985 and no negative surveys have been conducted since then. We would consider the species to be possibly extirpated where we would rank its occurrence as Failed to Find or Historical. Based on these definitions, the species is presumed extant at 52 sites and possibly extirpated at 16 sites. We would classify the occurrence as Failed to Find at 15 of the 16 sites where it is possibly extirpated. Almost half the sites where we presume the species to be extant are lacking recent survey information. Among the 52 sites where the species is presumed extant, the most recent observation is eleven years old or older at 23 sites.

The possible extirpation of the species at sites with previous records is based mostly on surveys that failed to find Poweshiek skipperling in 2009 and 2010. Skadsen (2009, pers. comm. 1 Oct 2010) surveyed six sites in 2009 and ten sites in 2010 and failed to find Poweshiek skipperling at any of the sites. The 2009-2010 results are in marked contrast to surveys conducted in 2002 when the species was recorded at 23 of 24 sites surveyed (Skadsen 2003). Moreover, Skadsen conducted his 2009-2010 surveys at sites that were "some of the best" for the species in past years (D. Skadsen, pers. comm. 1 Oct 2010) and in a year – 2010 – when the prairies were "alive with butterflies" (D. Skadsen, pers. comm. 5 Jul 2010). Cool and wet weather may have depressed butterfly populations, in general, in eastern South Dakota and west-central Minnesota in 2009 as it apparently did also in 2004 (Skadsen 2004, p. 2; 2009, p. 2).

Additional surveys are needed to determine the extent of the decline in South Dakota that was indicated by the 2010 surveys. Of the 52 sites where the species is presumed extant, based on the analysis summarized above, the most recent observation at 23 of the sites is older than ten years. In isolation, the 2010 survey results would be cause for concern, but they are especially concerning in light of the sharp and broad declines documented in Iowa and Minnesota and because the surveys were conducted at sites that Skadsen considered to contain high-quality habitat and management. The 2010 surveys were concentrated in the geographic center of the species' range in South Dakota (Fig. 1); future surveys should focus on a representative set of sites to the north and south. Selby (2009a, p. 5), for example, found 37 Poweshiek skipperlings at a potential wind power development site "approximately three miles west of Big Ranch in Lincoln County in 2008.

Wisconsin

Naturalists reported Poweshiek skipperling to be common to abundant on prairies in southeastern Wisconsin in the late 1800s (e.g. in Milwaukee and Racine Counties), although exact localities are unknown (S. Borkin, in litt. 2011, Selby 2010, p. 22). It was one of the first insects Wisconsin listed as endangered in 1989 (S. Borkin ***in litt.*** 2011).

Two of Wisconsin's three extant occurrences of Poweshiek skipperling inhabit prairie fragments in the Southern Unit of the Kettle Moraine State Forest (KMSF) in Waukesha County. KMSF contains portions of a formerly "large prairie complex that became increasingly fragmented due to conversion for human developments and encroachment of woody vegetation" (S. Borkin in litt. 2011). The larger of the two populations at KMSF inhabits a 6 ha prairie remnant on Scuppernong Prairie SNA . Counts of adults there exceeded 100 and were at their highest recorded levels between 1994 and 1999 (S. Borkin in litt. 2011). Numbers dipped to four in 2007 (S. Borkin, in litt. 2008), but rebounded to 40 in 2009 (S. Borkin, pers. comm. 2009). In 2010, counts were carried out on ten days with a maximum count of 17 on 30 June (S. Borkin,

pers. comm. 2011). The nearby Wilton Road site supports a "small remnant population" in a one hectare "patch of high quality prairie" that was completely surrounded by woody vegetation (S. Borkin, pers. comm. 2010). This population was discovered in 2003 when Susan Borkin (in litt 2008) found "a small number" of Poweshiek skipperlings after brush was cleared from the area in 2002. Surveys at this site have consistently yielded counts of less than ten (S. Borkin, in litt. 2008). Poweshiek skipperling is possibly extirpated from an adjacent third and much larger (at least four times larger) fragment (Kettle Moraine Low Prairie) in KMSF (S. Borkin, pers. comm. 2010) after it was overgrown by shrubs including willows (*Salix spp.*), quaking aspen (*Populus tremuloides*), and glossy buckthorn and then burned to restore the site to prairie (S. Borkin, in litt. 2011). This population was not surveyed as intensively through the flight period as at Scuppernong Prairie. The highest number recorded at the Kettle Moraine Low Prairie was 28 on 16 July 1995 (S. Borkin, pers. comm. 2011). A single Poweshiek skipperling was sighted there on 2 July 2004; no survey was done in 2005 and no Poweshiek skipperlings have been found in annual surveys conducted 2007-2010 (S. Borkin, pers. comm. 2011).

The third site inhabited by Poweshiek skipperlings in Wisconsin, Puchyan Prairie State Natural Area (SNA), is about 100 km to the northwest of KMSF in Green Lake County. This population is "very small" and "shrinking" (S. Borkin, pers. comm. 2009). Poweshiek skipperling was first discovered there in 1995 and 6-30 have been recorded in sporadic surveys since then (S. Borkin, *in litt.* 2008). Puchyan Prairie SNA is subject to flooding – the entire prairie portion of the site was submerged in 1993 (R. Hoffman, Wisconsin Department of Natural Resources, pers. comm. 2011). Borkin (*in litt.*2011) recommends that surveys be conducted to determine whether Poweshiek skipperlings may also occur on private land adjacent to the SNA.

In 1998 and 1999 Borkin (2000b) surveyed eight sites in Wisconsin in an effort to locate undiscovered populations of Poweshiek skipperling. Four of the eight sites "appeared to have sufficient host plants, nectar resources, size and other characteristics" typical of Poweshiek skipperling habitat, but she could not confirm the species' presence at any of the sites.

Canada

Manitoba

Poweshiek skipperlings were first recorded in Canada near Vita, Manitoba in 1985 (Catling & Lafontaine 1986, p. 63). They were found at each of seven prairies surveyed in the area and the populations were described as abundant but tending to be local. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) completed an assessment and status report for the Poweshiek skipperling in Canada (COSEWIC 2003) and designated it as "Threatened" in November 2003 under COSEWIC.

Poweshiek skipperling now occurs at only one location in Canada – at The Nature Conservancy's Tall Grass Prairie Preserve near Vita, Manitoba (Westwood 2010, p. 2). Poweshiek skipperling numbers declined there sharply after a 647 ha (1600 ac) wildfire in fall 2009 that burned much of the species' habitat, "including areas with potentially the largest and densest population" (Westwood 2010, p. 2) – only 13 Poweshiek skipperlings were recorded on the preserve in 2010 (Westwood 2010, p. 7 - 22). Jaimee Dupont (Nature Conservancy of

Canada, pers. comm. 2010) recorded 281 and 79 adults in 2008 and 2009, respectively, during surveys of comparable effort. Westwood (2010, p. 5) drafted detailed management recommendations for the preserve to facilitate recovery of Poweshiek skipperling numbers and also recommended an annual survey to monitor the species' status.

Population Estimates/Status

Emerging evidence indicates a recent dramatic and unexplained decline in Poweshiek skipperling numbers in the western part of the species' range. Since about 2003, populations formerly considered secure in the states of Iowa and Minnesota have undergone sharp declines and are either extirpated or present only at undetectably low densities at a vast number of sites surveyed. Recently, the species was only considered as "possibly extirpated" from its historic Indiana and Illinois ranges, but the apparent population collapses now threatens to place the states of Iowa, Minnesota, and North Dakota into the same category. Viable populations have only been documented recently in the state of Michigan, with the possible exception of Scuppernong Prairie in Wisconsin. The long term security of these populations, however, is also questionable. Only four populations in Michigan may have good or better viability, but these are largely isolated from other populations and at least one faces a significant threat from shrub invasion. Only about 15 percent of South Dakota Poweshiek skipperling sites have been surveyed in recent years, but results are also indicative of a recent decline there.

Species experts seem typically cautious about declaring Poweshiek skipperling extirpated from any site or region and there is good reason to be wary when interpreting negative survey findings. The species may only be reliably detected under certain ranges of conditions of wind speed and cloud cover during its approximately 17-day flight period (e.g., see Selby & Glenn-Lewin 1990, p. 19-20), which varies in its exact timing between years. In light of these limitations, the likelihood of detecting the species may be maximized by conducting repeated surveys throughout the flight period at sites where high numbers of the species have been encountered in previous years. Intensive survey efforts, however, reduces the number of sites that may be surveyed in a single year – that is, increasing survey intensity reduces the geographic extent of surveys due to limited resources.

We may only be confident that sharp and widespread declines of Poweshiek skipperling have occurred if such a presumption is supported by the results of both extensive and intensive surveys. In 2007 and 2008, mostly extensive surveys conducted throughout the flight period in Minnesota detected Poweshiek skipperling at only 9 percent (3/33) and 0 percent (0/25), respectively, of sites where it was known to have been present at least as recently as 1985 (Selby 2009a). During the 2007-2008 surveys, species' experts searched for Poweshiek skipperling at each site where conditions appeared suitable for the species (Selby 2009a, p. 3). To complement these surveys, Dana (2008) in 2007 conducted intensive surveys at four sites where the species' had earlier been recorded in large numbers. From 22 June to 7 July he walked transects totaling 52,985 meters along "the prairie slopes that are the most reliable locations for encountering the skippers" (Dana 2008, p. 3-5); he did not observe a single Poweshiek skipperling.

The lack of Poweshiek skipperling encounters in the Minnesota surveys could not be

explained by survey conditions or timing of the surveys. Dakota skippers, whose flight period overlaps almost completely with that of Poweshiek skipperling, were observed during each of these surveys – sometimes in large numbers (Dana 2008, p. 5). It is also unlikely that Poweshiek skipperling is present at any significant number of sites in Minnesota where it was not previously recorded. In 2007 and 2008, surveys included 44 and 35 sites, respectively, where Poweshiek skipperling had not been previously recorded – it was observed at none of those sites (Selby 2009a, p. 5-6). Most of these surveys were conducted late June to mid-July.

In 2007, Poweshiek skipperling was found in Iowa at only two of 31 sites (6 percent) with recent (1989-2005) Poweshiek skipperling records. The surveys were conducted along ""wandering transects" that provided fairly complete and representative coverage of the prairie and wetland habitats" (Selby 2009b, p. 5). At one of the two sites where Poweshiek skipperling was found, Hoffman Prairie, repeat surveys were conducted (Selby 2009b, p. 4-5). Numbers counted at both sites where the species was found were low (1-2) (Selby 2008, p. 6). In contrast, surveys in 1993 and 1994 documented Poweshiek skipperling at 82 (18/22) and 75 (12/16) percent of sites also surveyed in 2007 (Saunders 1995).

Selby (2009b) followed up the 2007 extensive survey effort with an intensive study at Hoffman Prairie, a site that once "supported a healthy population" of Poweshiek skipperling (Selby 2009b, p. 3). He compared degree-day data for 2009 to degree-day data for historic Poweshiek skipperling flight records to determine the optimal timing for the surveys (Selby 2009b, p. 4) and conducted four surveys– on 2, 3, 6, and 11 July 2009, which is within the typical Poweshiek skipperling flight period. Survey conditions were good only on 6 and 11 July, but he observed no Poweshiek skipperlings despite very intensive, replicate surveys in the species' primary habitat. He also surveyed prairie along U.S. Highway 18 in Hancock and Cerro Gordo Counties that included a site with a historical record of Poweshiek skipperling and also observed no Poweshiek skipperlings there (Selby 2009b, p. 3). It is unlikely that Selby would have missed the peak of the Poweshiek skipperling flight. He concluded that Poweshiek skipperling "is either so depressed that it escaped detection during very thorough replicated surveys, or it has been extirpated from the site" (Selby 2009b, p. 8).

In South Dakota Skadsen (2009, p. 12) has observed "even stable appearing populations becoming extinct" and thinks that Poweshiek skipperling is "the most endangered prairie-dependent butterfly in the state." Details of recent surveys – primarily modified Pollard counts along established transects (Skadsen 2009, p. 1) – are summarized above in the South Dakota section. More extensive surveys are needed to determine if the declines observed at the sites surveyed have also occurred at other sites or, as Skadsen (2009, p. 16) puts it, "to determine if the Poweshiek Skipperling is still extant in northeast South Dakota." Sites surveyed recently should also be resurveyed to confirm the status of Poweshiek populations where they have been undetected during recent surveys.

Declines of the nature seen in the western portion of the species' range have not been observed recently in Wisconsin and Michigan. These two states contain a very small proportion of the species' 1985-present records – about 5 percent. Nevertheless, the declines outside these states and the markedly different habitat types occupied there (especially in Michigan) have raised the

rangewide significance of conserving the species in these two states. Although they seem to have not been exposed to the factors that have affected populations to the west, Poweshiek skipperling is also facing significant threats in Michigan and Wisconsin, where the species is listed as threatened and endangered, respectively, under state statutes.

In summary, recent survey data indicate that Poweshiek skipperling has declined to zero or to undetectable levels at a large proportion of sites where it has been recorded since 1985. Iowa and Minnesota contain about 67 percent of the sites where Poweshiek skipperling has been recorded since 1985. The results of population surveys described above indicate that unidentified threats to the species have acted to extirpate or sharply diminish populations at all or the vast majority of sites in these two states (Dana 2008, p. 16; Selby 2010, p. 7). South Dakota contains about 21 percent of the U.S. sites with documented presence of Poweshiek skipperling since 1985. Recent surveys there are also suggestive of an emergent and mysterious decline, although a more extensive survey effort is needed to more thoroughly assess the status of the species in the state. North Dakota contains about 5 percent (13) of the recent records. Survey efforts for Poweshiek skipperling there have been minimal in recent years, but surveys conducted from 1996 to 2001 documented more than ten Poweshiek skipperling at only one site and were negative at seven sites. Michigan contains four population of good or better viability, but each of those faces threats of at least low-moderate magnitude and the state only contains about 4 percent of all Poweshiek skipperling records. There are three extant populations in Wisconsin. Based on recent available data, only one (Scuppernong Prairie) may be viable. The other two Wisconsin sites – Puchyan Prairie and Wilton Road – are threatened and of unknown viability, respectively. In Canada, multiple Poweshiek skipperling records occur in one general location in far southern Manitoba.

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Habitat Destruction

Poweshiek skipperling has persisted in areas that are relatively unsuitable for row crop agriculture due to steep terrain (e.g., in the Prairie Coteau of South Dakota) or where soils are too wet or rocky for row-crop agriculture. Habitat spared from the plow was then vulnerable to invasion by shrubs and trees if left idle. The species' habitat at Scuppernong Prairie in Wisconsin, for example, probably would have succeeded to shrubby or forested habitat if it not been "cut each fall for marsh hay" (S. Borkin *in litt.* 2011). It is now one of only three habitat areas left in the state for the species. Conversion of prairie for agriculture may be the single most important factor in the decline of the species' since Euro-American settlement, but the threat of such conversion to extant populations is not well known and is likely secondary to other threats.

Residential, transportation, and energy development pose threats to some Poweshiek skipperling habitat. Housing construction has likely contributed to the loss of at least two populations in Michigan and an important extant population in Michigan is "(L)ocated in part of Oakland Co.

under intense development pressure" (Michigan Natural Features Inventory, unpubl. data 2011). Road construction threatens Poweshiek skipperling habitat indirectly by increasing the demand for gravel and directly as a result of routine maintenance (e.g. broadcast herbicide applications and cleaning out ditches), improvements (e.g. widening roads or converting two-lane highways to four-lane highways), or new construction. Poweshiek skipperling habitat was destroyed or threatened on at least two private properties in Roberts County, South Dakota in association with the widening of U.S. Highway 12 (Skadsen 2003, p. 47). Roadside prairie remnants can support populations of Poweshiek skipperlings and serve as dispersal corridors between larger remnants, so these prairie losses could be significant. Wind energy turbines and associated infrastructure (e.g., maintenance roads) likely threaten Poweshiek skipperling habitat, at least on private land in South Dakota (Skadsen 2002, p. 39, D. Skadsen, pers. comm. 19 Feb 2010).

Many prairie remnants with Poweshiek skipperling populations are associated with gravelly glacial till soils where gravel mining is a threat. Gravel mining threatens habitat of Poweshiek skipperling at some Minnesota sites (Dana 1997, p. 15) and a site where Poweshiek skipperlings were recorded in 1997 in the Bitter Lake area of Day County, South Dakota is now a gravel pit (Skadsen 2003, p. 47-48). The progressive loss of habitat to gravel mining is a significant threat at Felton Prairie sites (Braker 1985, p. 53; Dana 1997, p. 15), although a stewardship plan may have reduced the immediacy of this threat (P. Buesseler, Minnesota Department of Natural Resources (DNR), pers. comm. 2003).

Degradation of habitat quality

Habitat quality is likely a powerful determinant of extinction probability in Poweshiek skipperling (Thomas et al. 2001, p. 1795). Among butterfly species in the United Kingdom, for example, equilibrium density of sites with optimum habitat are from 25 to more than 200 times greater than those for occupied sites with suboptimal, yet suitable, habitat (Thomas 1984, cited in Thomas et al. 2001, p. 1794). In addition, many Poweshiek skipperling populations are isolated and will not be recolonized in the event of their local extinction. Protection or restoration of habitat quality at these sites is critical to the species survival, although stochastic events still pose some risk.

Poweshiek skipperlings appear to depend on the presence of a diversity of native plants endemic to tallgrass prairie and prairie fen habitats. When non-native or woody plant species become dominant components of these habitats, Poweshiek skipperling may decline due to insufficient sources of larval food and nectar. For example, at Wike Waterfowl Production Area in Roberts County, South Dakota, Skadsen (2009, p. 9) attributed the apparent extirpation of Poweshiek skipperling to "a very low diversity and abundance of prairie forbs that are utilized as larval food and nectar sources for adults of prairie dependent butterflies."

Invasive Species and Secondary Succession – Poweshiek skipperling typically occurs at sites embedded in agricultural or developed landscapes from which a variety of plant species may invade. Non-native species that have invaded Poweshiek skipperling habitat include glossy buckthorn, smooth brome (*Bromus inermis*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and leafy spurge (*Euphorbia esula*) (Orwig 1997, p. 4, 8, MNFI unpubl. data 2011). Leafy spurge displaces native plant species and its invasion is facilitated by

actions that remove native plant cover and expose mineral soil (Belcher & Wilson 1989, p. 172). The threat from non-native invasive species may be compounded by expansion of native woody species. Glossy buckthorn and gray dogwood (*Cornus racemosa*) encroachment, for example, is "a major problem", at the important Brandt Road Fen in Michigan (Michigan Natural Features Inventory, unpubl. data, 2011).

Invasion of Michigan prairie fens by glossy buckthorn reduces light availability, total plant cover, and the coverage of grasses and sedges (Fiedler, in prep.). This threatens to reduce the availability of both nectar and larval host plants for Poweshiek skipperling. Roads and residential development likely disrupted the hydrology of a prairie fen where Poweshiek skipperling was last observed in 2007 and where 2009 surveys for Poweshiek skipperling were negative (Michigan Natural Features Inventory, unpubl. data 2009). If groundwater flow to prairie wetlands is intercepted (e.g., digging a pond in adjacent uplands. installing wells for irrigation or drinking water, etc.), it converts to shrubs (e.g., glossy buckthorn) or other invasive species "very quickly" (C. Hoving, Michigan Department of Natural Resources, pers. comm. 2011).

Prairie and prairie fens must be managed to prevent the indirect effects of succession to Poweshiek skipperling. If succession has progressed too far, established shrubs or trees must be removed in a way that avoids or minimizes damage to the native prairie. When succession is well advanced, managers may use intensive methods, including intensive fire management, to restore prairie plant communities. If not done carefully, these actions may themselves adversely affect local populations. Once smooth brome has invaded Poweshiek skipperling habitat, it will be challenging to eradicate it while minimizing adverse effects to Poweshiek skipperling. Willson and Stubbendieck (2000, p. 36), for example, recommended burning prairie habitats, annually in some cases, to control smooth brome at the stage when the tillers are elongating. In southwest Minnesota, this may typically occur in the second or third week of May (G. Willson, National Park Service, Lincoln, NE, pers. comm. 10/17/06). Cutting or grazing to remove actively growing smooth brome may have less intensive effects on Poweshiek skipperling larvae and could be used experimentally instead of fire, although these techniques may also pose some risk to Poweshiek populations if carried out annually and in the absence of nearby populations.

If not appropriately managed with fire, grazing, or haying, Poweshiek skipperling habitat is degraded due to reduced diversity of native prairie plants and eventually succeeds to shrubby or forested habitats that not suitable for Poweshiek skipperling. At Hartford Beach State Park in South Dakota, Poweshiek skipperling was extirpated (Skadsen 2009, p. 4) after lack of management led to invasion by smooth sumac (*Rhus glabra*) and quaking aspen (*Populus tremuloides*) (Skadsen 2006a, p. 5). As with invasive species, actions intended to reverse secondary succession may be intensive and may themselves adversely affect Poweshiek skipperling populations. For example, Poweshiek skipperling "never recovered after prescribed burns" were carried out at Kettle Moraine Low Prairie SNA in Wisconsin after it had become "very overgrown" (S. Borkin, *in litt.* 2011).

Haying – Haying may maintain habitat for Poweshiek skipperling and other prairie-obligate species, but as with any management practice, timing, frequency and intensity are important. Swengel (1996, p. 79) found that numbers of prairie-obligate butterflies were higher in hayed

than burned prairies, but if habitats are hayed during the adult flight period it will have a negative effect by eliminating nectar sources. Royer and Marrone (1992, p. 14), for example, ascribed the loss of one North Dakota population to "June/July haying. Even if habitats are hayed after the flight period, only a portion of a site (e.g. no more than one-third to one-half) should be hayed in any year to avoid uniform changes in plant communities. Consistent late-season haying of Poweshiek skipperling habitat in South Dakota, for example, appears to have facilitated the expansion of green needlegrass (*Stipa viridula*), a cool-season grass and prevented seed development in warm-season plants (Skadsen 2009, p. 8).

Grazing – Peer-reviewed research examining grazing impacts on prairie butterflies has not been published and most references to grazing impacts are based on ancillary observations made during research focused on other management impacts. One study examined grazing impacts on Dakota skippers in and around Glacial Lakes State Park in Pope County, MN (Selby 2006). The study was focused on all life stages of the Dakota skipper, but also included data collection for the adult stage of other prairie specialist butterflies, including Poweshiek skipperling. Both species were too scarce to collect data adequate to test hypotheses (Selby 2006, p. 2), but observations based on two years (2003 and 2004) of general and quantitative surveys suggested that numbers in the light to moderate grazed pasture were similar to those in the best portions of nearby ungrazed habitats (Selby 2006, p. 30). Poweshiek skipperling were almost absent from the study sites, but trends in Dakota skipper numbers may be indicative of trends that may be observed in Poweshiek skipperling. Within the grazed study area, numbers of Dakota skippers declined with increasing grazing intensity; Dakota skippers were absent from the most heavily grazed areas (Selby 2006, p. 16). Skadsen (2001b, p. 55) had earlier found that forb diversity was poor on the grazed lands included in this study and predicted the extirpation of both species unless management practices were not changed.

Royer and Marrone (1992, p. 18) stated that heavy grazing was a threat to Poweshiek skipperlings, but that "(O)ccassional light grazing" is not a long-term threat "as long as some contiguous habitat remains ungrazed." Swengel and Swengel (1999, p. 286) noted that at the Sheyenne National Grassland in North Dakota, grazing appeared to be unfavorable for Poweshiek skipperlings, but that other habitat factors (e.g. lower quality; drier prairie) could also be responsible for the low numbers of Poweshiek skipperlings. At Chekapa Creek Ridge and Knapp Pasture in South Dakota, heavy grazing apparently extirpated both Poweshiek skipperling and Dakota skipper (Skadsen 2002, p. 38; 2004, p. 7; 2006a, p. 11). Due to its proximity to other Poweshiek skipperling populations and a return to fall haying in 2005, Poweshiek skipperling recolonized Chekapa Creek Ridge in 2006 (Skadsen 2006a, p. 12). More recent surveys indicate that the species has again been extirpated from this site (D. Skadsen, pers. comm. 2010).

Reduced availability of nectar resources and larval food plants may be the primary factors leading to declines in Poweshiek skipperling populations on heavily grazed sites, but changes in vegetation structure may also be important. Dana (1997, p. 4) stated that "grazing reduces skipper numbers in direct proportion to its intensity", due to the reduction in flowers that provide nectar and perhaps by influencing adult behavior. He found that privately owned pastures in Minnesota's Hole-in-the-Mountain complex would only support low densities of skippers as long as they were heavily grazed and sprayed with herbicides (Dana 1997, p. 5). Surveys at this habitat complex in 2007-2008 failed to record any Poweshiek skipperling (Dana 2008, p. 8;

Selby 2009a, p. xxxi-xxxii). Factors in addition to overgrazing likely contributed to declines at this complex, however, because a variety of management approaches are used among the sites in this area.

Grazing may now only be favorable to the conservation of Poweshiek skipperling and other sensitive prairie invertebrates where it is light relative to typical grazing intensity or where managers adjust grazing prescriptions according to their effects on essential features of the prairie ecosystem (e.g., adaptive management). Overgrazing is a threat on most or all privately owned sites. Of the seventy privately owned sites where Poweshiek skipperling has been recorded since 1985, we are aware of only eight sites in Minnesota where grazing may not be a threat due to land easements.

Summary of Factor A – Extensive historical conversion of prairie and associated habitats – nearly complete in some areas – has isolated many Poweshiek skipperling populations. Within those patches, degradation of habitat quality is now the primary threat to the species' persistence. Of the various threats to Poweshiek skipperling habitat, invasive species and secondary succession are of the greatest magnitude. Recent information on threats is not readily available for all sites, but among sites that do not fall into the category of 'possibly extirpated', invasive species, succession, or both is a documented threat at about 25 percent of sites. This may significantly underestimate the current threat to Poweshiek skipperling habitat because habitat quality is monitored at a very small portion of sites inhabited by the species.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

This is not generally a problem for species such as the Poweshiek skipperling. Royer and Marrone (1992, p. 18) state that no such threats are known or likely and COSEWIC (2003, p. 18) states that collecting of specimens is not currently a threat. Scientific Collectors Permits are required in states where they have legal protection, and permission is often required to do collecting on protected areas.

C. Disease or predation.

Diseases or predators that are specific to the Poweshiek skipperling are not known (Royer & Marrone 1992, p. 16), but some parasitism or predation likely occurs during each of the life stages. Ten of 130 eggs tagged for field observation in a 1994 study of a Wisconsin population appeared to have suffered from predation or parasitism (Borkin 1995, p. 5); some were punctured and had the contents extracted and others turned black and dried up. In his study of Dakota skipper and Ottoe skipper (*Hesperia ottoe*), Dana documented some parasitism of their eggs and larvae by various wasp and ant species and predation by various insect taxa (Dana 1991, p. 19, 20-21). Available information does not indicate that disease and predation are a major threat to Poweshiek skipperling populations. Under certain conditions, however, they might become a factor. If Poweshiek numbers are already depressed or suffering from relatively high rates of disease, parasitoids, or predators, their impact might be significant.

D. The inadequacy of existing regulatory mechanisms.

Poweshiek skipperling is listed as threatened under state endangered species statutes in Iowa and Michigan and as endangered in Wisconsin (Table 3). In Minnesota it is listed as a species of special concern, which conveys no prohibitions against take of the species. Minnesota Department of Natural Resources intends to propose listing the species as endangered (R. Baker, Minnesota Department of Natural Resources, pers. comm. 6 May 2010). This would convey some protections, but it is unclear when this may go into effect. South Dakota has an Endangered Species Act, but no invertebrates are currently listed. North Dakota does not have a mechanism for conferring protection to threatened or endangered species at the state level.

Table 3. Summary of the status of Poweshiek skipperling under state endangered species statutes and the protections afforded by those statutes.

State	Official Status	Summary of Statutory Protection	Penalties	Take Permits
Iowa	T[1]	Take is prohibited. Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect and it includes an attempt to engage in any such conduct.	Violations are misdemeanors punishable by a fine of up to $100 plus reimbursement to state of $1,000 per listed animal taken.	State may issue permits for the capture, possession, sale, or purchase of listed species for scientific, education, or rehabilitation purposes, for propagation in captivity to ensure the survival of a species or to reduce damage to property or to protect human health.
Michigan	T	Take is prohibited. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct.	Violations are misdemeanors punishable by imprisonment for not more than 90 days, or a fine of not more than $1,000.00 or less than $100.00, or both.	State may issue permits for scientific, zoological, or educational purposes, for propagation in captivity to ensure survival.
Minnesota	SC[2]	None.	n/a	n/a
North Dakota	None.	None.	n/a	n/a
South Dakota	None.	None.	n/a	n/a
Wisconsin	E[3]	Take is prohibited, but not specifically defined in regulation or statute.	Violators fined $500 - $2,000 and lose hunting privileges for one year; for intentional violations - $2,000-$5,000 fine or 9 months imprisonment or both and loss of hunting privileges for 3 years.	Permits may be obtained for scientific collection or incidental take. Conservation plans must be prepared for some incidental take. The taking must not jeopardize the species within the state, the whole plant − animal community of which it is a part or the habitat that is critical to its existence.

[1] Threatened
[2] Special Concern
[3] Endangered

Endangered species statutes provide conservation agencies in three states with the authority to regulate collection of Poweshiek skipperling and related activities, but these actions do not constitute significant threats to the species. With the exception of Wisconsin's regulation of some incidental take, the statutory protections afforded by these state statutes may do little to protect Poweshiek skipperling from most threats. In Iowa, for example, Poweshiek skipperling populations appear to have declined to the point of extirpation despite its presence on the state's list of threatened species. In Michigan, the threats to important Poweshiek skipperling habitat are primarily indirect – increased cover of native shrubs and non-native plant species and habitat fragmentation. Even in Wisconsin, where threats from actions that may incidentally take Poweshiek skipperlings may be addressed in "conservation plans", state endangered species protections are not sufficient to protect the species from extinction that may result from stochastic events and habitat fragmentation that threaten the state's small and isolated populations. Overall, the regulatory mechanisms available under state endangered species statutes are important, but inadequate to protect the species from the threats to its continued existence.

U.S. Forest Service (Forest Service) has designated Poweshiek skipperling as a sensitive species in North Dakota. U.S. Forest Service (Forest Service) Manual, Chapter 2670.22 contains the following objectives for Sensitive Species [Forest Service Manual - All Issuances (Service-wide and Field); retrieved 15 March 2011 from http://www.fs.fed.us/im/directives/dughtml/fsm.html]:

1. Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
2. Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
3. Develop and implement management objectives for populations and/or habitat of sensitive species.

Poweshiek skipperling has been documented at two sites on the Sheyenne National Grasslands. At one site it was observed in 2001, but not found during follow-up surveys in 2002 and 2003. At the second site, it was last observed in 1996. The Forest Service Objectives for sensitive species would be beneficial if the agency's lands contained any significant populations of Poweshiek skipperling, but it is unclear whether the species is extant on any Forest Service lands. Therefore, these objectives have little current significance to the rangewide status of the species. If Forest Service lands may be managed or restored to facilitate conservation of Poweshiek skipperling in the future, these objectives may benefit the species.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated Poweshiek skipperling as threatened under the country's Species at Risk Act (SARA). Under SARA, take of Poweshiek skipperling would be prohibited on federal lands, but the species occurs only on non-federal lands in Canada. The Federal Cabinet may create an order extending SARA's powers (e.g., to private lands) if a species is insufficiently protected by provincial laws. Poweshiek skipperling is not yet listed under the Manitoba Endangered Species Act, but the Manitoba Endangered Species Advisory Committee has recommended that it be listed as Endangered (20 December 2010) under the Manitoba Endangered Species Act (J. Duncan,

Manitoba Conservation, Winnipeg, Manitoba, pers. comm. 2011). Manitoba Conservation will forward this recommendation to the Minister of Conservation in 2011 (J. Duncan, Manitoba Conservation, pers. comm. 2011). The Manitoba Endangered Species Act contains the following prohibitions, which would apply to all lands on which the species occurs, including private lands:

> No person shall
>
> (a) kill, injure, possess, disturb or interfere with an endangered species, a threatened species, or an extirpated species that has been reintroduced;
>
> (b) destroy, disturb or interfere with the habitat of an endangered species, a threatened species or an extirpated species that has been reintroduced; or
>
> (c) damage, destroy, obstruct or remove a natural resource on which an endangered species, a threatened species or an extirpated species that has been reintroduced depends for its life and propagation.

Summary of Factor D – Existing regulatory mechanisms, including state endangered species statutes, have not been adequate to prevent sharp population declines that have occurred in the western portion of Poweshiek skipperling's range. Only Wisconsin provides a regulatory mechanism to lessen the potential impacts of actions that incidentally take Poweshiek skipperling. There are no regulatory mechanisms to directly protect the species in Minnesota, North Dakota, and South Dakota. In Canada, take of the species is not currently prohibited.

E. Other natural or manmade factors affecting its continued existence.

Unknown Stressors Causing Population Declines

The sharp and broad declines documented in Iowa and Minnesota and possibly also in South Dakota are indicative of a response to one or more stressors that have yet to be ascertained. These unknown factors may consist of a combination of one or more of the threats described above and in this section below. These declines are reminiscent of the widely publicized decline of honey bees (*Apis mellifera*) in that they seem sudden and mysterious (Spivak et al. 2011, p. 34). The results of extensive surveys in the western portion of Poweshiek skipperling's range have documented the species' response to these unknown stressors and indicate that it poses an immediate threat of high magnitude. U.S. Fish and Wildlife Service is currently engaged with researchers to begin attempts to identify these stressors.

Fire

Fire improves Poweshiek skipperling habitat (e.g., D. Cuthrell, pers. comm. 13 Oct 2009), but it may also kill all or a significant proportion of the Poweshiek skipperlings in the burned units. Therefore, fire may be presumed to be a threat to Poweshiek skipperling at any site where too little of the species' habitat may be left unburned or where patches are burned too frequently. To reap the benefits of fire to habitat quality, Poweshiek skipperling must either survive in numbers sufficient to rebuild populations after the fire or recolonize the area from a nearby unburned area.

In addition, the return interval of fires should be infrequent enough to allow for recovery of the population between burns.

The effects of fire on prairie butterfly populations are difficult to ascertain (Dana 2008, p. 18), but the apparent hypersensitivity of Poweshiek skipperling indicates that it is a threat to the species in habitats burned too frequently or too broadly. Panzer (2002, p. 1306) identified four life history traits of duff-dwelling insects that were good predictors of a negative response to fire: (1) remnant dependence (occurring as small, isolated populations); (2) upland inhabitance (dry uplands burn more thoroughly than wetter habitats); (3) nonvagility (low recolonization rate); and (4) univoltine (slower recovery rates for one generation per year); species exhibiting all four traits should be considered "hypersensitive pending formal study" (Panzer 2002, p. 1306). Poweshiek skipperling meets all of Panzer's criteria for hypersensitivity and have additional life history traits that further suggest hypersensitivity to fire. Their eggs are laid near the tips of leaf blades and they overwinter as larvae on the host plants (Borkin 2000a, p. 2) where they are exposed to spring fires. If larvae are on prairie dropseed or little bluestem, which occur in dry prairie, rather than spike-rush or sedges, then the larvae are even more vulnerable (Selby 2005, p. 36). They are also notably weak fliers and are therefore likely to recolonize more slowly and across shorter distances than other more vagile skippers and butterflies – they may be among the poorest dispersers of the prairie-obligate butterflies (Swengel 1996, p. 81).

Swengel (1996) compared the relative magnitudes of butterfly observations among several burn age classes (e.g., 0, 1, 2, 3, 4+ years since last burn). She found that Poweshiek skipperling had the most negative initial response to fire (-96.6 percent deviation from expected abundance in year of fire) among six species of prairie-obligate butterfly species studied (Swengel 1996, p. 83). Numbers were still lower than expected one year post-fire (-27.0 percent), exceeded expectations after two years (177.8 percent), and declined slightly after three years (91.0 percent) (Swengel 1996, p. 83). In habitats that had not been burned for four or more years, Poweshiek skipperling abundance was about as low as in habitats sampled less than one year after being burned (Swengel 1996, p. 83).

Swengel's (1996) observations are consistent other findings – that is, Poweshiek skipperling numbers decline in burned areas for 1-2 years after the burn then rebound, but may decline again if management does not maintain the habitat. In 2002, Webster (2003, p. 12) found an average of 0.8 Poweshiek skipperling during 15-minute counts at ten sites burned in 2001 or 2002 and 15.9 at seven sites not burned for two or more years. D. Cuthrell (pers. comm. 13 Oct 2009) observed that in Michigan numbers of Poweshiek skipperling are low the summer after spring burns, but are more abundant in "each successive year." At Glacial Lakes State Park, Minnesota, Skadsen (2001b, p. 37) found no Poweshiek skipperling in an area that had been burned earlier in the spring.

Researchers and managers have focused on the effects of prescribed fire, but unplanned fires may also be a threat and may hamper management plans setup to carefully manage Poweshiek skipperling habitat. A human-set wildfire, for example, burned "much of the prime skipper habitat" in Manitoba's Tall Grass Prairie Preserve in late fall 2009 (R. Westwood, pers. comm. 3 May 2010).

Recent survey results in some areas, most notably, Iowa and Minnesota, indicate that other factors are acting independently (Dana 2008, p. 18) or in concert with fire to forestall the typical post-fire rebound. At each site inhabited by Poweshiek skipperling, the interactions between positive and negative impacts of fire and their combined impact on long-term survival must be understood to develop appropriate plans to manage prairies for insect conservation.

Pesticide use and Pest Control

Indiscriminant use of insecticides for pest control on rangeland or adjacent cropland can be a major threat to the species. Royer and Marrone (1992, p. 17) cite the combination of drought and grasshopper control programs along the Red River Valley as having serious impacts on the species. Use of herbicides, which usually targets dicots, can also affect Poweshiek skipperling populations indirectly by eliminating important nectar sources. Broadcast chemical control of leafy spurge, for example, may also eliminate native forbs that are skipper nectar sources (e.g., Orwig 1997, p. 7).

Dana (1997, p. 5) concluded that herbicide use for weed and brush control on private lands is the principal threat to skippers at the Hole-in-the-Mountain complex, Minnesota. Skadsen (2006b, p. 11) also documented the apparent extirpation of Poweshiek skipperling at Knapp Ranch in South Dakota after a July 2006 application of broadleaf herbicide associated with heavy grazing. The magnitude and immediacy of this threat is poorly understood, but may be mostly tied to the use of herbicides to support grazing. If broad applications of herbicides will typically be used whenever Poweshiek skipperling habitat is brought into grazing management, then this may be a threat on all privately owned sites where easements do not preclude grazing – about 22 percent of all sites where Poweshiek skipperling has been recorded since 2002.

Small Size and Isolation of Populations and Stochastic Events

As a habitat specialist, habitat fragmentation has had strong negative effects on Poweshiek skipperling's abundance and distribution because it is dependent upon native tallgrass prairie and, in Michigan, prairie fens. Habitat fragmentation has reduced once extensive areas of these habitats to a collection of patches of varying quality and isolation. The probability of extinction within patches may be determined primarily by degradation of habitat quality, management techniques (e.g., mowing, prescribed burns), and stochastic events, such as wildfire or floods.

Patch isolation and possible decreased permeability of surrounding matrix acts as a dispersal barrier between patches, ultimately decreasing genetic diversity within the patch through genetic drift and inbreeding. Poweshiek skipperling are not known to disperse widely; species experts have estimated maximum dispersal distance to be less than 1.6 km (miles). Most individuals may remain within a single habitat patch during their 5-7 day adult life span. Repopulation of sites after extirpation has been observed (e.g., after a flood, Saunders 1995, p. 15), but source populations may need to be adjacent or very close.

If we assume patch isolation occurs once a point occurrence[4] is greater than two km (miles) from other potential point occurrences, then about 39 percent of occurrences are effectively isolated and would not be recolonized. This has apparently occurred at Hartford Beach State Park, South Dakota, where the species was extirpated due to habitat succession and exotic plant invasion

[4] Geospatial data obtained from each state's natural heritage program.

(Skadsen 2009, p. 4,). Improved prairie management markedly improved habitat quality, but annual surveys conducted during the flight period from 2006 to 2009 have failed to detect a single Poweshiek skipperling (Skadsen 2009, p. 4, Skadsen, pers. comm. 2010).
This simple analysis, however, probably underestimates the threat posed by habitat fragmentation. Some populations may only be near others that are too small to produce significant numbers of immigrants. This is true for Scuppernong Prairie in Wisconsin, which is about 0.5 km (miles) from the Wilton Road population. Numbers at Wilton Road are likely too small to produce sufficient numbers of emigrants to Scuppernong Prairie to reestablish a viable population in the event of the latter's extirpation. In North Dakota, Orwig (1997, p. 3) found that a six ha patch of Poweshiek skipperling habitat at Hartleben Prairie was connected by grassland to another Poweshiek skipperling population, but neither population was "particularly strong." In addition, poor habitat quality negatively influences the number and quality of emigrants (Matter et al. 2009, p. 1467; Thomas et al. 2001, p. 1795). The threat of isolation is not likely alleviated by connections to low quality habitats that are not capable of producing immigrants at the numbers or frequency sufficient to reliably repopulate patches.

Extreme weather patterns or severe weather events have the potential to have a significant impact on Poweshiek skipperling populations because they can occur across a large geographic area. These events can include extremely harsh winters, late hard frosts following a spring thaw, severe storms, or cool damp conditions. Habitats isolated as a result of fragmentation will not be recolonized after local extinction.

Flooding

Flooding of areas with Poweshiek skipperling occurrence has resulted in at least temporary loss of habitat. At the Hartleben #2 site in North Dakota, Orwig (1997, p. 5) found most of the site "under water or too wet to support any forbs for nectar." Saunders (1995, p. 15) documented the species' temporary extirpation at a site in Iowa due to flooding – immigrants repopulated the site. Flooding may impact the small population at Puchyan Prairie in Wisconsin in some years – flooding in 1993 completely submerged the site at least for that summer (R. Hoffman, pers. comm. 2011).

Summary of Factor E – We have identified a wide variety of threats to Poweshiek skipperling, but the most significant threat to the species are one or more unknown stressors that have led to widespread population crashes in the western portion of the species' range. We place these unknown stressors under listing factor E even though it may, once identified, belong under factors A, C, or both. What is important, however, is that these unknown stressors or stressor pose an immediate threat of high magnitude to the species' viability.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

In 2005, U.S. Fish and Wildlife's National Wildlife Refuge System (NWRS) in North and South Dakota adopted the *Conservation Strategy & Guidelines for Dakota Skippers on Service Lands in the Dakotas*, which are based on the general *Dakota Skipper Conservation Strategy & Guidelines*. These guidelines are also largely or entirely appropriate for Poweshiek skipperling because the two species often occur on the same sites and habitats, have almost identical adult

flight periods, and are both univoltine (one generation per year). The Service will implement the conservation guidelines on any of its land where Dakota skipper is known to occur. The Service will also evaluate habitat features on other land that it owns to determine whether unrecorded populations of Dakota skipper may be present. Where the habitat features suggest that Dakota skippers could occur, the Service will conduct surveys for the species and/or manage the site in accordance with the *Dakota Skipper Conservation Strategy & Guidelines*. Poweshiek skipperling largely overlaps with Dakota skipper, but the Service's Division of Ecological Services should work with the NWRS to ensure that the similar measures should also be carried out on any lands where Poweshiek skipperling occurs.

At least one population in Michigan occurs on a site that is privately owned and enrolled in the Michigan DNR Landowner Incentive Program. The primary goal of the Landowner Incentive Program is to help private landowners create and manage habitat for species that are rare and/or declining by providing advice, management plans, and funding to qualified individuals and organizations (Michigan DNR. 2011. *Overview – Landowner Incentive Program.* Retrieved http://www.michigan.gov/dnr/0,1607,7-153-10370_36649---,00.html).

In Canada, The Nature Conservancy manages all or most of the land inhabited by Poweshiek skipperling and has recently given its conservation needs a high priority for planning and implementing management activities (R. Westwood, pers. comm. 3 May 2010).
In South Dakota management plans have been completed that are intended to guide habitat restoration at Hartford Beach State Park (HBSP) and Pickerel Lake State Recreation Area (PLSRA, Skadsen 2008, p. 4-7). At each site, the lack of haying, grazing, or fire had allowed plant succession to degrade and reduce the extent of Poweshiek skipperling habitat. At each site, habitat has been divided into 3-4 management units. A controlled burn was conducted in one unit at HBSP in 2008 and shrubs were removed from two of the units (Skadsen 2008, p. 4). At PLSRA, a controlled burn was conducted in 2007 and in 2008 the site was hayed and shrubs were removed. Dakota skipper was present in the burned unit for the first time since 2002 after "a dramatic increase in forbs, especially purple coneflower (*Echinacea angustifolia*), occurred after the burn" and "apparently attracted Dakota skippers from a nearby site" (Skadsen 2008, p. 2).

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate)

In approximate decreasing order of importance, threats to Poweshiek skipperling include 1) an unknown single or combination of unidentified stressors that has caused broad and sharp population declines in Iowa and Minnesota and perhaps also in South Dakota; 2) habitat degradation that results from overgrazing, invasive species, succession, herbicide application, interception of groundwater flows to prairie fens in Michigan, and other factors; 3) isolation of populations; 4) destruction of habitat by road construction, gravel mining, etc.; 5) fire that is applied to habitat patches either too broadly or too frequently; and, 6) existing regulatory mechanisms that are inadequate to protect the species from these threats.

In summary, unknown factors have led to broad declines in the western portion of the species' range and a very low proportion of recent (1985-present) records are associated with populations

of good or better viability. If not completely extirpated from Iowa and Minnesota, most or all populations there may be responding to stressors of uncertain origin. Preliminary indications from South Dakota suggest that Poweshiek skipperling populations there may also be responding to the same or similar stressors. Surveys planned for 2011 may further clarify the status of the species there. Recent data from North Dakota are sparse, but there are no indications that there are strong populations in that state. Wisconsin contains only a single population of at least marginal viability and the species is extirpated from Illinois and Indiana. The single population in Canada inhabits a relatively large area under protective ownership, but numbers there declined sharply after a recent wildfire burned through much of its primary habitat.

Formerly containing only a relatively minor portion of the species' range, Michigan contains the only occurrences where significant numbers (e.g., greater than 100) of Poweshiek skipperlings have been documented in recent years. The state contains four populations with good or better viability, but even those face immediate threats that are at least low to moderate in magnitude.

Poweshiek skipperling may be among the poorest dispersers of the prairie-obligate butterflies (Swengel 1996, p. 80-81). Once extirpated from a habitat patch, Poweshiek skipperling may only recolonize if strong populations are nearby – probably less than a mile away. In addition, Poweshiek skipperlings occur only in fragments of native tallgrass prairie or prairie fens – there is no indication that the species may occur in prairie habitats reconstructed on former agricultural lands, weedy roadsides, etc. Therefore, their extirpation from many sites may be irreversible.

For species that are being removed from candidate status:

___Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

Results of recent years' surveys for Poweshiek skipperling in Iowa, Minnesota, and South Dakota have raised concerns that the species is highly imperiled in these three states, which contain a major portion of the species' range. Therefore, it is imperative that any extant populations be identified so that their habitats may be managed to maximize population viability. If any extant populations are found in these three states, species experts should work with site managers to design and implement the most beneficial management for the species.

Habitat management

Prescribed Fire

- Considering the apparent hypersensitivity of Poweshiek skipperlings to fire and the recent dramatic population declines they have experienced, we recommend taking a conservative approach (Panzer 2002, p. 1306) and allowing at least four years to elapse between fires within any burn unit inhabited by Poweshiek skipperling.

- Delineate the Poweshiek skipperling habitat at each site inhabited by the species. If necessary, obtain the services of a biologist who is able to identify the likely extent and

distribution of the occupied habitat. Surveys are especially useful the year before a planned burn, but be aware that poor weather (e.g., persistent high winds) or low population numbers may reduce the likelihood of adequate survey results during the flight period in any given year. Therefore, it may be prudent to plan surveys for at least two consecutive years to increase the likelihood that the occupied habitat is adequately mapped.

- Ensure that the occupied habitat at each site is divided into as many burn units as feasible.
- Use the maximum length fire return interval that is adequate to maintain or restore high-quality native prairie habitat on each unit – allow at least four years before re-burning any area occupied by Poweshiek skipperlings to allow numbers to recover in burned areas.
- When appropriate to meet management objectives, allow fires to burn in a patchy ("fingering") pattern within units – i.e., do not make a concerted effort to burn 'every square inch' unless there is a clear management need for an unbroken burn. and leave fire "skips" unburned. Burning under cool or damp conditions may increase survival of insects present in the litter layer within the burned unit (Panzer 2003, p. 20).
- Consider the use of proactive techniques to increase the patchiness of fires within occupied habitat, especially where the unburned unit(s) may be small, greater than 0.5 km from the burn area, or difficult to protect with standard burn techniques.
- Spring burns should be conducted as early as possible to avoid delaying flowering of early and midsummer blooming forbs, which are crucial nectar sources for Poweshiek skipperlings during their flight period. If fires may need to be conducted in late spring to address a particular management need (e.g., control of smooth brome), other precautionary measures will be especially important. These include the division of occupied Poweshiek skipperling habitat into multiple burn units, ensuring that fires stay within planned burn areas, maximizing the number of years between fires that still allows for sufficient control of invasive species and woody succession, and reducing fuel loads (e.g., with late summer/fall haying – see below) in Poweshiek skipperling habitat in units where frequent or intense fire is not necessary.
- Do not use prescribed fire to manage Poweshiek skipperling habitats if the smallest feasible burn unit would burn most or all of their habitat in one year, unless you can identify an area from which Poweshiek skipperlings will recolonize the burned area. This requires a good understanding of the Poweshiek skipperling populations in the potential source area and of the management planned for that area during the relevant time period. Acquisition and restoration of adjacent habitat or alternate management strategies (e.g., light grazing or late summer/fall haying, see below) may be necessary to conserve Poweshiek skipperlings on small and isolated sites.
- If you plan to change the configuration of burn units or make other changes to your prescribed fire plan, review the location and timing of recent burns to understand the potential effects of these previous fires on the current abundance and distribution of Poweshiek skipperlings on the management area.

- Plan for a reasonable worst-case scenario with regard to the escape of fires out of burn units if that is a reasonable possibility. That is, plan for the contingency that the burn will escape a burn unit and burn one or more additional units that contain Poweshiek skipperling habitat. Determine how the Poweshiek skipperling population would persist despite such a reasonable worst-case scenario.

Haying and Brush-Cutting

Note: The guidelines below also apply to mechanical collection of native prairie seed.

- Hay or mow after mid-August to reduce the likelihood of removing or destroying Poweshiek skipperling eggs and to avoid removing nectar sources during the flight period. In general, hay or mow as late as feasible after mid-August to reduce the likelihood of adverse effects to any life stage. Late summer (e.g. August-September) haying or mowing can be more effective at reducing or controlling woody vegetation than most burning for several reasons - it is done at a time when the woody vegetation is already stressed and when most of the plants' resources are above ground. By contrast, spring and fall burns occur when the woody plants' resources are stored below ground, so they will produce more vigorous suckers following the burn. Late summer burns can be used, but it is difficult to get them to burn hot enough to be effective against established woody vegetation. Mowing can also be focused on the problem area, whereas prescribed fires usually burn best in the open prairie and worst where woody vegetation is a problem.
- Leave at least 20 cm (8 in) of stubble to provide habitat for over-wintering larvae. The ideal time to mow may be after Poweshiek skipperling larvae have entered diapause (i.e., have become dormant in preparation for winter). The senescence of native warm-season grasses may be a good indication that Poweshiek skipperlings have entered diapause. Mowing early in the spring during the time that burning should be conducted (see above) would also reduce the likelihood of adverse effects to Poweshiek skipperling.
- As with annual burning, annual haying may reduce plant diversity in tallgrass prairie. Therefore, hay in alternate years or subdivide the habitat into multiple units and leave at least some of the units unhayed each year. Resting hay units may also reduce the impacts of any adverse effects that may occur from haying that is conducted early enough to adversely affect Poweshiek skipperlings or other species dependent on native prairie (e.g., Ottoe skipper, *H. ottoe*).

Grazing

- Beyond a certain level, grazing is likely to adversely affect Poweshiek skipperling populations in proportion to its intensity because it removes nectar sources and degrades native prairie plant communities (e.g., increases coverage of invasive/non-native species), leading to a reduction in larval food plants. Therefore, limit the duration and intensity of grazing for the conservation of the Poweshiek skipperling and the native prairie ecosystem.

- Avoid grazing regimes that remove a significant proportion of floral nectar resources during the flight period. To protect nectar resources and vegetation for egg deposition and larval food (warm season grasses), "it may only be feasible to graze dry-mesic prairie slopes in the spring (April – May) before the growth of warm season grasses and forbs begins, with a minimum one-year rest period between rotations" (Skadsen 2003, p. 52-53).
- Maintain stubble heights greater than 20 cm (8 in in tallgrass prairie (Skadsen 2003, p. 53).
- Adverse effects may occur at lower grazing intensities in the wet-mesic/mesic prairies that Poweshiek skipperlings inhabit in parts of North Dakota and Manitoba than in the dry-mesic habitat type. Virtually all of the sites with the wet-mesic habitat type at which Poweshiek skipperlings still occur are managed with fall or late-summer haying. To ensure the persistence of Poweshiek skipperlings at these sites, they should not be grazed unless grazing methods are carefully developed that are shown to not threaten the Poweshiek skipperling populations at these sites.

Habitat Preservation

- Avoid any destruction or conversion of Poweshiek skipperling habitats to other uses. Successful restoration of Poweshiek skipperling habitat has not been demonstrated. Therefore, there is no evidence to support a presumption that destroyed Poweshiek skipperling habitat could be restored through planting or other means. Nevertheless, degraded Poweshiek skipperling habitats may be recoverable, especially if the adverse management has not been especially intense or if it is recent. For example, good quality Poweshiek skipperling habitat that is intensively grazed for one year may be likely to recover if more appropriate management is resumed and if a source population is nearby or if the species persisted on a portion of the site. Restoration of destroyed (e.g., plowed) or severely degraded Poweshiek skipperling habitat, however, should be considered experimental.

Habitat Restoration

- To effectively restore habitat for Poweshiek skipperlings, the location must be close enough to an area (e.g., 250 - 500 m (820 – 1640 ft) away) that would provide immigrants to the restored habitat. Sites adjacent to occupied habitats or connected to occupied habitats by suitable habitat corridors are best for restoration experiments.
- Techniques to attempt restoration could consist of a variety of activities (e.g., rest from grazing, tree or brush removal, planting native species, etc.), depending on site conditions, proximity to a source population of Poweshiek skipperlings, and land-use history. Restoration experiments that involve reintroduction of native plant species should be designed to mimic the floral diversity of Poweshiek skipperling's native prairie habitats and should emphasize Poweshiek skipperling nectar and larval food sources, as appropriate (see above).

- Road rights-of-way containing native prairie habitat may serve as corridors for grassland butterflies (Ries et al. 2001, p. 408-409), but the cooperation of the highway managers is very important to prevent untimely mowing or spraying of these areas. Road rights-of-way corridors are vulnerable to degradation caused by invasive species and may become unsuitable as corridors if not managed for habitat suitable for the Poweshiek skipperling.
- If Poweshiek skipperlings are extirpated from a site or likely once occurred there, manage the site to favor the recolonization of the species, especially if it has retained significant characteristics of Poweshiek skipperling habitat. Depending on the quality of the habitat, recolonization may be feasible if source sites are nearby or if artificial reintroduction becomes an alternative in the future. If recolonization is possible, monitor the sight during the flight period to detect any Poweshiek skipperlings.

Control of Weeds and Invasive Species

- Avoid broadcast applications of pesticides or herbicides that may be harmful to Poweshiek skipperlings or their nectar plants in Poweshiek skipperling habitat.
- Ensure that field crews recognize target weeds to avoid adverse effects to important native species.
- Manage sites to minimize the likelihood of invasion by weeds. Control methods that are necessary after invasion may have unintended consequences to Poweshiek skipperling or other native species.

Coordinated Management

- Conduct surveys to delineate local populations. This would enable coordination and management of populations that may cross one or more management units or ownerships.
- Coordinate management activities with property owners and managers of nearby Poweshiek skipperling habitats. For example, plan burns and other temporarily adverse management activities during years when nearby habitats will not be burned.

Survey Habitats and Monitor for Poweshiek Skipperlings

Results of recent years' surveys for Poweshiek skipperling in Iowa, Minnesota, and South Dakota have raised concerns that the species is highly imperiled in this major portion of its range. Therefore, it is imperative that any extant populations be identified so that their habitats may be managed to maximize population viability. Effective management of sites to conserve Poweshiek skipperlings depends on knowledge of the local distribution and relative abundance of Poweshiek skipperlings.

- Employ qualified persons to survey known and potential habitats and to monitor Poweshiek skipperling populations. This is especially important when first devising management plans, changing management plans, and for ongoing evaluation of the

effects of management on Poweshiek skipperling populations. (See *Prescribed Fire* above)

- Recent surveys in Iowa and Minnesota indicate that Poweshiek skipperling has undergone an extensive and drastic decline in those two states. Selby (Selby 2010, p. 7) suggested that "(A)dditional, more intensive surveys are needed at *key historic sites* throughout the state to make a more definitive determination of its status in Iowa" [emphasis added]. A similar effort may be needed in Minnesota.

Maintain Genetic Diversity of Populations

- Manage Poweshiek skipperling habitat to maximize genetically effective population sizes – i.e., the number of individuals reproducing each year. This may reduce the likelihood of inbreeding, which has been demonstrated in Dakota skipper (Britten & Glasford 2002). For example, connect isolated populations, expand suitable habitat patches, and do not disturb habitats during the Poweshiek skipperling flight period. Consider how various management practices may affect the number of breeding adults in both the short- and long-terms. For example, activities that kill Poweshiek skipperlings during larval or pupal stages will also affect the number of breeding adults.

Identifying Larval Host Plant(s)

- Prairie dropseed was confirmed as the primary larval foodplant for Poweshiek skipperling in southeastern Wisconsin by Borkin (1995, p. 6), but site-specific research is needed for further clarification of host plant preferences in other areas and to guide habitat management.

Research

- Smooth brome has invaded many sites where Poweshiek skipperlings occur and threatens to degrade the habitats at these sites. Recommended measures to control smooth brome – annual burning during the mid-spring tiller elongation phase (Willson & Stubbendieck 2000, p. 36-38) – may be detrimental to Poweshiek skipperlings. Therefore, measures to control smooth brome that do not themselves threaten Poweshiek populations must be developed through research or adaptive management.
- It seems clear that degradation of native plant diversity leads to decreased viability of Poweshiek skipperling populations. Research is needed, however, to identify specific vegetation features that distinguish habitats capable of supporting viable populations from those that contribute to population declines.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

We recommend that the Service assign Poweshiek skipperling a listing priority number of 2.

Rationale for listing priority number:

Magnitude:

As summarized above, threats to Poweshiek skipperling in approximate decreasing order of magnitude are 1) a single or combination of unidentified stressors that has caused broad and sharp population declines in Iowa and Minnesota and perhaps also in South Dakota; 2) habitat degradation as a result of overgrazing, invasive species, succession, herbicide application, and other factors; 3) isolation of populations (habitat fragmentation); 4) destruction of habitat by road construction, gravel mining, etc.; 5) fire that is applied to habitat patches too broadly or too frequently; and, 6) existing regulatory mechanisms that are inadequate to protect the species from these threats.

One or more unidentified stressors have strongly impacted Poweshiek skipperling populations in the western portion of its range, which contains more than 90 percent of the species' site records. In Iowa, extensive surveys of sites where Poweshiek skipperling was previously known to occur were carried out in 2007 – the species was found at only 2 of 38 sites. Follow-up surveys in 2009 and 2010 indicate the species is now possibly extirpated from at least one of those two sites. A similar effort was carried out in Minnesota in 2007 and 2008. At sites where the species was known to have previously occurred, it was found at only three of 26 and zero of 21 sites, respectively (Selby 2009a, p. 1-6). The species' possible extirpation – or declines to undetectable numbers – has now been documented at approximately half of the known sites in Minnesota (Dana 2008; Selby 2006, 2009a; Skadsen 2010, R. Dana, unpubl. data 2010). This includes several of the state's most important prairie butterfly habitats. In South Dakota,

Skadsen surveyed ten of "some of the best" sites in South Dakota in 2010 and found no Poweshiek skipperlings (D. Skadsen, pers. comm. 1 Oct 2010). There is little hope that the species occurs in significant numbers at sites where it has yet to be recorded. Surveys have eliminated many prairie remnants from consideration as Poweshiek skipperling habitat (e.g., Saunders 1995; Selby 2009b, p. 1-6) and it is unlikely to colonize new sites due to its poor dispersal capability and the pronounced fragmentation of its habitat.

Habitat degradation is a threat of high magnitude to Dakota skipper, especially in light of the apparent sharp declines in the western part of the species' range. Habitat quality is likely a powerful determinant of extinction probability in butterflies (Thomas et al. 2001, p. 1795), including Poweshiek skipperling. Invasion of the species' habitat by exotic species and native trees and shrubs, overgrazing, application of herbicides for pasture management, and even haying when it is too frequent or ill-timed threaten Poweshiek skipperling populations by removing or significantly reducing availability of plants that provide nectar and food for larvae. Among sites where the most recent surveys for Poweshiek skipperling were positive, invasive species, succession, or both threaten at least 25 percent of sites. This likely underestimates the magnitude, because site-specific threat information is unavailable for many of these sites. Four populations inhabiting Michigan prairie fens appear to be viable, but require ongoing protection from the effects of invasive species and other factors; the other six Michigan populations face high levels of threats.

Habitat fragmentation and the isolation of Poweshiek skipperling populations is also a threat of high magnitude to the species. A coarse analysis of Poweshiek skipperling populations indicates that at least about 40 percent of populations are effectively isolated – populations at these sites would not be reestablished naturally in the event of their extirpation. A decline in habitat quality, fire that is too extensive or too frequent, flooding, or another factor resulting in extirpation would remove Poweshiek skipperling from these sites permanently. In Michigan, five of the ten sites where the species is presumed to be extant are isolated from other habitat patches. In Wisconsin, Scuppernong Prairie and Wilton Road may become connected as a result of habitat restoration. Numbers are so low at Wilton Road, however, that removal of shrubs surrounding the site could cause the Poweshiek skipperlings to "disperse too widely causing the population to crash following the removal of the remaining woody vegetation" (Borkin in litt. 2010). The population at the third site in the state – Puchyan Prairie – is entirely isolated.

Fire is a threat of moderate magnitude to Poweshiek skipperling, but is also an important management tool for the species. At any site it is likely to become a threat if not conducted with conservation of prairie invertebrates as a primary objective. Poweshiek skipperling may be among the most sensitive of prairie butterflies to fire and coordination between habitat managers and butterfly experts is necessary to ensure that it is not implemented in a manner that degrades population viability. This type of coordination seems to improving, but not to the extent needed to reduce the magnitude of the threat to low.

Habitat destruction, primarily for agriculture, was the primary factor that fragmented Poweshiek skipperling habitat, but is now a threat of only low magnitude to Poweshiek skipperling. A considerable portion of the species' habitat is protected via public ownership or easements or is on land that may not be highly amenable to crop production.

Imminence: Poweshiek skipperling appears to be experiencing widespread and sharp declines in much or the entire western portion of its range. The immediacy of the threats in Iowa and Minnesota, and perhaps also South Dakota, are demonstrated by the declines that have occurred since about 2003. The rapidity and extent of the documented declines makes it reasonable to assume that the causative factors pose imminent threats to any populations that may remain extant in Iowa and Minnesota, which contains about 68 percent of all occurrence records. The results of less extensive surveys in South Dakota have raised concerns that the same factors are operating there. In the eastern portion of its range (Michigan and Wisconsin) populations are few and often isolated. Populations there face imminent threats including invasive species, genetic and demographic effects of small population sizes, isolation, and effects of development.

Throughout the species' range, a wide variety of factors threaten to degrade Poweshiek skipperling habitat unless management facilitates the persistence of a plant community dominated by certain native grasses and forbs important for larval feeding and adult nectaring; (2) grazing, if conducted, is managed to allow for abundant larval and adult food sources at least in a significant portion of the site; (3) haying, if conducted, is done after approximately mid-August, at least in a sufficient area within the site and not every year; (4) habitat is managed by fire, grazing, or mowing that limits invasive species (e.g., cool-season grasses) and woody plants; (5) managers ensure that the frequency, timing, and relative coverage (e.g., patchiness) of prescribed fires and other disturbances allow for sufficient recolonization of burned areas from unburned patches near the burned site; (6) conversion of Poweshiek skipperling habitat by gravel mining, agriculture, or other activities is precluded; and, (8) genetically effective population sizes are large enough to avoid deleterious effects of genetic drift on population growth.

The significant threats to this species are imminent.

Rationale for Change in Listing Priority Number (insert if appropriate)

___ Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Emergency listing might be warranted if we could immediately identify and address the factors responsible for the widespread decline of the species in the western portion of its range. These factors, however, are unknown at this time. We will, however, attempt to closely monitor the status of the species and threats to its survival to remain aware of the applicability of the emergency listing option.

DESCRIPTION OF MONITORING

In recent years, survey efforts increased dramatically in Iowa and Minnesota in an effort to confirm indications that Poweshiek skipperling and other prairie-obligate butterflies were undergoing broad-scale declines. These survey efforts are discussed in depth above. Before 2006 survey efforts were most robust in South Dakota with the primary intent of describing the status and distribution of Dakota skipper (Skadsen 2002, 2003, 2004, 2005). Because their flight periods are similar and habitats overlap with Dakota skippers, data on Poweshiek skipperling

populations and habitat conditions were also collected during these surveys. Currently, SDDGFP has switched to a more intensive approach, with repeated surveys on five specific sites accompanied by vegetation (floristic quality) monitoring and Skadsen is separately conducting similar intensive monitoring on several sites owned by the Sisseton-Wahpeton Sioux Tribe. South Dakota may implement an extensive survey effort in 2011 to determine the extent of the possible decline of Poweshiek skipperling in the state.

In North Dakota the Forest Service has conducted butterfly surveys on grazing allotments with an emphasis on tracts slated for burning at Sheyenne National Grasslands (Spomer 2002, p. 2) and at other sites with potential habitat on lands in Dakota Prairie Grasslands further west in the state. The North Dakota National Guard also conducted some surveys in 2002 that resulted in the location of two new Dakota skipper populations, but these sites may be outside of the range of Poweshiek skipperling. Recently, survey efforts in North Dakota have been patchy compared to the effort in South Dakota and Minnesota.

In Wisconsin and Michigan, surveys of all or most populations are likely to be conducted annually by Susan Borkin (Wisconsin Public Museum) or her colleague(s) and Michigan Natural Features Inventory (MNFI), respectively. MNFI currently has funding for surveys through 2012 (D. Cuthrell, pers. comm. 2011).

COORDINATION WITH STATES
Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Representatives of South Dakota Department of Game, Fish, and Parks, Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, Michigan Natural Features Inventory, and Iowa Department of Natural Resources provided information and/or comments on the original (Selby 2005) or updated (Selby 2010) status assessment. Dave Cuthrell – Michigan Natural Features Inventory – provided comments on the May 2011 draft of this document.

Indicate which State(s) did not provide any information or comments:

We received no comments on the status assessments from representatives of the State of North Dakota.

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Appendix A

Results of 2007/2008 surveys in Minnesota at sites with historical Poweshiek skipperling records (Selby 2009a, p. L).

Complex	Site Name	Year Last Recorded	Surveyed 2007?	No. Observed	Surveyed 2008?	No. Observed
Chanarambie Creek	Carney Prairie Bank	2005	Yes	1	Yes	0
Chanarambie Creek	Lost Timber	1997	Yes	0		
Chanarambie Creek	Masselinck Prairie	1997			Yes	0
Chanarambie Creek	Moulton 9 & 16	1997	Yes	0		
Chanarambie Creek	Sankey	2005	Yes	0		
Felton Prairie	B Bar B Ranch	1985	Yes	0	Yes	0
Felton Prairie	Clay County (Unit A)	1995			Yes	0
Felton Prairie	Clay County (Unit B)	1985			Yes	0
Felton Prairie	Felton Prairie SNA - Bicentennial Unit	1985	Yes	0	Yes	0
Felton Prairie	Felton Prairie SNA - Blazing Star Unit	1995	Yes	0		
Glacial Lakes State Park	Anderson PSP Main (Units A, B, C, D & E)	1997	Yes	0	Yes	0
Glacial Lakes State Park	Barsness 30 - Evenson (T3E)	2003	Yes	0	Yes	0
Glacial Lakes State Park	Glacial Lakes State Park-A (T4)	2001	Yes	0	Yes	0
Glacial Lakes State Park	Glacial Lakes State Park-B (T3W)	2003	Yes	0	Yes	0
Glacial Lakes State Park	Vegoe Prairie Bank	1997	Yes	0	Yes	0
Hole-in-the-Mountain Prairie	Altona WMA	2005	Yes	0	Yes	0
Hole-in-the-Mountain Prairie	Hole-in-the-Mountain Prairie (Private/TNC NE)	1985	Yes	0		
Hole-in-the-Mountain Prairie	Hole-in-the-Mountain Preserve (NE)	1996	Yes	0	Yes	0
Hole-in-the-Mountain Prairie	Hole-in-the-Mountain Preserve (original)	2005	Yes	0	Yes	0
Hole-in-the-Mountain Prairie	Hole-in-the-Mountain WMA (E)	1985	Yes	0	Yes	0
Hole-in-the-Mountain Prairie	Hole-in-the-Mountain WMA (main)	1985	Yes	0	Yes	0
Isolated Site	Camden State Park	2001	Yes	0		
Isolated Site	Compass Prairie SNA	1982	Yes	0		
Isolated Site	Expandere WMA (N)	1993	Yes	0	Yes	0
Isolated Site	Florida 34 & 35	1975				
Isolated Site	Fortier 9 & 10	1994	Yes	0	Yes	0
Isolated Site	Glynn Prairie SNA	1993	Yes	0		
Isolated Site	Lundblad Prairie SNA	1994	Yes	0		
Isolated Site	Pipestone National Monument	1991	Yes	0		
Isolated Site	Prairie Marshes WMA (N)	1994	Yes	0		
Isolated Site	Prairie Marshes WMA (S)	1994	Yes	0		
Isolated Site	Sangl WMA	1978	Yes	0	Yes	0
Isolated Site	Shelburne 26 (pasture)	1994				
Isolated Site	Sioux Nation WMA	1994	Yes	0		
Isolated Site	Split Rock Creek SP (N - Remnant)	2001	Yes	0		
Isolated Site	Storden LIP (20) & Prairie Bank (21 & 28)	1994			Yes	0
Isolated Site	Terrace WMA	2006	Yes	0	Yes	0
Isolated Site	Walls 7-1 Prairie Bank	1988			Yes	0
Prairie Coteau	Prairie Coteau East	1996	Yes	0	Yes	0
Prairie Coteau	Prairie Coteau SNA (main)	2005	Yes	1	Yes	0
Prairie/Victory WMA & NWPA	Prairie WPA	2000	Yes	1	Yes	0
	Total		34	3	25	0

Appendix **B. Minnesota Case Studies**

At each of the sites discussed below, at least 20 Poweshiek skipperlings were recorded during a survey at least once between 1985 and 2005 or the species was described as abundant, common, or extensive during that time period. In some cases, the ambient factors (wind speed, cloud cover, etc.) that may affect the likelihood of detecting Poweshiek skipperling are described to better understand how reliably the surveys may be compared.

Recent Minnesota Survey Results – Case Studies

Camden State Park – Lyon County, Minnesota

Skadsen (2001b, p. 9) recorded 27 Poweshiek skipperling in one section of Camden State Park on 3 July 2001, but did not detect the species in another section that contained recently burned remnant prairie. On 29 June 2007, Schlicht surveyed the same areas and did not detect any Poweshiek skipperlings (Selby 2009a, Appendix 4, p. xxx iv). Date, wind conditions (0 vs. 1-3 mph) temperature (81° vs. 83° F), survey duration (approximately 158 vs. 142 minutes[5]), and total species (11 vs. 13) and number of regal fritillary (*Speyeria idalia*) recorded (7 vs. 4) were similar between the 2001 and 2007 surveys, respectively.

Chippewa Prairie – Chippewa and Swift Counties

In 1995 and 1996 Schlicht conducted surveys on six days during the Poweshiek skipperling flight period at Chippewa Prairie. He recorded 2-43 Poweshiek skipperling per survey, with a high of 0.3 Poweshiek skipperling recorded per minute on 7 July 1995 (Schlicht 1997: Appendix) (Table 2). Selby (2006, p. 25) surveyed the same area on 12 July 2005 and observed no Poweshiek skipperlings "despite a survey under good conditions that was both intensive and extensive." He (Selby 2006, p. 25) suggested that "(A)dditional surveys a little earlier in the flight should be conducted in the future to confirm" the status of Poweshiek skipperling at Chippewa Prairie - the 2005 survey was conducted later than the dates of peak Poweshiek skipperling numbers observed in 1995 and 1996.

Table 4. Number of Poweshiek skipperling recorded during surveys at Chippewa Prairie, Chippewa and Swift Counties, Minnesota, July 1995 and 1996.

Date	Year	No. O. poweshiek	Wind Speed (mph)	Temperature	Cloud Cover	Duration of Survey
1-Jul	1995	43	2	80	10	241
7-Jul	1995	36	2	82	0	125
11-Jul	1995	2	8	94	10	130
4-Jul	1996	13	8	80	10	170
9-Jul	1996	2	10	74	10	155
14-Jul	1996	7	3	74	10	117

5 Excluding the northeast section of the park (Section 5), which may not have been surveyed by Skadsen (2001b).

Glacial Lakes State Park – Pope County

In 2001, Skadsen (2001b, p. 48) recorded 36 and 10 Poweshiek skipperling on 28 June and 9 July, respectively, along Transect 4 at Glacial Lakes State Park. On 5 July 2007, he resurveyed this transect under "fair-good" conditions and recorded no Poweshiek skipperling, although he described the habitat as "in excellent condition" with abundant prairie coneflower (*E. angustifolia*) in bloom and a "good diversity of native forbs and grasses" (Selby 2009a, Appendix, 4, p. l). Skadsen recorded five Dakota skippers during the 2007 survey (Selby 2009a, Appendix, 4, p. l) - in 2001 he recorded 29 and 17 on 28 June and 9 July, respectively (Skadsen 2001b, p. A-14). Selby (Selby 2009a, Appendix 5, p. liv) surveyed the site on 18 July 2008 and again observed no Poweshiek skipperling – he recorded two Dakota skipper and also described the habitat conditions as "good."

Glynn Prairie – Lyon County

Schlicht surveyed Glynn Prairie on 9 July 1993. Although he reported "(L)ots of brome and red clover", he recorded 25 Poweshiek skipperling during a 50-minute survey (data sheet appended to Schlicht & Saunders 1994). On 30 June 2007 he resurveyed the site under "good" conditions (zero cloud cover, 78° F, 2-3 mph wind), but found no Poweshiek skipperlings and reported that part of the site was "poor with sweet clover" (Selby 2009a, Appendix 4, p. xxxv).

Hole-in-the-Mountain Preserve - Lincoln County

Schlicht (data sheet appended to Schlicht 1997) surveyed Minnesota's Hole-in-the-Mountain Preserve in 1996 and 1997 and observed large numbers of Poweshiek skipperling in both years – for example, 76 during a four-and-one-half-hour survey on 10 July 1995 and 41 during three hours of surveying on 9-10 July 1996. In 2007, Dana (2008, p. 5) conducted three surveys at Hole-in-the-Mountain Preserve between 22 June and 7 July and found no Poweshiek skipperling along a combined 24,237 meters of transect.

Prairie Coteau Scientific and Natural Area – Clay County

Selby (Selby & Glenn-Lewin 1990) intensively surveyed Prairie Coteau Scientific and Natural Area (Prairie Coteau SNA) each year between 1988 and 1990. In 1990, he recorded 116 Poweshiek skipperling (Selby & Glenn-Lewin 1990, p. 19-20) during peak flights along a total of about 6250 m (Dana 2008, p. 16) of transect. Schlicht (data sheet appended to Schlicht 1997) also recorded substantial numbers of Poweshiek skipperling (>60) during surveys on 11 July 1995 and 15 July 1996. In 2007 Dana (2008, p. 7) conducted surveys between 24 June and 6 July, along 20,959 meters of transect at Prairie Coteau SNA and recorded 68 Dakota skippers during these surveys, but no Poweshiek skipperling. If detection rates during the peak of the Poweshiek skipperling flight were similar between Selby's 1990 and Dana's 2007 surveys and if the peak of the species' flight in 2007 would have overlapped with Dana's 2-6 July surveys (2008, p. 5), he should have recorded about 201 Poweshiek skipperling during those surveys (Dana 2008, p. 16; Selby & Glenn-Lewin 1990, p. 19-20).

Prairie Waterfowl Production Area – Big Stone County

In 2000, Skadsen (2001a, p. 6) found Poweshiek skipperling to be "abundant" on the north end of Prairie Waterfowl Production Area (WPA) and also found a "small 3-4 acre patch of native prairie on private land" adjacent to the WPA in Section 35" that "supported a surprisingly large population of *Oarisma poweshiek*." In 2007, Prairie WPA was one of the three historical Poweshiek skipperling sites at which the species was recorded, but only one was observed and no Poweshiek skipperling were recorded during a survey on 15 July 2008 (Selby 2009a, Appendix 4, p. i).

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: Thomas O. Melius
Regional Director, Fish and Wildlife Service Date June 9, 2011

Concur: _____
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review:
Conducted by:

(Revised 8/12/05)