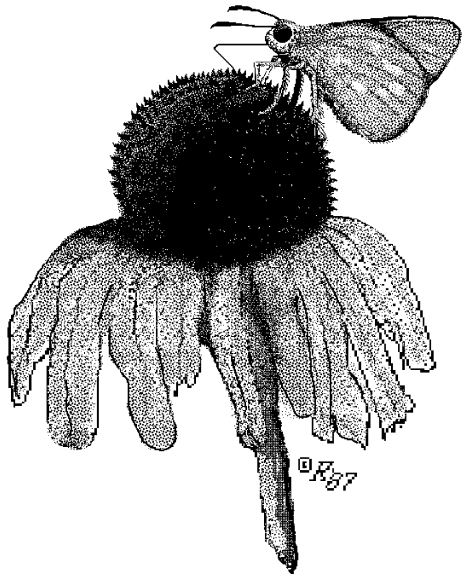
STATUS ASSESSMENT and CONSERVATION GUIDELINES

Dakota Skipper

Hesperia dacotae (Skinner)
(Lepidoptera: Hesperiidae)

Iowa, Minnesota, North Dakota, South Dakota, Manitoba, and Saskatchewan



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Disclaimer

This document is a compilation of biological data and a description of past, present, and likely future threats to the Dakota skipper (*Hesperia dacotae*). It does not represent a decision by the U.S. Fish and Wildlife Service (Service) on whether this species should be designated as a candidate for listing as threatened or endangered under the Endangered Species Act. The U.S. Fish and Wildlife Service will make that decision after reviewing this document, other relevant biological and threat data not including herein, and all relevant laws, regulations, and policies. The results of the decision will be posted on the U.S. Fish and Wildlife Service's Region 3 Web site, http://midwest.fws.gov/endangered/lists/concern.html. If designated as a candidate species, it will subsequently be added to the U.S. Fish and Wildlife Service's candidate species list that is periodically published in the Federal Register and posted on the World Wide Web, http://endangered.fws.gov/. Even if the species does not warrant candidate status it should benefit from the conservation recommendations contained in this document.

Cover Illustration

The line drawing of Dakota skipper on the cover is provided courtesy of Dr. Ron Royer, Minot State University, Minot, North Dakota.

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Part One: Status Assessment

I. Introduction

Part One of this status report summarizes background information on the habitat, biology, and ecology of the Dakota skipper (*Hesperia dacotae*) based on numerous publications, unpublished reports and observations, and an expert interview process (Appendix B). It also includes the best available information on the current distribution and status of the species in Minnesota, North Dakota, South Dakota, Manitoba and Saskatchewan based on recently completed field surveys and other information. Part Two discusses conservation issues and management needs.

The primary information sources for this report include McCabe's (1981) original article on Dakota skipper range and biology, Dana's (1983, 1991) doctoral research, Royer and Marrone's (1992) comprehensive report on the conservation status of the species in North and South Dakota, a series of field survey reports from Minnesota (Glenn-Lewin and Selby 1989, 1990, Cuthrell 1991, Schlicht and Saunders 1994, Schlicht 1997a,b, Dana 1997, Skadsen 1999c), North Dakota (Royer 1997, Royer and Royer 1998, Lenz 1999) and South Dakota (Skadsen 1997, 1999a), and Swengel's (Swengel 1996, 1998a, Swengel and Swengel 1999,) work on prairie skippers (Hesperiidae) in Iowa, Minnesota and North Dakota. Additional sources are cited in the text and listed in the References section and Appendix A of the report.

II. Species Information

A. Classification and Nomenclature

Class - Insecta (insects)
Order - Lepidoptera (butterflies and moths)
Family - Hesperiidae (skippers)
Subfamily – Hesperiinae (grass or branded skippers)
Genus - Hesperia
Specific Name – dacotae
Species – *Hesperia dacotae*
Common Name - Dakota skipper
Controversial or Unresolved Taxonomy - none

The Dakota skipper was first described in 1911 from collections taken at Volga, South Dakota, and Grinnell, Iowa (Skinner 1911 *in* Royer and Marrone 1992). The family Hesperiidae includes three other subfamilies and the genus *Hesperia* contains 18 species (Miller and Brown 1981, Ferris 1989 *in* Royer and Marrone 1992).

B. Description of the Species

The Dakota skipper is a small to medium-sized hesperiine butterfly with a wingspan of 2.4 to 3.2 centimeters (0.9 to 1.3 inches) and hooked antennae (Royer and Marrone 1992). Like other Hesperiidae species, Dakota skippers have a faster and more powerful flight than most butterflies because of a thick, well-muscled thorax (Royer and Marrone 1992).

Adult Dakota skippers are variable in markings. The dorsal surface of adult male wings ranges in color from tawny-orange to brown and there is a prominent mark on the forewing; the ventral surface is dusty yellow-orange (Royer and Marrone 1992). The dorsal surface of adult females is darker brown with diffused tawny orange spots and a few diffused white spots restricted to the margin of the forewing; the ventral surfaces are dusty gray-brown with a faint white spotband across the middle of the wing (Royer and Marrone 1992). Adult Dakota skippers may be confused with the Ottoe skipper (*H. ottoe*), which is somewhat larger with slightly longer wings (Royer and Marrone 1992). Dakota skipper pupae are reddish-brown and the larvae are light brown with black collar and dark brown head (McCabe 1981). These larvae differ from most other *Hesperia* in that the head capsule is pitted all over, including the lower part (ventrally) (McCabe 1981).

C. Summary of Habitat, Biology, and Ecology

1. Habitat

Dakota skippers are obligate residents of high quality prairie[1] ranging from wet-mesic tallgrass prairie to dry-mesic mixed grass prairie (Royer and Marrone 1992). They typically occupy remnant bluestem prairies characterized by a variety of composites (Asteraceae) and alkaline soils (McCabe 1981, Royer and Marrone 1992). Royer and Marrone (1992) categorized Dakota skipper habitat into two main types:

> The first is low (wet) prairie dominated by bluestem grass, with three flowers almost always present and blooming during Dakota flight: wood lily [*Lilium philadelphicum*], harebell [*Campanula rotundifolia*], and alkali grass [smooth camas; *Zigadenus elegans*]... The second is upland (dry) prairie, often on ridges and hillsides, dominated by bluestems and needlegrasses. Although harebell and wood lily (but not alkali grass) may occur in these sites, three other species are reliable indicators of this habitat: pale purple and upright coneflowers [*Echinacea spp.*] and blanketflower [*Gaillardia aristata*]... Although prairie preserves are often of only one or the other type, the habitats originally intermixed on a landscape scale and in some places still converge today.

Although Dakota skippers live in more than one type of native grassland, they are restricted to high-quality prairie habitats. Dana (1997) described Minnesota sites as dry-mesic prairie dominated by mid-height grasses with an abundance of nectar sources including purple coneflower (*Echinacea angustifolia*) and stiff milkvetch (*Astragalus adsurgens*). Dana (1991) never encountered Dakota skippers in wet or wet-mesic prairies despite abundant floral resources and their frequent use by similar skipper species. In systematic surveys at 12 Minnesota sites, Swengel and Swengel (1999) found that Dakota skippers were significantly more abundant on dry prairie than on either wet or mesic prairie. In northeastern South Dakota, Dakota skippers also inhabit dry-mesic hill prairies with abundant purple coneflower, but also use mesic to wet-mesic tallgrass prairie habitats characterized by wood lily and smooth camas (Skadsen 1997).

In eastern North Dakota, wet-mesic tallgrass prairie appears to support more dense populations than does drier mixed grass prairie to the west (Royer and Marrone 1992). Eastern North Dakota prairies inhabited by Dakota skippers are dominated by warm-season or bluestem grasses that always contain wood lilies, harebells, and smooth camas (Royer and Marrone 1992) and that are generally associated with glacial lake margins with alkaline soils (McCabe 1981). McCabe (1981) found that in eastern North Dakota smooth camas was a reliable predictor for the presence of Dakota skippers and that the Dakota skipper flight period coincided with the flowering of this species; Dakota skippers did not, however, use smooth camas as a nectar source.

[1] High quality prairie consists of a relatively high diversity of native species, including forbs (R. Dana, pers. comm., 2001).

Lenz (1999) characterized four Dakota skipper sites in the Towner-Karlsruhe Complex in northcentral North Dakota. On wet-mesic sites the most common forb species were smooth camas, blazing star (*Liatris ligulistylis*), Canada goldenrod (*Solidago canadensis*), and others; stiff sunflower (*Helianthus rigidus*) and thimbleweed (*Anemone cylindrica*) were most common on dry-mesic sites. Purple coneflower was rare in these habitats, although it is commonly associated with Dakota skippers in other regions. In the Towner-Karlsruhe complex, Dakota skippers appear to be more commonly associated with mesic to wet-mesic prairie than in other parts of their range to the south and east (Lenz 1999).

An association of bluestems and needle-grasses (*Andropogon and Stipa spp.*) and non-native Kentucky bluegrass (*Poa pratensis*) typifies dry-mesic Dakota skipper habitat in the rolling terrain of river valleys and the Missouri Coteau (Royer and Marrone 1992, Robert Murphy, U.S. Fish and Wildlife Service, North Dakota, pers. comm.2001). These prairies, on the western edge of the species' known range, typically contain wood lilies, harebells, and coneflowers and other asters as nectar sources, and in some areas, smooth camas (Royer and Marrone 1992, R. Murphy, pers. comm. 2001). In the western North Dakota prairies, Dakota skippers use microhabitats on rolling upland sites that mimic more eastern tallgrass prairies within what is otherwise a marginally dry climate for the species (Royer and Marrone 1992).

Two key factors have typically allowed persistence of remnant native prairie habitats inhabited by Dakota skippers -- soils unsuitable for agriculture or steep topography (Royer and Marrone 1992). Some habitats inhabited by Dakota skippers, however, are still threatened by conversion for agriculture, most notably sites in North Dakota's Towner-Karlsruhe complex (Table C.2.). McCabe (1979, 1981) and Ron Royer (Minot State University, North Dakota, *in litt.* 2000) have linked the historical distribution of Dakota skippers to glacially related surface geology and soils, and possibly regional precipitation-evaporation ratios. Edaphic features, such as soil moisture, compaction, surface temperature, pH, and humidity, may be significant factors in larval survival and, thus, important limiting factors for Dakota skipper populations. The location of larval food plants rarely seems to affect Dakota skipper distribution within their habitat since these warm-season grasses are usually dominant and evenly dispersed (Swengel 1994), although invasion by smooth brome (*Bromus inermis*) may limit larval food intake (see below).

2. Biology

The annual, single generation of adult Dakota skippers emerges from mid-June to early July, depending on the weather, with flights starting earlier farther west in the range (McCabe 1979, 1981, Dana 1991, Royer and Marrone 1992, Skadsen 1997, Swengel and Swengel 1999). Males emerge as adults about five days earlier than females, although observed overall sex ratios are do not differ (Dana 1991). The flight period in a locality lasts two to four weeks and mating occurs throughout this period (McCabe 1979, 1981, Dana 1991). Dakota skippers lay eggs on broadleaf plants (McCabe 1981) and grasses (Dana 1991). Potential lifetime fecundity is between 180 and 250 eggs per female; realized fecundity depends upon longevity (Dana 1991). Females lay eggs daily in diminishing numbers as they age; a female living a week after emergence will lay about half the potential number of eggs (Robert Dana, Minnesota Department of Natural Resources, *in*

litt. 1994). Dana (1991) estimated potential adult life span at three weeks and average life span (or residence on site before death or emigration) at three to 10 days on one Minnesota prairie.

Dakota skippers overwinter as larvae and complete one generation per year. Eggs hatch after incubating for 7-20 days. Larvae then crawl to the bases of grass plants where they form shelters at or below the ground surface with silk, fastened together with plant tissue (Dana 1991). Each larva constructs 2-3 successively larger shelters as it grows (Dana 1991); at night they emerge from their shelters to forage (McCabe 1979, 1981, Royer and Marrone 1992). Dana (1991) and Royer and Marrone (1992) observed that little bluestem was a favored food source, but that larvae consumed several grass species. Seasonal senescence patterns of grass species relative to the larval period of Dakota skippers are likely important in determining the suitability of grass species as larval host plants.

Dakota skippers have six or seven larval stages (instars, McCabe 1981, Dana 1991). They overwinter (diapause) in their ground level or subsurface shelters during either the fourth or fifth instar (McCabe 1979, 1981, Dana 1991, Royer and Marrone 1992). The following spring, larvae resume feeding and undergo two additional molts before they pupate. During these last two instars, larvae shift from buried shelters to horizontal shelters at the soil surface (Dana 1991).

Grassland fire, grass species composition, soil pH, humidity, and extremes of winter low temperatures may be important in determining survival of larvae (McCabe 1979, 1981, Royer and Marrone 1992). Larval survival may be higher where relatively short fine-stemmed bunchgrasses prevail. Grasses that possess these traits, such as little bluestem (*Schizachyrium scoparium*), are characteristic of Dakota skipper habitat. Grass height is important because larvae must travel at least daily from their shelters at or near the ground to palatable grass parts. Palatable tissues are a “considerable distance” (Dana 1991) off of the ground on tallgrasses, such as big bluestem (*Andropogon gerardii*) or indiangrass (*Sorghastrum nutans*), both of which are typical dominants in mesic tallgrass prairie. In addition, the marked hairiness that is found in some grass species may impede the progress of larvae (Dana 1991). Prairie remnants invaded by smooth brome are likely unsuitable for Dakota skippers. The effectiveness of larval shelters built at the bases of smooth brome would likely be less effective than those constructed deep in the dense bases of bunchgrasses. In addition, smooth brome is likely too tall for efficient feeding by Dakota skippers and it becomes senescent before or during mid-late summer when larvae need palatable grass tissue for food.

Plant sources of nectar for adults vary regionally and include purple coneflower, harebell, white prairie-clover (*Dalea candida*), long-headed coneflower (*Ratibida columnifera*), fleabanes (*Erigeron spp.*), blanketflowers, black-eyed Susans (*Rudbeckia spp*.), and evening primrose (*Oenothera serrulata*) (McCabe and Post 1977, Royer and Marrone 1992). Plant species likely vary in their value as nectar sources for Dakota skipper due to the amount of nectar available to the species during the adult flight period (Dana 1991 and see below). Of the Dakota skippers they observed nectaring during systematic surveys in Minnesota, Swengel and Swengel (1999) observed 85% nectaring at the following three taxa, in declining order of frequency: purple coneflower, blanketflower, and ground plum (*Astragalus sp.*). They also observed Dakota

skipper nectaring at 22 other plant species. Dana (1991) reported the use of 25 nectar species in Minnesota with purple coneflower most frequented; McCabe (1979, 1981) observed Dakota skippers using eight nectar plants.

3. Ecology

From its earliest identification the Dakota skipper was considered rare (Royer and Marrone 1992), although considerable destruction of its habitat likely occurred before the species was first described in 1911 (see below). McCabe (1981) observed very stable population numbers on North Dakota and Minnesota prairies he visited repeatedly from 1968-1979. On dry-mesic prairie in Clay County, Minnesota, Dana (1991, 1997) also observed stable numbers into the thousands during his intensive studies from 1978 to 1983, although Schlicht (1997) and Reiser (1997) reported more variable densities on the same sites in 1995-96. Based on these more recent observations, Dana (1997) suggested that populations could experience significant size fluctuations between years. At some sites in wet-mesic bluestem prairies of North Dakota, density may exceed 40 individuals per hectare (ha) (Royer and Marrone 1992). At these densities, Dakota skippers may exclude other skipper species (Royer and Marrone 1992). At Hole-in-the-Mountain preserve, Minnesota, Dana (1991) found peak abundance of approximately 1000 Dakota skippers over about 40 ha (~20-30/acre); he estimated that 2000-3000 may have been alive at various times during the flight period and that only one-third to one-half of adults were alive simultaneously. Where they occur, these high densities persist for only about a week to ten days.

Royer and Marrone (1992) concluded that Dakota skippers are not inclined to dispersal, although they did not describe individual ranges and dispersal distances. McCabe (1979, 1981) found main activity areas for Dakota skippers shift annually in response to local nectar sources and disturbance. Marked adults in Dana's (1991) study moved across <200 m of unsuitable habitat between two prairie patches and more frequently moved along ridges than across valleys. Average adult movements were <300 m over 3-7 days. Dana (1997) later observed reduced movement rates across a small valley with roads and crop fields compared with movements in adjacent widespread prairie habitat. The five Dakota skipper experts that we interviewed in 2001 (Appendix B) indicated that it was unlikely that Dakota skippers were capable of moving greater than 1 km between patches of prairie habitat separated by structurally similar habitats (e.g., crop fields or pasture, but not native prairie). Skadsen (1999) reported apparent movement of unmarked Dakota skippers from a known population 800 m (0.5 miles) to a site with an unusually heavy coneflower growth. He had not observed Dakota skippers in three previous surveys when coneflower production was sparse; the sites were connected by "native vegetation of varying quality" with a few asphalt and gravel roads interspersed (Dennis Skadsen, Natural History Investigations, Grenville, South Dakota *in litt.* 2001).

Before the beginning of widespread prairie destruction in about 1820, prairie was relatively continuous throughout the tallgrass and mixed grass prairie ecoregions that included the range of the species (Fig. 1). Dispersal among local populations following disturbances such as fires likely decreased the probability of extinction of local populations (McCabe 1981). Before widespread

destruction of this habitat began in the 19th century, the species may have existed as a single metapopulation or several large metapopulations, with local populations connected by dispersal. Britten and Glasford (2002) found that the genetic distances among seven extant populations in the southern portion of the species' range indicated that they were connected in recent history

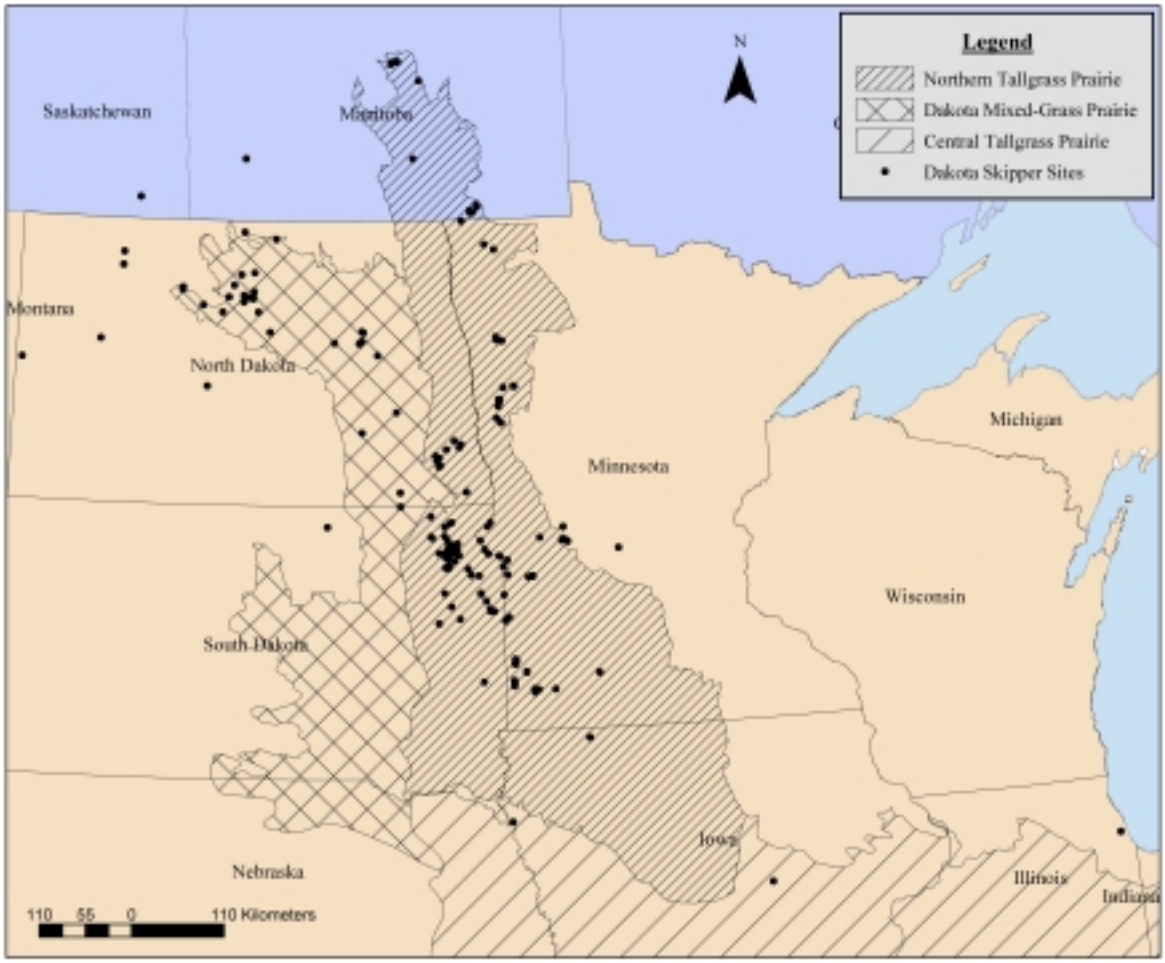

Figure 1. Known locations of sites at which Dakota skipper has been recorded, including sites from which the species has been extirpated. Note the location of the easternmost records near Chicago, Illinois. A total of three Dakota skippers were collected there in 1889 and 1895. Selected TNC (The Nature Conservancy) ecoregions are shown here to illustrate the general area of transition from tallgrass to mixed grass prairie. Not all ecoregions containing mixed grass and tallgrass prairie are included in this figure.

(Fig. 2). These populations are now separated from one another by as much as 300 km (Fig. 2). Dakota skippers now occupy fragments of this formerly widespread and contiguous prairie (Fig. 1).

Britten and Glasford (2002) also found that Dakota skipper populations have "(H)eterozygote deficiencies relative to Hardy-Weinberg expectations and high inbreeding coefficients." Therefore, these populations may be inbred. On the other hand, if genetically distinct subpopulations exist within populations, pooling samples among subpopulations may also result in observed heterozygote deficiencies compared to Hardy-Weinberg expectations (i.e., a Wahlund effect, Britten and Glasford 2002). In addition, a "temporal Wahlund effect" may have occurred if close relatives were more likely to be present at any given time during the flight period and if Britten and Glasford (2002) sampled "excessively homozygous broods on any given day." This would underestimate the heterozygosity present in the sampled population.

McCabe (1979, 1981) reported predation of Dakota skippers by ambush bugs (Hemiptera: *Phymata spp.*), flower spiders (Aranaea: *Misumena spp.*), and orb weavers (various Araneidae). Dana (1991) also observed predation by white crab spiders (Araneida: *Misumenops spp.*), ambush bugs, and robber flies (Diptera: Asilidae) on older, worn adults. He also reported limited disease mortality in captive-reared larvae. Royer and Marrone (1992) concluded that neither predation nor disease play strong roles in Dakota skipper population dynamics.

The species appears to be one of the more environmentally sensitive invertebrate members of tallgrass and mixed grass prairie habitats (Royer and Marrone 1992). Other sensitive species found on Dakota skipper prairies include regal fritillary (*Speyeria idalia*), Arogos skipper (*Atrytone arogos*), Ottoe skipper (*H. ottoe*), Poweshiek skipperling (*Oarisma poweshiek*), and the federally threatened Western prairie fringed orchid (*Platanthera praeclara*),.

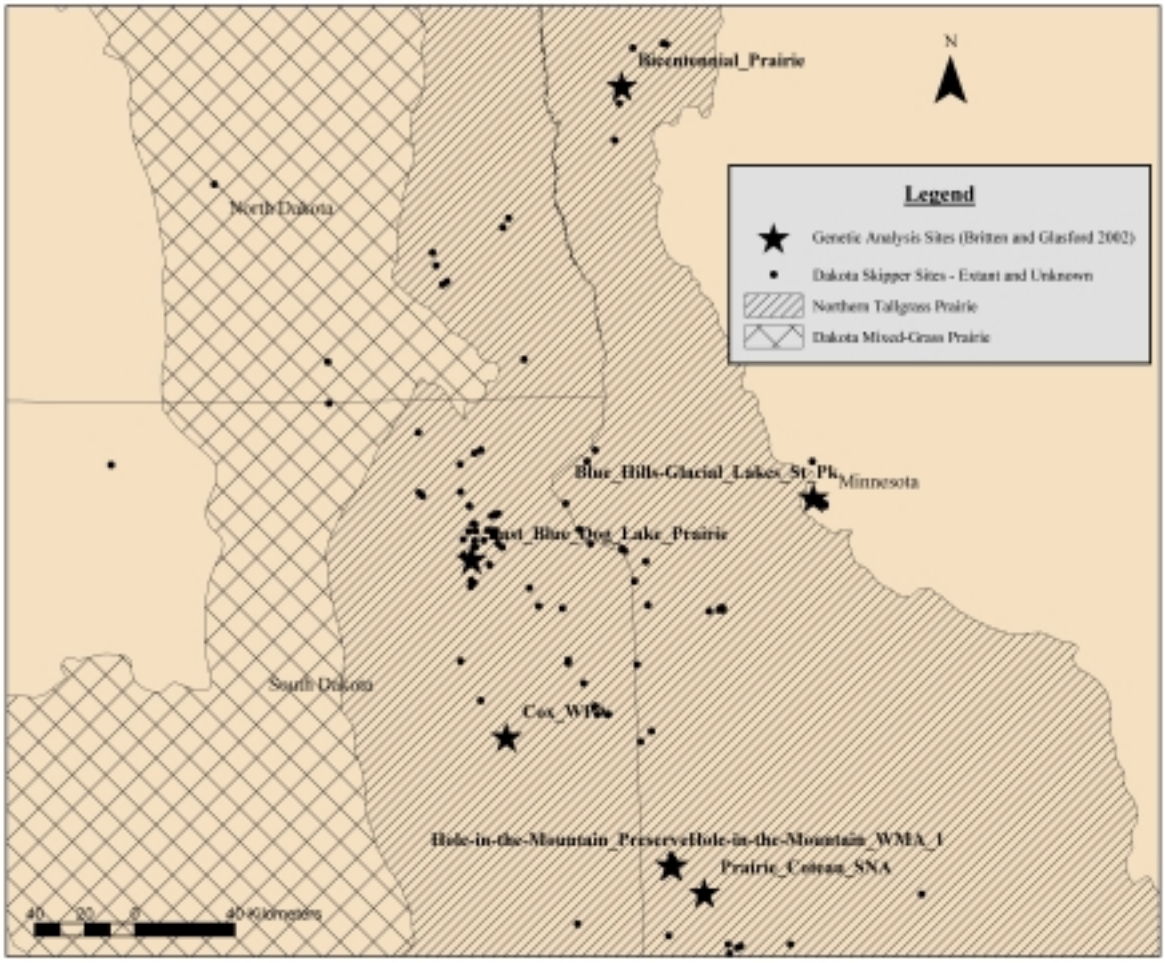

Figure 2. Britten and Glasford (2002) collected Dakota skippers from the sites indicated by stars in 1998-1999. They found that the small genetic distances among these populations indicated that they were connected within "recent history." Dakota skipper distribution may have become fragmented into the extant populations shown above since the onset of prairie destruction in the 19th century. Distances among some of these populations may be close enough now to expect dispersal among extant sites, especially among the two Hole-in-the-Mountain sites (location symbols overlap at this scale) and Prairie Coteau SNA.

D. Range and Population Trends

1. Historical Range and Trends

Dakota skipper distribution formerly included tallgrass and mixed grass prairies of Illinois, Iowa, Minnesota, South Dakota, North Dakota, Manitoba, and Saskatchewan (Fig. 1). Their current distribution is centered in western Minnesota, northeastern South Dakota and the eastern half of North Dakota (Royer and Marrone 1992) (Fig. 3). Royer and Marrone (1992) suggested a remote possibility that Dakota skippers may also occur in far eastern Montana and southeastern Saskatchewan, in habitats similar to those occupied by the species in northwestern North Dakota. Hooper (Royal Saskatchewan Museum, Regina, Saskatchewan, pers. comm. 2002) found Dakota skipper in Saskatchewan for the first time in 2002, after looking for the species there "for the last 40 years." Royer (R. Royer, pers. comm. 2002) no longer thinks that the species occurs in Montana. Its status in western North Dakota seems tenuous, with the species disappearing from all but two sites in recent years (Ron Royer, Minot State University, Minot, North Dakota, pers. comm. 2001).

The distribution of Dakota skipper has become extremely fragmented from its core through the northern and western fringes (McCabe 1981, Royer and Marrone 1992, Schlicht and Saunders 1994, Royer 1997, Schlicht 1997a,b, Skadsen 1997, 1999a, Swengel and Swengel 1999) (Figs. 1-3). This is based on the assumption that the species was formerly distributed throughout the northern tallgrass and Dakota mixed grass prairies and in at least a portion of the central tallgrass prairie ecoregion (Fig. 1). The historical distribution of Dakota skippers may never be precisely known because "much of tallgrass prairie was extirpated prior to extensive ecological study" (Steinauer and Collins 1994), such as butterfly surveys. Based on records of vouchered specimens, however, we know that Dakota skipper range has contracted northward out of Illinois and Iowa. The species was last recorded in Illinois in 1888 (McCabe 1981) and in Iowa in 1992 (Orwig and Schlicht 1999). The species' status seems tenuous on the western edge of its range (see above); far northern sites in Minnesota are also highly isolated and vulnerable[2] or threatened (Cuthrell 1991).

Britten and Glasford's (2002) genetic analyses support the presumption that this species formerly had a relatively contiguous distribution, at least in Minnesota and South Dakota. They found that genetic distances among seven sites in Minnesota and South Dakota were small enough to presume that these Dakota skipper populations were connected in recent history (Fig. 2).

The marked range reduction of Dakota skippers is due largely to conversion of native prairies for agriculture (e.g., row crops) or other uses and to habitat degradation (e.g., overgrazing) on unplowed prairies. Loss of native prairie within the last 200 years has been extensive throughout the general region historically occupied by Dakota skipper (Table 1). As is indicated by their occurrence records, habitat affinities, and physiological requirements, Dakota skippers were

[2] See Table C in Appendix C for definitions of status categories for Dakota skipper populations.

likely widely distributed throughout northern tallgrass prairie and Dakota mixed grass prairie (Fig. 1). Although historically present further south in the central tallgrass prairie region (Fig. 1), our knowledge of the extent of their former distribution there is hampered by a paucity of data collection before the onset of widespread prairie destruction. No historical figures are available

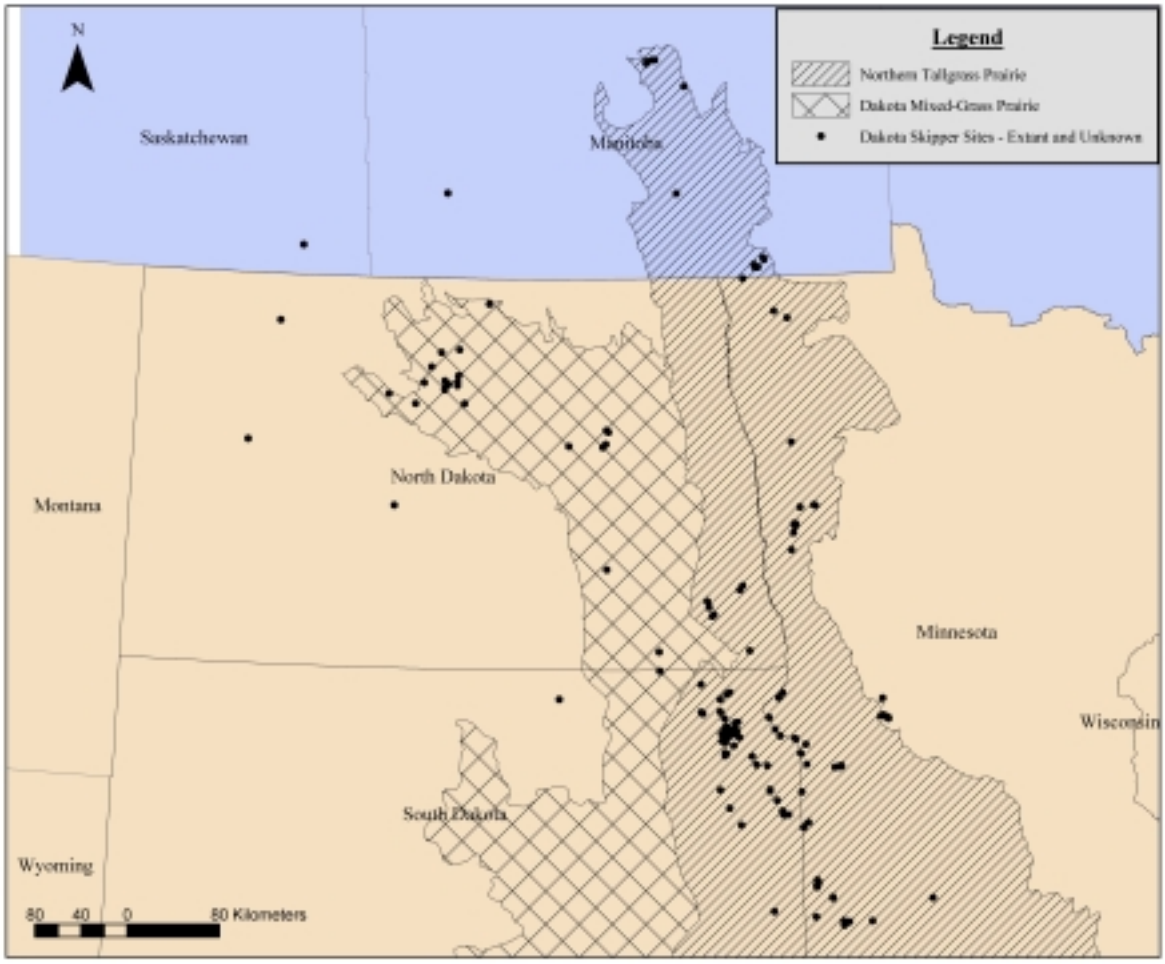

Figure 3. Dakota skipper records from populations that are currently extant or whose status is unknown and selected ecoregions. Populations presumed extinct are omitted. Selected TNC (The Nature Conservancy) ecoregions are shown to illustrate the general area of transition from tallgrass to mixed grass prairie. Not all ecoregions containing mixed grass and tallgrass prairie are included in this figure.

Table 1. Historical loss of prairie in states and one Canadian province in which Dakota skipper occurs or is known to have occurred (adapted from Samson and Knopf 1994). Data for mixed grass prairie in South Dakota are not available.

	Historical (ha)	Current (ha)	Decline (%)
Tallgrass			
Manitoba	600,000	300	99.9
Illinois	8,900,000	930	99.9
Iowa	12,500,000	12,140	99.9
Minnesota	7,300,000	30,350	99.6
North Dakota	1,200,000	1200	99.9
South Dakota	3,000,000	449,000	85.0
Mixed Grass			
Manitoba	600,000	300	99.9
North Dakota	13,900,000	3,900,000	71.9
South Dakota	1,600,000	N/A	N/A
Saskatchewan	13,400,000	2,500,000	81.3

for the specific prairie types (i.e., plant associations) that Dakota skipper inhabits. It is likely, however, that the historical loss of these habitats closely reflects the general losses of tallgrass and mixed grass prairie and we assume that the numbers of Dakota skippers has declined approximately in proportion to the loss of their habitat (Table 1). Once isolated on remnant habitats, local populations of Dakota skipper may continue to disappear even if habitat remains, due to factors subtler than outright prairie destruction.

2. Current Range and Population Trends

Species Expert Site Status Rankings. We asked Dakota skipper experts to use the following definitions to describe the status of Dakota skipper populations at each site in Minnesota, North Dakota, and South Dakota (Appendix C) with which they were knowledgeable:

Secure (S):	Inherently viable by size; no active threats (<5% probability of extinction within 50 years);
Vulnerable (V):	Possibly not viable by isolation, etc.; threats may affect (not secure, but <20% probability extinction within 20 years);
Threatened (T):	Active threats and/or high inherent vulnerability (>20% probability extinction within 20 years);
Extirpated (E):	Converted habitat or degraded and no recent observations despite searching.

Of the 175 sites ranked, 37 were ranked by more than one expert. Of these, opinions varied among or between experts at 17 (46%) sites. All differences of opinion were between adjacent status categories (i.e., S-V, V-T, or, T-E). At the three sites ranked by three experts each, two of three experts agreed at two sites and all three agreed at the other. Where opinions differed, we assigned the more optimistic status ranking for the site status summaries in Table 2 and Figure 4. For example, for sites ranked as V and T by two experts, respectively, we assigned a rank of V. (All differences of opinion are shown in Tables C.1-3.) We violate this rule in two cases – for Prairie Coteau SNA, to which we have attached a rank of vulnerable. Dennis Schlicht ranked this site as vulnerable whereas Robert Dana ranked it as secure, but commented that it may be vulnerable. Because of Dana's acknowledgement that this site may be vulnerable and not secure (R. Dana *in litt.* 2001), we decided that this status represents the preponderance of opinion for this site. In the second case, Carney Prairie in Minnesota, Schlicht (pers. comm. 2001) ranked the site as secure whereas Dana (pers. comm. 2002) ranked it as vulnerable. We decided that vulnerable was the appropriate ranking for Carney Prairie; although it contains some excellent habitat (Table C.1) and is protected by a conservation easement (R. Dana, pers. comm. 2002), it is subject to pesticide spray from neighboring properties (D. Schlicht, pers. comm. 2002). Moreover, it is a small site (24 ha) with a correspondingly small population of Dakota skipper (R. Dana, pers. comm. 2002).

***Iowa*.** Dakota skippers are presumed extirpated from Iowa (Schlicht and Orwig 1998, Gerald Selby, The Nature Conservancy, Des Moines, Iowa, pers. comm. 2001). Historically they were recorded in three counties and were last seen at Cayler Prairie, Dickinson County, in 1992. They were not found in surveys there between 1980-1991 or since 1992 (Schlicht and Orwig 1998, G. Selby, pers. comm. 2001). Selby conducted surveys at Cayler Prairie in 2000 and found no Dakota skippers and the species was not observed at eight sites surveyed between 1988-1997 cited in Swengel and Swengel (1999). Potential habitat may occur in some areas where only "cursory" surveys have been conducted in northwest Iowa (G. Selby, pers. comm. 2001). Therefore, further surveys may be warranted to conclusively document the status of Dakota skipper in Iowa.

***Manitoba*.** There are 13 sites in Manitoba at which Dakota skippers have been recorded (Manitoba Conservation, *in litt.* 2001). The current status of these populations is unclear. Hugh Britten's collection of 72 Dakota skippers among three sites in 2000, however, confirms at least the persistence of these three populations (Britten 2001).

***Minnesota*.** Dakota skippers have been recorded at 63 sites[3] in 17 counties; seven populations out of these 63 occurrences have become extinct since their discovery; including two county records (Table C.1). Populations have become extinct at four sites since the 1970s. Extirpation has not been confirmed at any Minnesota site in the last 20 years, except at Roscoe Prairie, a Nature Conservancy preserve in Stearns County (Schlicht and Saunders 1994). Population status is unknown, however, at 12 of the 63 sites; some of these populations (e.g., Salt Lake WMA, Dana, *in litt.* 2001) may be extinct and two (Lundblad Prairie and Hastad WPA) may be nonexistent, but based only on the observations of Dakota skippers that strayed from nearby populations (Dana *in litt.* 2001). Of the 56 sites at which Dakota skipper is presumed to be extant (i.e., including "unknown" sites, Table C.1.), 40 occur within 10 groups whose sites we presume are connected by dispersal (Table C.1). Sixteen sites are isolated. Of the extant sites, Minnesota Department of Natural Resources owns 14[4], The Nature Conservancy owns six, county governments own four, U.S. Fish and Wildlife Service owns three, various private owners own 28, and the Minnesota Historical Society owns one.

Experts ranked only one Minnesota site as secure – Hole-in-the-Mountain Preserve -- and 27% of the sites as either secure or vulnerable (Table C.1.). Potentially important populations that face one or more threats occur at several sites not ranked as secure. Skadsen (pers. comm. 2001) found Dakota skippers along almost all of 25 miles of transects in and around Glacial Lakes State Park in 2001, but much of this population inhabits private land with no legal protection. The large population around Felton Prairie is not secure without additional land protection and management; gravel mining threatens three of the five sites that comprise the Felton Prairie Complex (Table C.1.), especially the best quality habitat on Clay County property (Robert Dana, Minnesota Department of Natural Resources, St. Paul, MN, pers. comm. 2001; Brian Winter,

[3] Throughout the report, a site refers to an entire population or part of a population under single, contiguous land ownership. Sites may be adjacent to each other and form a single, interbreeding population.
[4] One of these sites also includes land owned by The Nature Conservancy.

The Nature Conservancy, Glyndon, MN, pers. comm. 2001). Dakota skipper status at Chippewa Prairie is less clear; although the site is protected by The Nature Conservancy, the population may be smaller than on more suitable (drier) habitat elsewhere (Schlicht and Saunders 1994, Schlicht 1997a) and further surveys are warranted (R. Dana *in litt*. 1994). The likelihood that there are significant unrecorded populations of Dakota skippers in Minnesota is likely low (i.e., 10-15%), but further surveys may be warranted in some specific areas (R. Dana, pers. comm. 2002).

***North Dakota*.** Dakota skippers have been reported from 43 sites in 17 North Dakota counties, of which at least eleven sites and three county records have been extirpated since the 1980s and early 1990s (Table C.2). Extinction of populations has apparently resulted from habitat conversion and habitat degradation due to heavy grazing, weed control spraying, and other disturbances, such as aspen management by bulldozing at Killdeer Mountain (Royer 1997). Threats are not restricted to private lands; invasion of native prairie by exotic species (e.g., smooth brome (Murphy *in litt.* 2002) and leafy spurge (*Euphorbia esula*)), chemical control of exotic species invasions, and fire (Royer 1997) are also potential threats to Dakota skippers on some public lands in North Dakota. Royer and Marrone (1992) concluded that it is highly unlikely that additional little bluestem prairie tracts of sufficient size to support a significant population of Dakota skippers existed in North Dakota.

Of the 32 extant or possibly extant sites in North Dakota, 17 occur within two complexes—Towner-Karlsruhe in McHenry County (13 sites) and Sheyenne Grasslands (4 sites, Table C.2) in Ransom and Richland Counties. The other 15 sites presumed extant are isolated from other sites. Land ownership of extant sites is largely private (19 sites); North Dakota Department of Lands owns five sites, U.S. Fish and Wildlife Service, U.S. Forest Service, and The Nature Conservancy each own two sites, and the state highway department owns one extant site. U.S. Fish and Wildlife Service owns easements on two of the privately owned sites in the Towner-Karlsruhe complex and on one of the sites in the Sheyenne Grasslands complex (Table C.2). These easements prohibit haying, mowing, and seed collection before July 15. They also preclude digging, plowing, disking or otherwise destroying the vegetative cover and agricultural crop production; the easements allow grazing (U.S. Fish and Wildlife Service, *in litt* 1999).

No Dakota skipper populations in North Dakota may be secure, although it is clear that the Towner-Karlsruhe complex is the current stronghold for the species in the state. Lenz (1999) found that 30% of the Towner-Karlsruhe area was still native prairie. Between 1996-2000, however, approximately 570 ha (1400 acres) of previously unplowed native prairie was converted to irrigated cropland primarily or exclusively for crop rotations that included potatoes (Andy Wingenbach, Natural Resources Conservation Service, McHenry County, North Dakota, pers. comm. 2001). No sites inhabited by Dakota skipper in McHenry County were known to be converted during this time. This episode of prairie conversion, however, seems to indicate a general vulnerability of prairie in this area to conversion, where relatively flat topography and high water table facilitates the development of irrigated, row-crop agriculture (Gary Erickson, U.S. Fish and Wildlife Service, J. Clark Salyer National Wildlife Refuge, North Dakota, pers. comm.2001). U.S. Fish and Wildlife Service has recently purchased grassland easements at three

Dakota skipper sites and adjacent to two others (Karen Kreil, U.S. Fish and Wildlife Service, Bismarck, North Dakota, pers. comm.2001, Table C.2.). The North Dakota Land and Highway Departments own five of the Towner-Karlsruhe sites and the rest are privately owned. Some Towner-Karlsruhe sites are linked by highway rights-of-way that contain native prairie vegetation and by other prairie remnants. According to the definitions above, however, Royer (*in litt.* 2001) would describe no sites in North Dakota as secure – each is subject to private or State management that includes plausible management options that could extirpate Dakota skipper from the site (Table C.2.). Tim Orwig (Worcester, Massachusetts, pers. comm. 2001) and Steve Spomer (University of Nebraska, Lincoln, Nebraska, pers. comm. 2001) also ranked the status of the Sheyenne Grassland sites and two of the isolated North Dakota sites (Oakes and Hartleben Prairie – Spomer) and would describe none of these sites as secure.

Dakota skipper populations at Sheyenne National Grasslands have evidently suffered from intensive grazing, leafy spurge invasion, and the effects of herbicides used to control leafy spurge on nectar plants, but a few populations remain. McCabe (1979) cited the McLeod Prairie in the Sheyenne Grasslands in southeastern North Dakota as the best site for Dakota skippers in North Dakota. Since then, however, leafy spurge invasion has significantly modified the habitat and they are now extirpated from that site (Royer 1997). Swengel and Swengel (1999) did not observe Dakota skippers at 8 survey sites in the Sheyenne grasslands during 1988-1997; Royer did observe a few isolated Dakota skippers in the Sheyenne grasslands during this period (R. Royer, pers. comm. 2001). In 2001, Spomer (S. Spomer, pers. comm. 2001) resurveyed the sites at which Royer observed Dakota skippers and failed to relocate the species at any of those sites. Spomer did, however, find Dakota skippers at a site in the Sheyenne Grasslands at which the species was not previously recorded ("Unnamed, SNG", Table C.2). As of 1996, Orwig (1996) suggested that Brown's Ranch in Ransom County, which is owned by The Nature Conservancy, had potential to support a metapopulation and that it was the "last hope" for supporting Dakota skippers in the Sheyenne River ecosystem. The U.S. Fish and Wildlife Service has also recently acquired a grassland easement on a privately owned Sheyenne Grassland site (Craig Mowry, U.S. Fish and Wildlife Service, Tewaukon National Wildlife Refuge, North Dakota, pers. comm. 2001, Table C.2). Royer (1997), however, claims that throughout the Sheyenne Grasslands, both public and private lands have been so heavily grazed and altered by grasshopper and leafy spurge control that extirpation of Dakota skippers from the area is almost certain in the long-term.

Dakota skipper experts rated all sites outside of the two complexes discussed above as threatened or vulnerable (Table C.2, status of Spring Creek population is unknown). Tewaukon National Wildlife Refuge may have the potential to support a large population of Dakota skippers (Orwig 1996). The species currently inhabits a portion of the refuge (Hartleben Prairie), but the isolation of this population threatens its persistence (T. Orwig, pers. comm. 2001, Royer 1997). The Eagle Nest Butte population on Ft. Berthold Indian Reservation (McKenzie Co.), on the western edge of Dakota skipper range, is too small and isolated to be secure (Royer 1997, pers. comm.2001); the nearest extant population, at Lostwood National Wildlife Refuge, is approximately 110 km away. The population at Lostwood National Wildlife Refuge and nearby Waterfowl Production Areas (Burke and Montrail Cos.) is isolated at the putative northern margin of the species' current range in North Dakota. Holywater Spring (Rolette Co.) is also a northern outpost and

isolated (Royer 1997). Although Royer (*in litt.* 2001) describes the habitat there as good, isolation and conversion (Table C.2) threaten it.

South Dakota. Dakota skippers have been recorded at 53 sites in 10 counties, of which five sites are known to be extirpated due to habitat loss or degradation (three sites since the early 1990s). Extirpation has been observed at two state-owned sites and at one site owned by the Sisseton-Wahpeton Sioux Tribe since 1990, and earlier at two private sites (Skadsen 1997, pers. comm. 2001).

Of the 48 sites whose populations are either extant or whose status is unknown, all but 16 occur within complexes. The largest population complex is the Scarlet Fawn Prairie-Knapp's Pasture complex in Day and Roberts Counties, with 19 extant sites and one site from which Dakota skippers have been extirpated (Chekapa Creek Ridge, Table C.3.). Smaller complexes are the Bitter Lake and Crystal Springs Areas in Day and Deuel Counties, respectively, North End Coteau des Prairies in Roberts and Marshall Counties, and on the Lake Traverse Reservation in Day and Marshall Counties. The population has not been thoroughly surveyed at Ordway Prairie in McPherson County or west of the current known range. The Ordway Prairie region may be a significant outpost for Dakota skippers (Doug Backlund, North Dakota Natural Heritage Program, Pierre, SD, pers. comm.2001), although it is on the western extent of the species' known historic range. Skadsen (1997, 1999a; pers. comm. 2001) ranked 16 sites as secure in the Scarlet Fawn-Knapp's Pasture complex and 11 other South Dakota sites as secure in Day, Marshall, Deuel, Grant, Hamlin, and McPherson Counties (Table C.3). Of the 48 South Dakota sites where Dakota skipper is presumed extant (i.e., including sites whose status is unknown, Appendix C), 10 are owned by the Sisseton-Wahpeton Sioux Tribe, 9 by the U.S. Fish and Wildlife Service, four by South Dakota state conservation agencies, three by The Nature Conservancy, and 21 by various private owners; one site owner is unknown.

The Scarlet Fawn Prairie-Knapp's Pasture complex forms a secure refuge for the species under current management practices (Skadsen 1997, 1999a, Table C.3.). The Sisseton-Wahpeton Sioux typically manages their lands in this complex and elsewhere with annual fall haying (i.e., mid-August to late September, D. Skadsen, pers. comm. 2002), a practice that appears to favor the persistence of Dakota skippers (D. Skadsen, pers. comm. 2001). The U.S. Fish and Wildlife Service has recently acquired grassland easements at four sites with Dakota skippers in this complex and at six other tracts in the area. The long-term (50 year+) prognosis for the tribally owned sites is that their management will not change (C. Mowry, pers. comm.2001). Not all potential Dakota skipper habitat in South Dakota has been surveyed and additional populations are likely, particularly at eight locations listed by Skadsen (1997).

Saskatchewan. As stated above, Dakota skipper has been recorded at one site in Saskatchewan, about ¼ mile (approx. 0.4 km) south of Oxbow, Saskatchewan (R. Hooper, pers. comm. 2002). Hooper collected three males and found no females. Each male collected was found perching on *Echinacea* flowers on an ungrazed knoll within a patch of mixed grass prairie that was approximately 1 ha in extent.

III. Population Assessment

A. Current Protective Status Under State/Provincial/Tribal/Federal Laws and Regulations

1. International

As of June 2001, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, http://www.cosewic.gc.ca/) has designated Dakota skipper a Group 1 - Highest priority candidate for listing as a "Canadian Species at Risk." COSEWIC candidate species are those that are suspected of being in some COSEWIC category of risk of extinction or extirpation at the national level, before being examined through the status assessment process. Group 1 contains species of highest priority for assessment by COSEWIC. COSEWIC designations confer no legal protection because Canada has no national law that confers legal protection analogous to the Endangered Species Act of the United States.

The Province of Manitoba has declared Dakota skippers as an endangered species under its Endangered Species Act. Under this provincial law, "it is unlawful to kill, injure, possess, disturb or interfere with the species; disturb, destroy or interfere with the habitat of the species; or damage, destroy, obstruct or remove a natural resource on which the species depends for its life and propagation" without a permit (Gordon Graham, Manitoba Conservation, Winnipeg, MB, *in litt.* 2001).

The World Conservation Union/IUCN classifies Dakota skippers as globally vulnerable (by criteria VU A1c + 2c, IUCN 2000). This classification applies to species that are thought to be facing a high risk of extinction in the wild in the "medium-term future" and is based on (1) an observed, estimated, inferred or suspected reduction of at least 20% over the last 10 years or three generations, whichever is longer; or (2) a reduction of at least 20% projected or expected to be met within the next ten years or three generations, whichever is longer, based on a decline in area of occupancy, extent of occurrence and/or quality of habitat.

2. Federal

Presently the Dakota skipper receives no federal protection under the Endangered Species Act. The species was first added to the federal candidate species list in 1975 (Notice of Review, 40 Federal Register (FR) 12691). Three years later the U.S. Fish and Wildlife Service proposed to list the species as threatened and proposed critical habitat (43 FR 28938-28945). The proposed rule was withdrawn in 1979, however, because it did not meet the requirements set forth in the 1978 amendments to the Endangered Species Act (44 FR 12382-12383). Dakota skippers were then designated as category 2 candidate species—species for which data were insufficient to support a proposed rule to list (49 FR 21664-21675)—until the category 2 classification was eliminated in 1996 (61 FR 64481-64485).

In January 1994, the U.S. Fish and Wildlife Service received a petition to list the Dakota skipper as an endangered or threatened species. The U.S. Fish and Wildlife Service concluded in the

administrative 12-month finding on the petition that listing was not warranted because the demise of the species did not appear imminent despite the long-term decline in the population and its habitat (60 FR 10535). Further, as of 1995, the Service found that "additional information is required concerning the species and its threats before making the determination that the species is endangered or threatened within the definition of the Act. Timely protection and appropriate prairie management might eliminate the need to list the species" (60 FR 10535).

3. Tribal

No special status.

4. State

Iowa: State-endangered
Minnesota: State-threatened
North Dakota: No legal protection; North Dakota Natural Heritage Inventory category S2
South Dakota: No legal protection; South Dakota Natural Heritage Inventory category S2

B. Summary of Land Ownership and Protection

Across the species' range, land ownership by number of extant sites (not acreage) is 52% private, 18% state (13% on state lands dedicated to conservation), 11% federal, 7% tribal, 8% The Nature Conservancy or Manitoba Naturalists' Society, 3% county, and 2% unknown. Land ownership differs markedly among the states as does the distribution of secure sites by ownership (Table 2, Fig. 4).

Table 2. Land ownership of Dakota skipper sites. Number of sites whose status is either extant (i.e., secure, vulnerable, or threatened) or unknown by state, with number of sites rated as secure in ( ). The status of each Canadian site is unknown. For details see Appendix C; site status is based largely on R. Dana, pers. comm. 1998, *in litt.* 2001, T. Orwig pers. comm. 2001, Royer 1997; Royer *in litt.* 2001, Royer and Royer 1998, Schlicht 1997a, D. Schlicht pers. comm. 2001, Schlicht and Saunders 1994, Skadsen 1997, 1999, D. Skadsen pers. comm. 2001, Skadsen *in litt.* 2001, and S. Spomer, pers. comm. 2001). State lands in conservation status include state parks, game and waterfowl areas, and scientific and natural areas. "State Non-Conservation Agency" includes school sections, highway, and land department parcels whose primary purpose is not to conserve natural features.

Landowner	MB	SA	MN	ND	SD	Total
County			4			4
Federal			3	4	9 (7)	16 (7)
Sisseton-Wahpeton Sioux Tribe					10 (10)	10 (10)
TNC/Manitoba Naturalists Society	1		6 (1)	2	3 (2)	12 (3)
Private	10		28	19	21 (8)	78 (8)
State Conservation Agency	1		15		4	20
State Non-Conservation Agency	1			6		7
Unknown		1		1	1	3
Total	13	1	56 (1)	32 (0)	48 (27)	150 (28)

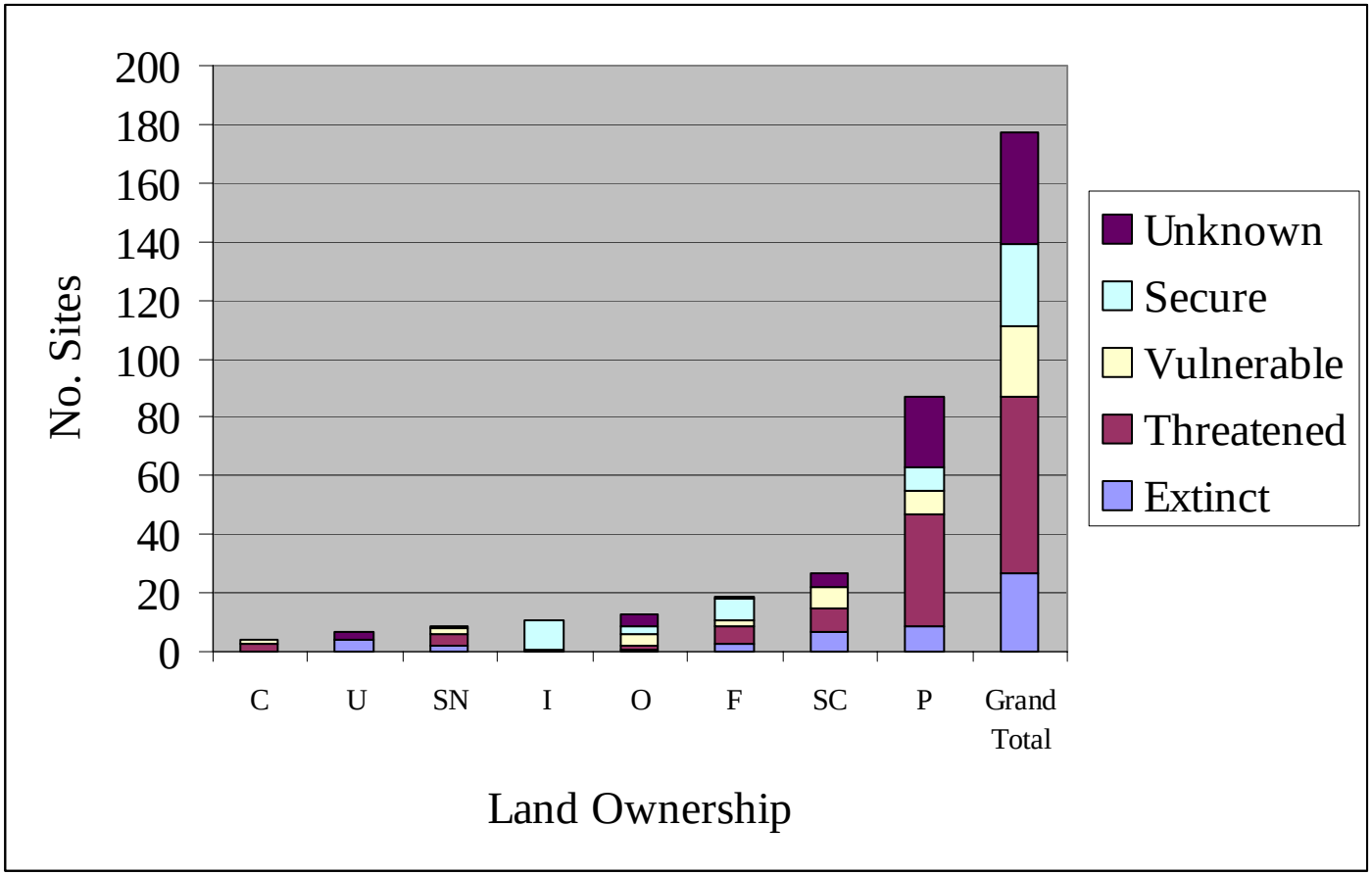

Figure 4. Land ownership and status, as ranked by Dakota skipper experts, of all recorded Dakota skipper populations. Ownership categories are county (C), unknown (U), state non-conservation (e.g., highway) agency (SN), Sisseton-Wahpeton Sioux Tribe (I), The Nature Conservancy or other private conservation organization (O), federal (F), state conservation agency (SC), and private (P). Secure: Inherently viable by size; no active threats (<5% probability of extinction within 50 years); Vulnerable: Possibly not viable by isolation, etc.; threats may affect (not secure, but <20% probability extinction within 20 years); Threatened: Active threats and/or high inherent vulnerability (>20% probability extinction within 20 years); Extinct: Converted habitat or degraded and no recent observations despite searching.

C. Past, Current and Anticipated Conservation Activities to Benefit Species

Conservation agencies have recognized the need to address the status of prairie skippers for at least 20 years. A workshop was held in 1980 to initiate studies of Dakota skippers and other prairie butterflies. In June 1995, the U.S. Fish and Wildlife Service convened Dakota skipper experts to outline tasks needed to preserve enough viable populations to ensure long-term security for the species. The group outlined a plan for 1) surveying populations and characterizing site/habitats at priority areas; 2) identifying and recommending management needs, both generally and in more detail at a subset of important sites; 3) monitoring; and 4) outreach and education. More recently, a Dakota skipper recovery strategy meeting was held in South Dakota in March 1999, with state, federal, and non-governmental biologists attending (Skadsen 1999b).[1]

Research and survey work on Dakota skippers began with Dana's (1991) doctoral study on fire effects at Hole-in-the-Mountain, Minnesota, beginning in 1979 and McCabe's (1981) 1979 surveys for the Garrison Diversion project in North Dakota. The U.S. Fish and Wildlife Service funded surveys in Minnesota in 1993, 1994, and 1995, and North and South Dakota in 1995 with follow-up surveys completed for the Minnesota Department of Natural Resources (1997), South Dakota Department of Game, Fish, and Parks (1996, 1997, 1998), and North Dakota Department of Parks and Recreation (1996, 1997, 1998) (Schlicht and Saunders 1994, Schlicht 1997, Royer 1997, Skadsen 1997, 1999, Royer and Royer 1998). Additional work has been completed on characterizing habitat at important Dakota skipper sites in Minnesota (Dana 1997) and North Dakota (Royer 1997, Lenz 1999). Currently, Britten (2001) is comparing genetics among at least nine Dakota skipper populations in Minnesota, South Dakota, and Manitoba. Royer (*in litt.* 2000) is assessing abiotic habitat parameters (soil temperature, moisture, site aspect, slope, etc.) related to management and conservation of Dakota skippers to complement prior floristic characterization of these habitats. The Minnesota Department of Natural Resources and U.S. Fish and Wildlife Service are also planning to cooperatively study the effects of grazing on Dakota skipper. Finally, surveys to assess the status of Dakota skipper populations were conducted in 2001 in several areas throughout the range of Dakota skipper, including in and around Glacial Lakes State Park in Minnesota by Dennis Skadsen and at Sheyenne Grasslands by Steve Spomer.

U.S. Fish and Wildlife Service's endangered species program has also funded some management activities intended to benefit Dakota skipper. This includes planning for Dakota skipper population and habitat management at Big Stone National Wildlife Refuge, Minnesota (Olson 2000), landowner contacts and education on conservation practices in South Dakota (Skadsen 1999b), and prairie vegetation restoration at Chippewa Prairie in 2000 and at Twin Valley Prairie Scientific and Natural Area, Minnesota in 2001.

[1] Part Two of this report, Conservation Recommendations, summarizes guidance on practices beneficial to Dakota skippers.

U.S. Fish and Wildlife Service purchases easements to prevent prairie conversion for agriculture and provides cost-share to support rotational grazing and other practices that may benefit Dakota skippers. If easements are near Dakota skipper habitat they may provide dispersal corridors or buffer skipper sites from external threats (e.g., pesticide drift). Thus far, prairie easements generally prevent grasslands from being plowed or destroyed and haying before July 15, but may not restrict grazing, pesticide use, or other practices that can degrade the status of Dakota skipper populations. Cost-share partnerships on easement areas, however, may further enable landowners to manage grasslands to benefit Dakota skippers and other prairie endemic species. The Service may implement such actions through the Partners for Fish and Wildlife program. Since 1990, the Fish and Wildlife Service has purchased easements to prevent grassland conversion on several hundred thousand acres in Minnesota, North Dakota, and South Dakota. Only some of these acres include Dakota skippers. Grassland easements have encompassed four Dakota skipper sites in the Scarlet Fawn Prairie-Knapp's Pasture complex in South Dakota, two sites in the Towner-Karlsruhe complex in North Dakota, and one site in the Sheyenne Grasslands area of North Dakota (C. Mowry, pers. comm.2001, K. Kreil, *in litt.*, 2001). The Fish and Wildlife Service has purchased grassland easements that protect only wetland acreage on six other South Dakota properties inhabited by Dakota skippers (two in the Scarlet Fawn Prairie-Knapp's Pasture complex). Easements also covered grasslands adjacent to two more Dakota skipper sites in the Towner-Karlsruhe complex, North Dakota.

The Nature Conservancy's Minnesota and Dakotas offices initiated a Prairie Coteau Coordinated Conservation Planning Effort and Plan in 1998 (Miller 1999, Skadsen 1999b). Their strategy is to facilitate conservation actions by various landowners, including private, county, state, tribal and federal, on high biodiversity prairie sites. Additional partners include conservation organizations, local conservation districts, and universities. A field representative was hired in 1999 to coordinate this work. Recently, The Nature Conservancy also acquired a new reserve in the Sheyenne Grassland area, Brown Ranch, which harbors Dakota skippers.

Many of the best Dakota skipper sites in South Dakota are on tribal lands managed by the Sisseton-Wahpeton Sioux Tribe (e.g., Scarlet Fawn and Oak Island Prairies) (Skadsen 1997). The Day County Conservation District, South Dakota, has placed a high priority on implementing prescribed grazing on rangelands known to support Dakota skippers and bordering sites in the Upper Waubay Basin Watershed (Skadsen 1999b). Their efforts include soliciting grants and providing education on grazing management, controlled burning, and integrated pest management to control leafy spurge, through workshops and a demonstration site.

D. Summary of Status and Threats

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

Within the historical range of Dakota skipper (Fig.1) the extent of native prairie habitat has declined sharply since approximately 1830 (Royer and Marrone 1992, Table 1). Smith (1992) states that in 1900 most of the prairie in Iowa had been converted to cropland and that the prairie ecosystem in Iowa "was close to extinction." "Two hundred and forty million acres of tallgrass prairie were converted to agricultural land in about seventy years" in Iowa, beginning about 1850 (Smith 1992). Similar settlement and destruction of Illinois prairie began about twenty years earlier (Smith 1992). Samson and Knopf (1994) reported that >99% of the original tallgrass prairie in Iowa, Minnesota, and North Dakota is destroyed (from 21 million total has down to 43,000 ha), while 85% of South Dakota's original 3 million ha of tallgrass prairie is gone (Table 1). Mixed grass prairies in North Dakota have declined by approximately 72% (data are not available for South Dakota mixed grass area) (Table 1, Samson and Knopf 1994). These figures do not, of course, account for the amount of remaining tallgrass and mixed grass prairie that is degraded (e.g., by overgrazing, invasion by smooth brome, plant succession, etc.) to the point that it is no longer suitable for Dakota skippers.

Each threat is discussed briefly in this section while information on best management practices for Dakota skippers is in Part Two.

Conversion of Dakota Skipper Habitat to Non-Grassland

Loss of Dakota Skipper Habitat to Conversion for Agriculture

Many extant Dakota skipper populations have survived in fragments of prairie relatively unsuitable for row crop agriculture (McCabe 1981) due to steep terrain (e.g., in the Prairie Coteau of South Dakota) or poor soils. Nevertheless, observers have recorded the extinction of several populations of Dakota skipper as a result of conversion of their habitat for agricultural use since approximately 1980. Royer and Marrone (1992) documented loss of four sites in North Dakota that were converted to irrigated potato fields and one in South Dakota that was also converted for crop production. In North Dakota, further conversion is a threat in the important Towner-Karlsruhe complex (Royer and Royer 1998, Lenz 1999) where the flat topography and high water table facilitate conversion to irrigated crop production (Gary Erickson, J. Clark Salyer National Wildlife Refuge, North Dakota, pers. comm. 2001; R. Royer, pers. comm. 2001). Twelve of 32 extant sites are thought to be threatened by conversion (R. Royer, pers. comm. 1998, Table C.2.).

Loss of Dakota Skipper Habitat to Conversion for Mining and Other Causes

Conversion of prairie for non-agricultural land uses, including gravel mining and housing (New 1981), also has caused recent extirpation of Dakota skipper populations and threatens others. Mining of prairie remnants for construction materials threaten habitat of Dakota skipper at some Minnesota sites (Dana 1997). The progressive loss of habitat to gravel mining is a significant threat at Felton Prairie sites (Braker 1985, R. Dana, pers. comm. 2001, B. Winter, pers. comm. 2001). Skadsen (pers. comm. 2001) also reported that one site in South Dakota near the Scarlet Fawn-Knapp's Pasture Complex would be at least partly destroyed by a planned 4-lane highway and that the project's need for gravel may exacerbate the threat of gravel mining in the project's vicinity.

Increasing water levels in South Dakota may also threaten some Dakota skipper habitat. Skadsen (1997) reported loss of one site to flooding due to rising water levels at Bitter Lake, South Dakota (Table C.3).

Degradation of Dakota Skipper Habitat

Habitats of numerous Dakota skipper populations that are not faced with outright destruction are threatened by habitat degradation. Swengel and Swengel (1999) reported a significant negative relationship between habitat degradation and Dakota skipper abundance during systematic surveys at 12 Minnesota prairies. They found that Dakota skipper numbers were significantly lower at degraded sites than at sites that were not degraded. Changes in vegetation (e.g., species composition and structure), hydrology, or soil structure adversely affect one or more life stages of Dakota skipper at degraded sites.

Degraded sites support proportionally fewer native plant species, particularly nectar plants (R. Dana, pers. comm.2001). Dana (1991) concluded that "(R)egular access by adults to nectar is clearly important" for Dakota skippers. Nectar provides critical water, but also provides carbohydrates to supplement larval fat reserves to meet the energetic demands of flight (Dana 1991). Moreover, fecundity would likely decline in Dakota skippers with inadequate access to nectar, as has been observed in other butterfly species (Dana 1991). Dakota skippers appear to prefer plant species whose nectar resources are unavailable to nectarivores that lack "a slender trophic apparatus about 5 mm in length or longer" (Dana 1991). Such plant species likely contain a more dependable "standing crop" of nectar for Dakota skippers (Dana 1991). Dakota skippers appear to be somewhat generalistic, however, when apparently preferred species are absent (Dana 1991). The absence or paucity of preferred nectar species, however, may reduce adult survival, female fecundity, or both.

Royer (*in litt.* 2000) suggests that habitat degradation may affect larval survival more than adult survival or reproduction. Soil compaction and vegetation removal, whether by extensive grazing, mowing, or fire, may substantially alter soil water movement, evaporation, and near-surface humidity, which in turn affect larval survival. To test these hypotheses, Royer (*in litt.* 2000) is currently implementing a study to "identify and analyze edaphic microhabitat features within

occupied sites across the species' remaining U.S. range and in both occupied hay meadows and adjacent grazed units in North Dakota." Prairie habitat may also be degraded by invasion of exotic plants, by methods used to control plant and invertebrate pests, by improperly managed grazing, haying, or burning, or by suppression of natural disturbance regimes that lead to accumulation of plant litter and succession. All these threats are greatly exacerbated by habitat fragmentation (see below) because it reduces or eliminates the likelihood that immigrants from other populations will refound extinct populations.

Invasion by exotic or alien species. Invasion of native prairie habitats by species such as leafy spurge, Kentucky bluegrass, or smooth brome threatens Dakota skippers. Once these plants invade a site they often become dominant and replace native forbs and grasses used by Dakota skipper adults and larvae, respectively. Dana (1991) suggested that Dakota skipper larvae probably would not be able to survive on grasslands dominated by smooth brome because of its large, widely spaced stems and its mid- to late-summer senescence. These traits may preclude efficient larval travel between ground-level shelters and food (large and widely spaced stems), reduce the effectiveness of larval shelters (widely spaced stems), and limit larval food sources (mid- to late summer senescence). Kentucky bluegrass is also senescent or dormant during the mid-summer when Dakota skipper larvae need palatable grass tissue for feeding (Dana 1991).

Pest Control. Broadcast spraying of insecticides to control grasshoppers kills butterflies and is greatly harmful to small Dakota skipper populations (Royer and Marrone 1992). New approaches to integrated pest management are attempting to reduce chemical use and more carefully target grasshopper problems. Grasshopper outbreaks could also adversely affect small and isolated butterfly populations through their short-term destruction of prairie vegetation (John Payne, Animal and Plant Health Inspection Service, Hyattsville, Maryland, *in* litt.1994).

Broadcast chemical control of exotic plants such as aerial spraying of leafy spurge also eliminates native forbs that are skipper nectar sources (Royer and Marrone 1992). In repeated surveys, Royer and Marrone (1992:33) observed what "appears to be a correlation between disappearance of *Hesperia dacotae* and the advent of chemical spurge control methods in Ward, Barnes and Ransom Counties of North Dakota" including the Sheyenne National Grasslands area in the last ten to twenty years. Dana (1997) 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.

Grazing. Dakota skipper habitats were historically grazed by bison (*Bos bison*), formerly an important component of prairie ecosystems (Bragg 1995, Schlicht and Orwig 1998). Cattle (*Bos taurus*) grazing differs substantially from bison grazing patterns (Matlack et al. 2001). Both species may adversely affect Dakota skippers by removing forage for larvae (i.e., palatable grass tissue) and adults (i.e., nectar-bearing plant parts), by trampling larvae, and, hypothetically, by altering larval microhabitats (Royer *in litt.* 2000, see above). Dana (1997) reported that in Minnesota, grazing by cattle reduces skipper numbers in direct proportion to grazing intensity. This is likely also true for bison. As for fire (see below), however, Dakota skipper populations may survive even intensive grazing episodes if a sufficient portion of the habitat patch remains

suitable (e.g., left ungrazed or lightly grazed) for reproduction or if nearby populations are not simultaneously extirpated and provide immigrants to refound the affected population. In addition, Dakota skippers are able to coexist with cattle grazing in tallgrass prairie, depending on the qualities of the grazing management (duration, intensity, etc., see below).

Effects of Grazing on Dakota skippers in Mixed Grass Prairie

In mixed grass prairies of North Dakota (Fig. 3), Dakota skippers can apparently tolerate little to no grazing (McCabe and Post 1977, Royer and Marrone 1992, Royer and Royer 1998). McCabe (1981) observed that grazing eliminated Dakota skippers on alkaline prairies in North Dakota; nectar plants such as tooth-leaved primrose (*Oenothera serrulata*) and harebell rapidly diminished with light grazing whereas heavy grazing eliminated long-headed coneflower (*Ratibida columnifera*) and purple coneflower. Long term grazing of sufficient intensity, duration, or both often leads to the replacement of native plants with exotic, cool-season species, such as bluegrass and smooth brome, and greatly reduces floral diversity, which is not restored when grazing pressure declines absent intensive human intervention (Dana 1997, Jackson 1999). Cattle also likely physically destroy larvae (McCabe 1981) in proportion to their density and duration of grazing. Royer (*in litt.* 2000) suggests that adverse grazing impacts to Dakota skipper in mixed grass prairie may stem more from altered soil and moisture characteristics caused by cattle trampling than from direct mortality or changes to vegetation.

Effects of Grazing in Tallgrass Prairie

Overgrazing is a significant threat to Dakota skippers in tallgrass prairie, although the species may persist in grazed tallgrass prairie when grazing management (intensity, duration, etc.) allows for the persistence of important habitat components. Livestock grazing is the dominant use of privately owned tallgrass prairie remnants in South Dakota, except for property owned by private conservation groups (Higgins 1999). According to Dakota skipper experts, grazing threatens Dakota skipper populations on most of the privately owned sites on which the species occurs (Tables C.1. - C.3.). Grazing is likely to adversely affect Dakota skippers when it significantly reduces the density and diversity of important nectar and larval host plant species or eliminates them entirely. In Minnesota, Dana (1997) observed that in overgrazed native prairie exotic grasses are “major to dominant”, native forb species richness and diversity decline, and “foliage height is often less than 10 cm.” In South Dakota, Higgins (1999) found that vegetation height and litter depth were lower on privately owned prairie remnants. Land managers also frequently use herbicides to control weeds and brush on grazed remnant prairies, which evidently further reduces native forb diversity (Dana 1997). At Felton Prairie in Minnesota, Braker (1985) and Schlicht (1997) each found significantly higher numbers of Dakota skippers in ungrazed than in grazed tallgrass prairie.

In tallgrass prairie Dakota skipper populations can be eliminated by overgrazing within one year, but grazing does not necessarily lead to their decline at a site (Dana 1983, Dana 1991). Dakota skipper densities have remained high at some grazed sites (Tim Orwig, personal observation in Schlicht 1997). In tallgrass prairie, Dakota skippers may benefit from light grazing that maintains

areas of mixed grass vegetation structure (Dana 1991). Schlicht (1997) found that Dakota skipper was abundant on prairies subjected to light grazing regimes, but absent on nearby idle prairies that were no longer used for grazing. In addition, Dakota skippers were more abundant on grazed than burned prairies within Glacial Lakes State Park, Minnesota (Schlicht 1997). Similarly, in eastern South Dakota, Dakota skipper populations were secure at sites managed with light rotational grazing, which retained vegetative diversity (Skadsen 1997).

Haying. Similar to grazing, haying may adversely affect or benefit Dakota skipper populations, depending on how it is implemented. Mowing grasslands and removing the cuttings (haying) maintains prairie vegetation structure as grazing and burning did historically. Mowing prairies before or during the Dakota skipper's flight period, however, deprives adults of nectar sources, favors growth of Kentucky bluegrass, and may kill or cause adult Dakota skippers to emigrate (Royer and Marrone 1992, McCabe 1979, 1981, Dana 1983, Dana 1997). Lenz (1999) observed that annual haying appears to diminish the vigor of native, warm season grasses and may reduce forb density in north-central North Dakota habitats. In the Dakotas late season (mid-August to October) haying appears to minimize adverse affects; most remnant Dakota skipper populations in the eastern Dakotas are found on fall-hayed prairies (McCabe 1979, 1981, Skadsen 1997). McCabe (1981) suggested that late season haying is highly beneficial to maintaining Dakota skipper populations. Moreover, Swengel and Swengel (1999) observed significantly greater Dakota skipper abundance during systematic surveys on hayed tracts compared with either idle or burned tracts in Minnesota.

Controlled Burning. Historically, fire was an important element in sustaining native grasslands (Bragg 1995). Today, managers often use prescribed or controlled fires to retain native grassland structure and species and to achieve other objectives (e.g., limit invasion of smooth brome). Controlled fire, however, frequently differs from historical wildfire in its relative patchiness, frequency, intensity, and seasonality. For example, controlled fires are often set during dormant periods for native grass species (spring and fall) whereas wildfires mostly occurred during the summer (Bragg 1995). Moreover, remnant prairies are often burned more frequently and thoroughly than occurred historically (Schlicht and Orwig 1999). The latter is partly a function of the relatively small patches in which native prairie now occurs. For example, before widespread prairie destruction began in about 1830, native grasslands inhabited by Dakota skipper were relatively continuous from Illinois to Manitoba.

When prairie remnants are burned in large units or even from border to border, all skippers may be eliminated at once. Historically Dakota skipper populations probably persisted because burns were patchy, allowing for recolonization from adjacent unburned areas (Swengel 1998a). Without careful design, prescribed burning on isolated remnant prairies can cause local skipper extirpation (McCabe 1981, Dana 1991, Swengel 1998a, Orwig and Schlicht 1999).

Fire on prairie remnants may decrease the abundance or even contribute to the extirpation of Dakota skipper. In systematic surveys of Minnesota prairies, Swengels (Swengel and Swengel 1999; Swengel 1998a) observed significantly lower Dakota skipper abundance on sites that had been burned, compared with hayed sites. Similarly, Schlicht (1997) observed lower abundance

on burned than on grazed sites in the Minnesota Valley area. Orwig and Schlicht (1999) suspected that excessive burning eliminated Dakota skippers from the last remnant location in Iowa, Cayler Prairie, despite 20 years of legal protection on this 64-ha (160 acre) preserve. Similarly, Schlicht (2001) attributes a marked decline in Dakota skipper observations at Prairie Coteau Preserve in Minnesota to repeated fires.

Rotational burning has been hypothesized to benefit Dakota skippers by increasing nectar plant density and by positively affecting soil temperature and near-surface humidity levels due to reductions in litter (e.g., Dana 1991). Swengel (1996), however, documented a strong negative population response in Dakota skippers and other grassland butterfly species at least five years after burns. Dakota skipper abundance was significantly lower for 2-4 years after fires on Minnesota preserves. At Prairie Coteau Preserve in Minnesota, however, Schlicht (2001) found greater flower abundance on regularly burned than rarely burned sites although Dakota skipper abundance had declined most on the burned sites. In summary, the long term, population level effects of rotational, controlled fire on Dakota skippers remains a subject of scientific debate (e.g., Ann Swengel, Baraboo, WI, *in litt.*, 1993, 1994, R. Dana, *in litt.*, 1994). It is clear, however, that under at least some conditions and when too frequent or extensive relative to the area of suitable habitat, fire is a threat to Dakota skipper populations.

Lack of Management/Disturbance. Although inappropriate or excessive grazing, haying, and burning threaten Dakota skipper populations, their persistence depends on some type of disturbance implemented at appropriate frequencies and intensities. Prairies that lack periodic disturbance undergo succession to woody shrubs, accumulate litter, have reduced densities of nectar plant flowers, and may face increased risk of exotic species (e.g., smooth brome) invasion (McCabe 1981, Dana 1983, 1997). Braker (1985) found reduced Dakota skipper numbers at Felton Prairie, Minnesota in tracts that had not been hayed or burned for several years. In systematic surveys of Minnesota prairies, Swengel and Swengel (1999) observed significantly lower Dakota skipper abundance on unmanaged or idle sites, compared with abundance on hayed sites, but found higher abundance on idle than on burned sites. Skadsen (1997) reported deterioration of several unburned and unmowed South Dakota prairies in just a few years due to encroachment of woody plants and exotic grasses.

On some sites game managers intentionally facilitate succession of native prairie communities to woody vegetation or plant trees. This effectively converts prairie habitats to shrubland, forest, or semi-forested habitat types and facilitates invasion or expansion of adjacent grasslands by exotic, cool-season grasses. Moreover, the trees and shrubs provide perches for birds that may prey on Dakota skippers (for example, Hole-in-the-Mountain County Park, Minnesota [Dana 1997]).

Prairie Plant Harvesting. A potential threat to Dakota skipper populations is collection of purple coneflower for the commercial herbal remedy market (Skadsen 1997). Purple coneflowers are an important nectar source for Dakota skippers in much of their range. Biologists surveying skipper habitats have not reported signs of *Echinacea* collecting, but illegal or unregulated harvest could become a problem in Dakota skipper habitats due to economic demands (Skadsen 1997).

Habitat Fragmentation. What may have been a single population of Dakota skippers spread across formerly extensive tallgrass and mixed grass prairie (McCabe 1981, Fig. 1) is now fragmented into (at least) approximately 62 isolated populations (Appendix C). Britten and Glasford (2002) studied seven populations in the southern portion of the species' range and found that the small genetic differences among them suggest that these populations, now isolated from one another to varying degrees (Fig. 2), were formerly connected. Each Dakota skipper population is now subject to "genetic drift that will erode its genetic variability over time" (Britten and Glasford 2002). Britten and Glasford (2002) also found heterozygote deficiencies relative to Hardy-Weinberg expectations and high inbreeding coefficients. Reduced genetic diversity could lower the capacity of local populations to adapt to environmental changes.

Dakota skippers are not likely to disperse over long distances. Interviews with five experts (see above and Appendix B) suggests that movements from one prairie patch to another may be typically limited to approximately 1 km. Isolated populations that are eliminated by fire, overgrazing, exotic plant invasion, untimely haying, or other causes will not be refounded by immigrants (McCabe 1981, Swengel 1998a). Extirpation of small, isolated populations may take many years, but may be inevitable where immigration from nearby populations is not possible (Hanski et al. 1996). In systematic surveys on Minnesota prairies, Swengel and Swengel (1997, 1999) found no Dakota skippers on the smallest remnants (<20 ha), and significantly lower abundance on intermediate size (30-130 ha) than on larger tracts (>140 ha). These differences were not caused by vegetative characteristics, because site size did not correlate significantly with vegetation type, quality, or topographic diversity.

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

Although its population biology could make the Dakota skipper sensitive to collection losses at some locations, the present level of scientific collection is incidental and does not threaten the existence of the species (Royer and Marrone 1992). The species is not collected for commercial purposes.

3. Disease or predation.

No known diseases or parasites are specific to the Dakota skipper (Royer and Marrone 1992) and no threats to Dakota skipper populations due to disease have been reported. Predation by birds or insects is not considered a major feature of Dakota skipper population dynamics and does not threaten the species (Royer and Marrone 1992).

4. Inadequacy of existing regulatory mechanisms.

In South Dakota, no state law provides a mechanism for protecting invertebrates as threatened or endangered species (D. Backlund, pers. comm.2001)). North Dakota Game and Fish Department has the authority under North Dakota Century Code 20.1-02-05(16) to preserve and manage threatened and endangered wildlife, including invertebrates, but has not yet exercised that authority. In Minnesota, Dakota skippers are designated as a threatened species under the State's

threatened and endangered species statute. This law prohibits taking Dakota skippers unless the Minnesota DNR permits such taking for purposes such as conservation or scientific study. The Minnesota statute does not, however, prohibit the destruction of Dakota skipper habitat. As stated above, the Province of Manitoba has designated Dakota skipper as an endangered species. Therefore, it is "unlawful to kill, injure, possess, disturb or interfere with the species; disturb, destroy or interfere with the habitat of the species; or damage, destroy, obstruct or remove a natural resource on which the species depends for its life and propagation" without a permit in Manitoba. Dakota skipper is currently a candidate for listing as a Canadian Species at Risk, but such a listing would confer no legal protection by the Canadian federal government.

The U.S. Fish and Wildlife Service and U.S. Forest Service have full authority to manage Dakota skipper habitat on those agencies' lands (e.g., refuges and grasslands). Mechanisms and funding also exist for cooperation with states, tribes, local governments, and private landowners for conservation agreements and easements to protect habitat and foster management actions that promote butterflies.

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

Interspecific competition does not appear to limit Dakota skipper distribution or population size because co-occurring species use different plant species as nectar sources (McCabe 1979, 1981). Further, hybridization involving Dakota skippers has not been reported (Royer and Marrone 1992).

Global climate change—with projections of increased variability in weather patterns and greater frequency of severe weather events, as well as warmer average temperatures—would affect remnant prairie habitats and would likely be detrimental for Dakota skippers (Royer and Marrone 1992). The effects of gradual shifts in plant communities and catastrophic events, such as severe storms, flooding, and fire, are exacerbated by habitat fragmentation. Populations that are isolated demographically and genetically beyond dispersal distance from other sites cannot recover from local catastrophes.

Even with proper prairie management, small populations are vulnerable to weather conditions and an accidental event when restricted to isolated sites (Schlicht and Saunders 1994). It is highly likely that Dakota skipper numbers will continue to decline in coming decades due to the extirpation of isolated local populations where recolonization is no longer possible, even without further habitat destruction (Schweitzer 1989). Long term (e.g., ≥50 year) persistence is only possible where metapopulations composed of interacting demes are large enough to persist when at least some local populations persist.

6. Summary of Status and Threats

In 1995, the U.S. Fish and Wildlife Service (1995) concluded that the Dakota skipper faced loss and degradation of its prairie habitat due to harmful burning, haying, grazing, and pesticide use. Invasion of prairie by alien plants, plant succession, and habitat loss through physical conversion of prairie were also negative factors. The Dakota skipper and its habitat were in long term decline, but the demise of the species was deemed not imminent. Expert advice to the U.S. Fish and Wildlife Service suggested that additional survey work was needed in Minnesota (R. Dana, *in litt.* 1994) and South Dakota (Skadsen 1999b) and that generally more surveys and trend analysis were needed (A. Swengel, *in litt.* 1994). Numerous additional surveys have been conducted throughout the range of Dakota skipper since that time and those surveys' positive findings are reported in this document. Based on comments from Dakota skipper experts throughout the species' range, eastern South Dakota may be the only area in which significant areas of potential habitat remain unsurveyed (see below). Royer (*in litt.* 1994) contended that declines in North Dakota habitat, however, were clearly threatening the species in that state. The U.S. Fish and Wildlife Service determined that listing Dakota skippers under the Endangered Species Act was not warranted in 1995 and stated its intent to bring sufficient management and protection to the species to enable its removal from the candidate species list.[2]

Since the early 1990s, Dakota skipper populations have been lost from seven North and South Dakota sites documented in Royer and Marrone (1992) (Royer 1997, Skadsen 1997) and threats at many remnant sites are unabated. Due to substantial survey effort, however, numerous previously-unrecorded locations have been documented since 1991, including 30 site records in South Dakota (Skadsen 1997, 1999), 15 in Minnesota (Schlicht and Saunders 1994, Schlicht 1997a,b, Minnesota Natural Heritage Program database), and 9 in North Dakota (Royer and Royer 1998). Many of these sites are within complexes, however, and may only comprise local populations within metapopulations. Further surveys are still needed in South Dakota, because viable populations may exist south and west of the species' current documented range (Skadsen 1998, 1999).

Also since 1995, at least four Dakota skipper sites have been protected, at least from some threats, via acquisition or conservation easement. The Nature Conservancy has purchased one site in the Sheyenne Grasslands region of North Dakota (Brown Ranch preserve) and the U.S. Fish and Wildlife Service has purchased easements preventing grassland conversion at three sites in North Dakota. Most easements are located in these important metapopulations: Glacial Lakes area, Minnesota, Towner-Karlsruhe complex in North Dakota (4) and Scarlet Fawn Prairie-Knapp's Pasture complex in South Dakota (6). Fish and Wildlife Service easements do not provide legally binding protection from overgrazing, but do preclude conversion and haying before July 15.

[2] Dakota skippers were removed from the candidate species list in 1996 when the list of category 2 candidates was eliminated (Federal Register 61:64481-64485).

More than a decade ago Schweitzer (1989) concluded "This species is extirpated from a significant portion of its range… Its continued survival…is now threatened by fragmentation of its habitat. …Several decades into the future…the best that can be hoped for is the survival of a few metapopulations on some of the larger prairie preserves and gradual disappearance of the small remnant colonies." Royer and Marrone (1992) similarly concluded that because of ongoing trends the Dakota skipper was very likely heading to eventual extinction throughout its range unless extensive reserves were managed for this species.

Dakota skippers are adversely affected by a variety of activities that threaten to endanger the species throughout a significant portion of its range. The vast reduction and fragmentation of the formerly extensive prairie grasslands exacerbates these threats. Dakota skippers are likely to persist only in native tall- and mixed grass prairie remnants where (1) they have survived since the onset of rapid prairie destruction following Euro-American settlement on-site or where extant populations are near enough to facilitate immigration (approximately 0.5 km); (2) management facilitates the persistence of a plant community dominated by a species rich assemblage of native grasses and forbs; (3) grazing, if conducted, is managed to allow for abundant larval and adult food sources present during the larval and adult flight periods, respectively, at least in a sufficient portion of the site; (4) haying, if conducted, is done only while adults and larvae are absent or in diapause, respectively, at least in sufficient portions of the site; (5) tallgrass prairie is managed by fire, grazing, or mowing that prevents invasion of exotic, cool-season grasses and woody plants; (6) managers ensure that the frequency, timing, and relative coverage (e.g., patchiness) of prescribed fires allow for sustained recolonization of burned areas by Dakota skippers from unburned patches within isolated populations or metapopulations; (7) conversion due to gravel mining, agriculture, or other activities is not a significant threat; and, (8) genetically effective population sizes are sufficient to avoid deleterious effects of genetic drift on population growth (i.e., extinction).

Part Two: Conservation Recommendations[1]

This part of the candidate assessment is intended to help guide the conservation of Dakota skipper populations. It first summarizes current management of Dakota skipper sites and concludes with detailed management recommendations to conserve Dakota skippers.

Background

Because Dakota skipper distribution is now highly fragmented and because prairie is a disturbance-dependent ecosystem, favorable management is necessary to ensure the persistence of Dakota skipper populations (see above). On both public and private sites, management activities frequently adversely affect Dakota skippers due either to conflicting management objectives or lack of knowledge about conserving Dakota skippers. Skadsen (1999b), emphasized that improved prairie management on state and U.S. Fish and Wildlife Service lands and cooperation between these two agencies, improved communication between agencies and private landowners, and easement and cost-share incentive programs were necessary to conserve prairie through favorable management on private lands.

On public lands, prairie management is often not fully suited to butterfly conservation and economic interests threaten some sites. Schlicht and Saunders (1994) recommend a shift in management priorities on remnant prairie preserves from plants to rare animals. This includes managing at smaller scales so that no one action or disturbance affects an entire local invertebrate population. They suggest randomizing management patterns and juxtapositioning idle, burned, and mowed tracts and maximizing edges from which butterflies can recolonize disturbed tracts. Swengel (1998b) emphasized "sparing and localized" use of the more intensive management approaches such as fire and herbicides to correct specific, well-defined problems. The results of management treatments should be carefully monitored to see if specific goals are being achieved, including conservation of butterfly populations.

Management may need to be diversified among sites or habitat blocks to effectively maintain ecosystems and specialist species with differing management needs (Swengel and Swengel 1997, Swengel 1999). Management within isolated sites, however, should be consistent over time because isolated populations are not resilient or able to recover from variable, adverse events (Swengel and Swengel 1997, Swengel 1998a). Some publicly owned skipper sites in Minnesota are threatened by gravel mining (Dana 1997, Schlicht 1997b) and substantial economic incentives will be needed to overcome this threat (B. Winter, pers. comm.2001).

On private lands, economic pressures can readily cause shifts in land management. Royer and Royer (1998) called for a cooperative, long-range management plan to sustain Dakota skipper populations under various ownerships (mostly private) within the Towner-Karlsruhe Complex in McHenry County, North Dakota. They recommended that this plan emphasize 1) highway right-

[1] References cited in Part II are included in Part I, Section IV, References.

of-way management to facilitate dispersal of butterflies among prairie tracts, 2) promotion of fall haying instead of grazing on state and U.S. Fish and Wildlife Service lands, and 3) cooperative agreements for favorable haying and rotational grazing on private lands. Given appropriate management, the Towner-Karlsruhe Complex could provide a refuge of >1,000 ha (Royer and Royer 1998). Similarly, Schlicht and Saunders (1994) recommended numerous site-specific management needs at 53 Minnesota prairies and Schlicht (1997b) recommended site purchases and easements needed to control grazing rates at private tracts around Glacial Lakes State Park and in the Chanarambie Creek area of Minnesota.

Some private land managers implement practices that appear to facilitate persistence of Dakota skipper, such as well managed grazing and fall haying. The management of private tracts by the Sisseton-Wahpeton Sioux Tribe in South Dakota, for example, may be an exception to the general vulnerability of Dakota skippers on lands not specifically devoted to conservation. The Tribe has favorable rules and customs for preventing conversion of prairie remnants, many of which are occupied by Dakota skippers. The Tribe manages most of these remnants with annual fall haying (i.e., mid-August to late September, D. Skadsen, pers. comm. 2002). Early-season mowing, however, is not prohibited by tribal rules. In addition, the Tribe has begun leasing some remnants for grazing. In at least one recent case, leasees allowed a prairie remnant to be overgrazed, leading to the apparent extirpation of Dakota skipper (Chekapa Creek Ridge site, Table C.3.). Nevertheless, Tribal and other private, state, and federal lands within the Scarlet Fawn Prairie-Block's Pasture Complex (19 extant sites, Table C.3.) form a secure metapopulation of Dakota skippers (Skadsen 1997, 1999b).

Specific prairie management recommendations for prescribed burning, mowing, grazing, and brush and exotic species control follow in Section 3, Prairie Management.

A. Site Protection

Opler (1981) recommended that prairie preserves should be at least 400 ha (1,000 acres) in extent to conserve insect populations. He based this on observations reported from Iowa and Minnesota where invertebrate prairie obligates were often missing from tracts under 40 ha (100 acres) and in tenuous status on tracts between 40 and 400 ha. As previously described, Swengel and Swengel (1997, 1999) found the highest Dakota skipper densities on sites >140 ha (346 acres) in Minnesota. Smaller reserves connected by migration corridors of suitable habitat, such as highway and railroad right-of-ways if maintained in native vegetation, may suffice where large reserves are not possible (Opler 1981, Moffat and McPhillips 1993). These collections of small sites presumably allow butterflies to disperse between sites or local populations to recolonize disturbed areas—thus replicating historical population dynamics and movements among local populations. Although not specific to Dakota skippers, Reis et al. (2001) found strong preliminary evidence that managing roadsides for native vegetation benefits butterfly communities. Metapopulations are likely the only opportunity for long term Dakota skipper conservation throughout its range given the current fragmentation of its habitat (Thomas and Jones 1993). For example, Royer and Marrone (1992) recommended protection at five North Dakota and four South Dakota sites to secure key regional metapopulations in those states.

Easements and cost-share arrangements, rather than outright land purchase may accomplish this protection.

B. Prairie Management

Moffat and McPhillips (1993) and Swengel (1998b) provide good general overviews on managing prairie habitats to benefit butterflies. The following sections of this report use their guidance plus additional references more specific to Dakota skippers. Management prescriptions must be tailored to the specific ecological region (Madden et al. 2000) and the desired ecological outcomes or goals for each site (e.g., plant and animal species composition, exotic plant invasion threat, etc.) (Swengel 1998b, Willson and Stubbendieck 2000).

Dakota skipper populations are largely isolated from one another. As a result, populations are likely to experience genetic drift that will erode their genetic variability over time (Britten and Glasford 2002). Therefore, management should strive to maximize genetically effective population sizes -- the number of individuals reproducing each year -- to reduce or avoid the deleterious effects of genetic drift. This may be achieved, in part, by minimizing habitat disturbances throughout the breeding (i.e., flight) period and by connecting isolated populations. Such connections may be feasible at some sites, such as between the Hole-in-the-Mountain sites and Prairie Coteau SNA in Minnesota, which are geographically close (Britten and Glasford 2002).

Britten and Glasford (2002) also recommend devising plans for managing groups of semi-isolated populations, or metapopulations. They suggest first conducting field studies similar to that of Dana's (1991), where necessary to delineate local populations, then devising management plans to maximize the size of each population while maintaining connections among them. Finally, the plans should describe how management would occur to avoid disrupting mating during the peak flight period and to consider impacts to larvae.

Prescribed Burning. Periodic fires prevent succession of prairie plant communities from grassland to woody or shrubland types, which would render the site unsuitable for Dakota skippers. Fire can also increase plant nutritional qualities and flowering rates (Dana 1991, Bragg 1995) and decrease fuel loads. Fires and bison grazing were essential to maintaining prairie grasslands (Bragg 1995). To persist, species endemic to prairies must be able to either survive fires in place or to recolonize burned areas. Although fires kill Dakota skipper larvae (Dana 1981) and kill or displace adult butterflies, adults in contiguous or nearby populations —where they exist—may recolonize burned areas. When Dakota skipper populations are isolated, however, potential immigrants are not available to restore local populations eliminated by fire or other intense disturbances (e.g., overgrazing) (McCabe 1981, Royer and Marrone 1992, Swengel 1998a, Orwig and Schlicht 1999).

Timing and frequency of prescribed fire treatments and the proportion of the site burned in any year or series of years, are critical considerations for conserving remnant butterfly populations on isolated prairie fragments. When managers prescribe burns in isolated prairie remnants, the

timing, frequency, and proportion of the site burned are all critical to remnant butterfly populations. Moffat and McPhillips (1993) recommended using and timing fires only to meet specific management objectives (e.g., control exotic grasses), but to otherwise minimize prescribed burning. Swengel's (1998b) observations suggest, however, that burned prairies, even those burned rotationally, typically support fewer butterfly species than prairies managed without fire. Although long term population effects of prescribed fire remain subject to debate and research, a precautionary assumption is that all individual Dakota skippers within the area actually burned will be killed and that local populations may be depressed.

More specific to Dakota skippers, McCabe (1981) recommended that fires be directed away from the previous season's main oviposition sites, but this assumes substantial knowledge about site use by skippers. In controlled trials, Dana (1991) found evidence that early spring burns caused less mortality to Dakota skipper larvae than late spring burns. He also found that fires with relatively light fuel loads caused less mortality. He recommended early spring burning, especially when fuel loads are high. Depending on their exact timing and annual phenological variations, late spring through mid-July burns kill late instar larvae, which are either in the litter or on exposed plant parts, force adults to emigrate, or destroy Dakota skipper eggs (Dana 1983). Fall burns may also be detrimental because soil temperatures are typically warmer than in early spring, possibly causing greater mortality of larvae (Dana 1983). Moreover, fall burns may allow for greater subsurface temperature fluctuations during winter. McCabe (1981) suggested that night burns would likely destroy adults while slow back-burns may destroy any larval stage. Schlicht (2001) concluded that Dakota skippers are vulnerable to fire throughout their life cycle.

When fire is necessary at a Dakota skipper site, managers must carefully design burn units and rotations to minimize effects to butterfly populations and their host and nectar plants (Opler 1981, Panzer 1988, Swengel 1991, 1996, Moffat and McPhillips 1993, Dana 1997). Thus, managers should delineate Dakota skipper habitat within management areas and divide it between or among burn units. The unburned portions must provide true refugia with adequate habitat and space to ensure the persistence of the population while part of its habitat is effectively eliminated for a season or more. Because populations fluctuate naturally due to weather and other events, this refugium must be sufficiently large and should be left undisturbed long enough to assure sustaining these source populations through phases of low abundance. This will likely require that surveys be conducted before prescribed burn design to estimate Dakota skipper abundance and to delineate habitat locations within the management area.

Panzer (1988), Swengel (1991, 1996) and others suggest that patchy burns that leave mosaics of unburned spaces within burn units may also provide some refuge for butterflies and speed local recolonization following fires. Orwig (1996) observed that use of patchy, "fingering" fires on small portions of Hartleben Prairie, North Dakota, resulted in increased nectar sources while sustaining Dakota skippers. Uniform treatments affecting a large proportion of the Dakota skipper habitat at a site should always be avoided (Swengel 1996) and contiguous units should not be burned in consecutive years. Opler (1981) recommended dividing reserves into at least three units, with attention to local variation (micro-geographical scale) in species' distributions. Panzer (1988) suggested burning no more than 25-50% of reserves at once unless the habitat was

highly degraded. More conservatively, Swengel (1991, 1996) recommended burn units covering no more than 20-25% of the total preserve distributed evenly among habitat types. Alternatives to burning, such as haying, grazing, and brush cutting, should be considered for maintaining prairie butterfly populations where burning is not essential to other conservation objectives. Dakota skipper populations appear stable; for example, on tallgrass prairie remnants owned by the Sisseton-Wahpeton Sioux Tribe that are managed with annual, fall haying (D. Skadsen, pers. comm. 2002).

The numbers of years between burns to best conserve Dakota skipper populations varies based on numerous factors. In vigorous Minnesota prairies, Dana (1991) suggested that rotational burns every three years would beneficially remove accumulated litter. Swengel (1991, 1996) and Schlicht and Saunders (1994) recommended longer intervals of 5-10 years, to allow populations to recover between burns. Reduced fire frequency generally increases fire intensity due to greater fuel loads, although grazing and haying implemented between burns would reduce litter accumulation. Therefore, managers must weigh the trade-offs between increased fire intervals and the risks of high-intensity and widespread fires. For each site, managers have to balance management that is optimal for Dakota skippers with other critical site conservation objectives, such as efficiently controlling exotic plant invasions, while ensuring that Dakota skippers persist. For areas that are too small to meet both objectives, managers should consider acquiring and, if necessary, restoring adjacent habitat.

Haying. Swengel (1996) found that Dakota skipper populations responded positively in the year after haying (grass mowing and clipping removal) and were always more abundant in hayed than comparable burned units. Late season haying may forestall or retard succession of prairies to woody plants, thus maintaining skipper habitat (Royer and Marrone 1992). Fall haying may be the single best method for maintaining Dakota skipper populations, although it may not be adequate by itself in more mesic tallgrass habitats (Schlicht 1997) and is not always feasible. For mesic tallgrass prairie, Swengel (1998b) recommended rotational midsummer haying as a general management tool for prairie-specialized butterflies because it removes bulk and height from warm-season grasses that may suppress forb flowering. The stubble left after cutting provides some vegetation for egg-laying and larval feeding, although managers must be careful to leave sufficient nectar resources for adults (Swengel 1998b). Dana (1991) thought annual haying during the growing season in Minnesota tallgrass prairie could benefit Dakota skippers by reducing productivity of relatively robust species and litter accumulation and by favoring plant communities with stature more typical of mixed grass prairie. In mixed grass prairie in the Dakotas, very late (October) mowing is optimal to maintain prairie plant communities, while avoiding adverse effects to invertebrates and ground-nesting birds (McCabe 1981). At least six inches of grass stubble should be left, however, to protect overwintering larvae (R. Royer, pers. comm. in Moffat and McPhillips 1993). Because fall (post-growing season) haying leaves very little plant cover over winter, Swengel (1998b) recommended either rotational fall haying or leaving permanent unmowed areas.

Swengel (1991) recommended mowing no more than annually. Lenz (1999) observed that annual haying in central North Dakota may reduce native grass vigor and forb abundance and recommended occasional annual rests from haying to allow plant species recovery in the mixed

prairie of North Dakota. Division and rotation of hay units, as recommended for prescribed burning, may be necessary to ensure persistence of Dakota skippers at some sites. (Moffat and McPhillips 1993). Swengel (1998b) recommended cutting no more than one third of mesic tallgrass prairie and no more than one-quarter of drier habitats occupied by Dakota skipper each year. Spreading the mowing over a few weeks may also reduce impacts (Swengel 1998b).

Grazing. Grazing may be the least understood prairie management tool relative to butterfly conservation (Moffat and McPhillips 1993, Swengel 1998b). Grazing of sufficient intensity or duration eliminates Dakota skippers from all types of habitat in which it occurs. Dakota skippers are able to persist, however, on some grazed lands. Grazing may be the only reasonable alternative to maintain prairie vegetation on rocky or steep areas and is an acceptable alternative in tallgrass prairie if well managed (Royer and Marrone 1992). In Minnesota, grazing may help maintain habitat structure preferred by Dakota skippers (Schlicht 1997), although grazing may be less beneficial than haying (Swengel 1998a, Swengel and Swengel 1999). Intensive (high stocking density and long duration or across seasons) and, in mixed grass prairie, even moderate grazing is highly detrimental to Dakota skippers (Royer and Royer 1998). Therefore, only carefully managed grazing should be used when it is necessary for prairie management on Dakota skipper sites (Moffat and McPhillips 1993). Dakota skippers have persisted on some privately owned and managed tallgrass prairie on which grazing is the principal management tool, most notably in the Scarlet Fawn Prairie-Knapp's Pasture Complex in eastern South Dakota. The manner in which grazing is implemented (e.g., stocking rates, duration, etc.) is key to whether Dakota skippers will persist or become extinct at a given site (P. Delphey, pers. obs. 2001). It is not uncommon for Dakota skippers to be common on one site, but extinct on an adjacent site where grazing has been more intense (P. Delphey, pers. obs. 2001).

Brush control. On sites that will not be mowed, grazed, or burned, or where brush persists despite these disturbances, brush control may be a practical alternative to conserve prairie butterflies (Moffat and McPhillips 1993). Conifers can simply be cut, but most deciduous species will resprout and even spread if cut (Swengel 1998b). For resprouting species, Swengel (1998b) recommended direct application of herbicides in treatments spread over time.

Exotic species control. In no case should pesticides that may be harmful to Dakota skippers or their nectar plants be broadcast or widely applied in Dakota skipper habitat (but see below). The first approach to exotic species control should be to address the underlying causes for the invasion. Methods to control exotic species once they are established can be more harmful to butterflies than the presence of exotic species.

In all cases, site-specific ecological (e.g., phenological) and species composition information should be considered when making plans to control or eradicate invasive species [e.g., see Willson and Stubbendieck (2000)]. Authors disagree on whether fire (Dana 1991) or haying (Swengel 1996) is preferable for simultaneously controlling exotic grass invasion and conserving Dakota skippers at a site. Willson and Stubbendieck (2000) found that the relative coverages of smooth brome and native, warm-season tallgrasses and the phenology of smooth brome are the key site-specific factors to consider in devising plans to successfully restore tallgrass prairie

degraded by this exotic grass. Royer and Marrone (1992) suggested that mowing or, where mowing is not possible, controlled grazing can forestall invasion of Kentucky bluegrass, smooth brome and buckbrush, in tallgrass prairie. Where these practices are not practical or sufficient, hand removal or spot spraying may be justified (Orwig and Schlicht 1999, Olson 2000).

Moffat and McPhillips (1993) emphasized spot-herbiciding and spot brushing as overlooked tools to fight woody succession and invasion of exotics, such as leafy spurge. Biological control is another promising option (J. Payne, *in litt*. 1994), including release of flea beetles (*Aphthona spp*.) for leafy spurge on Dakota skipper habitat at Big Stone National Wildlife Refuge, Minnesota (Olson 2000). Use of chemicals to control leafy spurge and Canada thistle is likely to destroy other broad-leaved plants, many of which serve as nectar sources for Dakota skippers and other prairie insects (Royer and Marrone 1992). Widespread (e.g., aerial) applications of pesticides to Dakota skipper habitat should be avoided. Where such techniques seem unavoidable to control exotic species, managers should strive to avoid or minimize direct and indirect adverse effects to Dakota skippers through the development of new or modified control techniques or by finding alternatives to pesticides.

C. Management of "Extirpated" Sites

Sites from which Dakota skippers have evidently been extirpated, but still provide suitable habitat, should be managed with the assumption that the species may still be present. Dakota skippers may be overlooked during surveys (Britten 2001); only highly trained individuals can document the presence of the species and they must be present during its relatively short flight period. Moreover, recolonization of suitable habitats may occur naturally and these "extirpated" sites may be suitable for intentional attempts to reintroduce the species in the future if artificial propagation is implemented. Sites we describe as extirpated were described as such by Dakota skipper experts familiar with the sites. If there was significant doubt about the status of a population, we described its status as "unknown" (App. C).

D. Research, Surveys and Monitoring

Royer and Marrone (1992) called for research to determine precise habitat requirements and the development of management plans to meet those requirements. Specifically,

1) monitoring of population dynamics at index sites over multiple years;
2) evaluating relationships between tallgrass and mixed grass prairie, including study of plant community structure, edaphic and other factors, to determine environmental needs;
3) determining species vagility and degree of genetic isolation in the few remaining population complexes large enough to contain more than a single deme (requires mark and release techniques suitable only for larger populations); and,
4) assessing effects of controlled haying, grazing, and burning on the Dakota skipper and its habitat.

The 1999 Dakota skipper recovery strategy meeting in South Dakota produced recommendations to study the effects of grazing on Dakota skippers and other prairie invertebrates, particularly

determining what level or intensity is detrimental (Skadsen 1999b). Effects of controlled burns and late summer haying are also not well enough understood. The group recommended studies at the Scarlet Fawn Prairie-Knapp's Pasture Complex, South Dakota. Other research questions raised at the South Dakota meeting included defining suitable habitat and acreage needed for species survival, and better understanding dispersal patterns between remnant tallgrass prairies. Earlier, Schweitzer (1989) focused on a need for data on the dispersal and colonizing ability of female Dakota skippers, to evaluate metapopulation dynamics and conservation priorities.

Skadsen (1999b) recommended surveys to determine the western and southern extent of Dakota skipper range in South Dakota, in McPherson, Edmunds, Brown, Marshall, Day, Clark, Hamlin, Codington, Grant, Deuel, and Moody Counties (including the Ordway Prairie, Hecla Sandhills and Crandall Hills areas). Further surveys in the Prairie Coteau in northeast South Dakota are also likely to locate additional sites (Skadsen 1999b). U.S. Fish and Wildlife Service waterfowl production areas and easement lands in South Dakota had not been thoroughly surveyed as of 1999. Populations are not well defined at some potentially secure, high quality reserves owned by The Nature Conservancy, including Ordway Prairie in South Dakota and Minnesota's Chippewa Prairie. In Minnesota, surveys may be warranted in lands surrounding the Hole-in-the-Mountain complex (Dana 1997).

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Appendix A. Persons Contacted

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Richard Baker, Zoologist, Natural Heritage and Nongame Research Program, Minnesota Department of Natural Resources, St. Paul, Minnesota
Barry Betts, President, Biological Services, Inc., Chamberlain, South Dakota.
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Cathy Carnes, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Green Bay, Wisconsin
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Chuck Kjos, Biologist (retired), U.S. Fish and Wildlife Service, Twin Cites, Minnesota
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Robert Murphy, Wildlife Biologist, Des Lacs National Wildlife Refuge Complex, Kenmare, North Dakota
Robyn Niver, Biologist, U.S. Fish and Wildlife Service, Pierre, South Dakota
Bridget Olson, Biologist, U.S. Fish and Wildlife Service, Big Stone National Wildlife Refuge, Odessa, Minnesota
Tim Orwig, Ph.D. Candidate, Boston University, Worcester, MA (formerly Assistant Dean, Morningside College, Sioux City, Iowa)
Ronald Royer, Professor, Minot State University, Minot, North Dakota
Dennis Schlicht, Iowa Lepidoptera Project, Center Point, Iowa
Gerald Selby, Director of Science and Stewardship, The Nature Conservancy, Des Moines, Iowa
Dennis Skadsen, Natural History Investigations, Grenville, South Dakota

Steve Spomer, University of Nebraska, Lincoln, Nebraska
Dan Svingen, Wildlife Biologist, Dakota Prairies Grassland Office, U.S. Forest Service, Bismarck, North Dakota
Ann Swengel, Vice President, North American Butterfly Association, Baraboo, Wisconsin
Jennifer Szymanski, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota
Brian Winter, Director of Science and Stewardship, Northern Tallgrass Prairie Ecoregion, The Nature Conservancy, Glyndon, Minnesota

Appendix B. Expert interview process – methods and summary.

Dakota Skipper Status Assessment Expert Interviews Process

Purpose: To gather expert, scientific opinion on the population viability of Dakota skippers at currently occupied sites in Minnesota, North Dakota, and South Dakota.

Persons Interviewed:

Name	Affiliation	Date	Interviewer
Dr. Robert Dana	Minnesota DNR	21 Aug 2001	Cochrane
Gary Marrone	Retired, SD	21 Aug 2001	Cochrane
Dennis Schlicht	independent surveyor	21 Aug 2001	Cochrane
Tim Orwig	independent surveyor	22 Aug 2001	Cochrane
Dr. Ronald Royer	Minot State University, ND	23 Aug 2001	Delphey
Dennis Skadsen	Day County SWCD, SD	23 Aug 2001	Delphey

Methods: We selected experts to interview by compiling a list of all persons known to have worked on this species, including doing field surveys. We emailed or called each potential interviewee to explain the task and set up interview times. We asked each person to suggest any other experts whom we may not have identified. Because of time constraints we were not able to interview all the experts on our list (e.g., Dr. Hugh Britten, University of South Dakota; James Reiser, University of Nebraska; Gerald Selby, The Nature Conservancy, Iowa; Steve Spomer, University of Nebraska; and Ann Swengel, North American Butterfly Assn.). The scientists we interviewed provided experience with Dakota skipper sites throughout the species' United States range (i.e., all U.S., surveyed sites were covered by at least one person's experience).

Interviews were completed by telephone following an introductory text and standard list of questions (Attachments 1, 2). Before each call, we created a blank form customized to the region(s) within the particular interviewee's expertise. This form was emailed or faxed to the interviewee before the interview along with a copy of the draft status report, which included tables indicating status at every documented Dakota skipper site in every state. During the phone interviews, we recorded answers directly in the electronic forms (word processing) as we were talking on the telephone. We allowed for any clarification questions and follow-up comments, which we recorded under the applicable question.

The expert interviews were prepared by Dr. Jean Cochrane based on her experience running expert panels for the Fish and Wildlife Service in Alaska and Minnesota, and graduate studies at the University of Minnesota related to using expert opinion for species viability analysis. She is a co-author, with Dr. Lynn Maguire of Duke University, of a chapter titled Expert Opinion, in the report, Scientific standards for conducting viability assessments under the National Forest Management Act: report and recommendations of the NCEAS working group. (Andelman, S.A. et al. 2001. National Center for Ecological Analysis and Synthesis, Santa Barbara, CA. 160pp.).

Following the interviews, we asked the experts to provide corrections and comments about the following fields in the site status tables from the draft status report Appendix C: acres, status, habitat quality, and threats. We gave them a standard scale with definitions for the site status rankings and a list of threat types with codes (Attachment 3). We also asked them to record the last time they had visited each site. We provided electronic or faxed files for their responses.

Summary prepared by: Jean Cochrane, Twin Cities (MN) Field Office, U.S. Fish and Wildlife Service, 21-22 Aug. and 20 Nov 2001

Attachment 1. Interview introductory text.

Introduction

Thank you for agreeing to help us evaluate the status of Dakota skippers by answering some questions about population viability at currently occupied sites. I'm going to ask you to provide your personal judgment about the relative likelihood of population persistence at specific sites. I may ask these questions in relation to specific environmental or human activities (what we call threats). And in some cases I will be asking about individual sites and in others about clusters of nearby sites, using Appendix C from the status report as a reference.

[break for Table C sites review: which they've surveyed & most recent dates]

In creating our framework for the questions and your answers, we are trying to follow standard guidelines for the use of expert judgment in environmental risk analysis. For example, rather than asking you to come up with a single, summary estimate for your answers to some of my questions, I will give you a range of choices. I'm going to give you 100 points to allocate between those choices. The number of points you give to each choice should represent your degree of belief that each is the correct answer. For example, I may ask what is the likelihood that Dakota skippers will be present on Beautiful Prairie in 50 years and give you five choices for answering: 0-25%, 25-50%, 50-75%, 75-95%, and >95%. If you gave 20 of your points to each of these five choices you are indicating that you are so uncertain you cannot chose between them. If, in contrast, you allocated your points 0, 0, 0, 25, 75, you believe that >95% is probably the correct answer, while 75-95% is less plausible but still possible. A good way to think about these questions is to ask yourself, if there were 100 identical Beautiful Prairies at exactly this location and I could watch them for 50 years, how many do I think would still have Dakota skippers at year 50?

Remember, we are only asking for your personal judgment and your answers can reflect your degree of certainty or uncertainty in your beliefs. We will be asking the same questions of other experts on this species and these sites. No one's answers will automatically determine how the Fish and Wildlife Service rates the rangewide status of Dakota skippers, but everyone's answers and comments will be considered in our evaluation.

Feel free to ask questions at any time. We can discuss each question after your initial answers and if you want to revise your point allocations, that's fine. I will be recording your answers and comments as we go by typing into my computer.

Attachment 2. Interview form.

Expert:
Phone #:
Date:

1. Review Appendix C: most recent yr visits & surveys

The first set of questions deals with how we should delineate populations that are spread between sites in a cluster but still connected by migration between sites...that is, metapopulations. We need both to better understand the relevant movement dynamics, and also to come up with a consistent working definition for describing sites in the three states and Manitoba.

2. Based on your field experience, please estimate the maximum distance that Dakota skippers (DS) are capable of flying between patches of prairie habitat separated by structurally different habitats (e.g., forests, roads)? [capable of ≅ at least 1/generation does this]

100's of meters	2 km	1 km	>1 km

3. ... between patches of prairie habitat separated by structurally similar habitats (not native prairie)?

100's of meters	2 km	1 km	>1 km

4. *No question/deletion from preliminary draft.*

Let's define an isolated site as one clearly separated from any other DS site by substantially more than the estimates you have provided in questions 2-4 (e.g., >10 km).

5a. Please estimate the likelihood that DS populations will be present in 20 & 50 years on isolated sites of 20 acres. Assume the sites provide high quality prairie with favorable management (we won't define what that means here; I'm asking for a best case analysis):

present w/in	0-25%	25-50%	50-75%	75-95%	>95%
20 years					
50 years					

5b. Please estimate the likelihood that DS populations will be present in 20 & 50 years on isolated sites of 80 acres. Assume the sites provides high quality prairie with favorable management:

present w/in	0-25%	25-50%	50-75%	75-95%	>95%
20 years					
50 years					

5c. Please estimate the likelihood that DS populations will be present in 20 & 50 years on isolated sites of 160 acres. Assume the sites provides high quality prairie with favorable management:

present w/in	0-25%	25-50%	50-75%	75-95%	>95%
20 years					
50 years					

6. If a site is isolated but provides high quality prairie with favorable management, how large must it be for you to predict >95% likelihood of having DS populations in 20 & 50 years?

>95% w/in	80ac	160ac	320ac	640ac	>640ac
20 years					
50 years					

I will be asking the following set of questions for each site complex or potential metapopulation where you have field experience. My questions will be specific to the following possible threats [read list; allow to add other].

7a. For each of the following potential threats, please estimate the likelihood that this threat will occur at one or more sites within the _____ cluster with sufficient extent or intensity to cause a decline in Dakota skippers within 20 years (if 0%, leave row blank):

Threat	**>0-25%**	**25-50%**	**50-75%**	**75-95%**	**>95%**
conversion					
alien species					
grazing					
herbicides					
mow-haying					
non-mgt fire					
managed fire					
lack mgt					

7b. etc. *Repeated for any other site clusters appropriate to the interviewee..*

In the next set of questions I will be asking about the likelihood that DS will disappear from *all sites* within the specific complex within different time frames. Cluster extinction could be due to any one or more of the threats we have discussed, including cumulative and synergistic effects.

8a. For the _____ cluster please estimate the likelihood that:

	0%	>0-5%	5-20%	20-50%	>50%
DS extinct w/in 20 yrs					
DS extinct w/in 70 yrs					

8b.etc. *Repeated for any other site clusters appropriate to the interviewee..*

9. Do you have any other comments on or corrections for the status report?

Attachment 3. Information provided to the experts for their corrections to the site status tables in the draft Dakota skipper status report, Appendix 3. We asked the experts to review and correct as needed the acreage, status, habitat quality, and threats fields, providing the following definitions for status and threats.

Status categories:	secure:	Inherently viable by size...; no active threats (<5% prob. extinction within 50 years)
	vulnerable:	Possibly not viable by isolation, etc.; threats may affect (not secure, but <20% prob. extinction within 20 years)
	threatened:	Active threats and/or high inherent viability (>20% prob. extinction within 20 years)
	extirpated	converted habitat or degraded and no recent observations despite searching
	unknown	

Threat categories:

B	burning
C	conversion
E	exotic species invasion
F	flooding
G	grazing
H	herbicides
I	isolation
M	mining
N	no or inadequate management
U	other human uses (includes early season mowing)
W	woody encroachment or tree planting.

Appendix C. Dakota skipper sites, Minnesota, North Dakota, and South Dakota.

We grouped sites into known or suspected metapopulation complexes, based on the following references that contained the most recent information on site size, population status, habitat quality, and site threats: for Minnesota: Schlicht and Saunders 1994, Skadsen 1997, 1999a,c, Minnesota Natural Heritage Program database, R. Dana, pers. comm. 2001, T. Orwig, pers. comm. 2001, and for North Dakota, Royer 1997, Royer and Royer 1998, and R. Royer, pers. comm. 1998; and for South Dakota, Royer and Marrone 1992, Skadsen 1997, 1999a, and D. Backlund, *in litt.* 1998. "Owner" codes are The Nature Conservancy (TNC), Manitoba Naturalists Society (MNS), U.S. Forest Service (FS), U.S. Fish and Wildlife Service (FWS), Minnesota Historical Society (MHS), National Park Service (NPS), state or provincial agencies (DNR, GFD, GFP, NDLD, MAN), state/federal/provincial highway (HWY), counties (CTY), tribal (TRIB), private landowners (PRV), and private with FWS grassland easement (PRV-E). "Twn N, Rng W, Section" is the site legal description as Township (all N), Range (all W), and Section. "Acres" is acres of occupied habitat, or where two numbers are given, the total site acres/estimate of occupied acres from survey maps. "Stat." is the most recent estimate of population status at the site, S = secure (Inherently viable by size...; no active threats [<5% prob. extinction within 50 years]), V = vulnerable (Possibly not viable by isolation, etc.; threats may affect [not secure, but <20% prob. extinction within 20 years]), T = threatened (Active threats and/or high inherent vulnerability (>20% prob. extinction within 20 years), U = unknown, and E = extirpated (Converted habitat or degraded and no recent observations despite searching). Threats: B = burning, C = conversion, E = exotic species invasion, F = flooding, G = grazing, H = herbicides, I = isolation, M = mining, N = no or inadequate management, U = other human uses (includes early season mowing), and W = woody encroachment or tree planting. In Tables C.4-C.6, survey years are 19__ or 20__. Under observations/counts by year, "x" = no count was given in the reference, but the species was recorded, "-" = site was surveyed, but Dakota skippers were not observed, and "sev" = several Dakota skippers observed.

Table C.1. Dakota skipper sites and site complexes in Minnesota. Ten site complexes are indicated by bold type. Populations presumed to not be connected to other sites by dispersal are grouped into "Miscellaneous Sites."

Site Name	County	Owner	Twn N, Rng W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Frenchman's Bluff								
Frenchman's Bluff Preserve	Norman	TNC	143 43 SE18	40	V	Dr. Robert Dana (RD)	small; maybe larger comp.	
Private tract	Norman	PRV	143 44 SE13	15	T	RD	good condition	G H M E
Felton Prairie								
Bicentennial Prairie	Clay	CTY	141 45 SW5	140	V, T	RD, Dennis Schlicht (DS)	Good	B
Blazing Star Prairie/Preserve	Clay	TNC	141 45 NE5	100	V, T	RD, DS	Good	B
Felton Prairie -County	Clay	CTY	141 45 6 / 142 45 31	200	T	RD, DS	good to mod. degraded	M, B
B-B Ranch	Clay	PRV	141 45 8,12,17,18	300	V, T	RD, DS	degraded	M G
Private tract	Clay	PRV	141 46 NE36	?	U	RD	Now mostly a gravel pit[1]	M
Glacial Lakes								
Blue Hills-Glacial Lakes St Pk	Pope	DNR	124 39 24,124 38 19	600+	V, V, T	RD, DS, Tim Orwig (TO)	Mixed, but includes high quality habitat	B
Knutson Prairie	Pope	PRV	124 38 NW29	25	T	RD, TO	medium	E N
Pope County Highway Pit	Pope	CTY	124 38 NW29	20	T	RD, TO	good/half gravel pit	M
Anderson Prairies, Wedum P.	Pope	PRV	124 38 29	320+	V	RD, TO	medium to high	G
Dodd Prairie	Pope	PRV	124 38 SW28	10	T	RD, TO	fair	G E
Thompson Prairies	Pope	PRV	124 38 NW33	100+	T, V	RD, TO	good to high	G O
Swartz Prairie	Pope	PRV	124 38 NW33	200+	T	RD, TO	good, but deteriorating due to planted conifers	W E
Glacial Lakes WPA	Pope	FWS	124 39 23	10	T	DS	Mixed	B
Evenson Prairie	Pope	PRV	124 38 NE30	150	V	RD		?
Chippewa Prairie								
Chippewa Prairie Preserve	Chippewa/Swift	TNC	119 43	80	T, V	DS, RD	Degraded	B E
Chippewa Prairie Wildlife Area	Swift/Chippewa	DNR	120 43 SE35		U	DS, RD	Contains both good and degraded habitat.	B E
private tract	Swift	PRV	120 43 SW36	40	T	RD		
private tract	Chippewa	PRV	119 43 W2		U	RD		

[1] R. Dana, pers. comm. 2001

Table C.1. Minnesota sites continued.

Site Name	County	Owner	Rng N, Twn W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Hole-in-the-Mountain								
Hole-in-the-Mountain Preserve	Lincoln	TNC	109 45 18, 19	280+	S	DS, RD	Good	
Hole-in-the-Mt. Wildlife Area - I	Lincoln	DNR	109 45 20		V	RD	Good	B
Hole-in-the-Mt. Wildlife Area – II	Lincoln	DNR	109 45 30	380[2]	T	RD		
private tract	Lincoln	PRV	109 45 NE 31		T	RD	moderately degraded '85	G H O
private tract	Lincoln	PRV	109 45 SE 17	80+	T	RD	degraded '85	G H O
private tract	Lincoln	PRV	109 45 NE 17	100+	T[3]	RD	degraded '85	G H O
Hole-in-the-Mt. County Pk	Lincoln	CTY	109 45 NE 7	40	T	RD	small area good '85	N W E
Prairie Coteau								
Prairie Coteau SNA	Pipestone	DNR	108 44 29, 32	200-280	V-S, V	RD, DS	moderately degraded	B
private tract	Pipestone	PRV	108 44 NW33		T	RD		G H O
Chanarambie Creek Hills								
Chanarambie Camp	Murray	PRV	105 43 NW2	100	T	DS, RD	poor	N
Griffin Prairie	Murray	PRV	105 43 NE17	40	T	RD	fair to poor	H G
Carney Prairie	Murray	PRV	105 43 SE32	60	V, S	RD, DS	excellent in parts	
Chanarambie Creek	Murray	PRV	105 43 SE3	120	T	DS	Some high, small area	
Traverse County Coulees								
private, Traverse Co Coulees	Traverse	PRV	126 47 NE7	40+	T	RD	somewhat degraded	N W
private, Traverse Co Coulees	Traverse	PRV	126 48 NE26	40+	T	RD	some very good, idle	N W
Big Stone Wildlife Management Area								
Big Stone WMA	Big Stone	DNR	122 46 SW18	40	T, E	RD, DS	fairly good	B W
private tract; by Big Stone WMA	Big Stone	PRV	122 47 NE13	80	U	RD		G N W

[2] Hole-in-the-Mountain Wildlife Area is composed of two separate parcels that together include approximately 380 acres.
[3] Site needs additional survey work.

Table C.1. Minnesota sites continued.

Site Name	County	Owner	Rng N, Twn W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Bonanza Prairie/Big Stone Bluffs								
Bonanza Prairie SNA	Big Stone	DNR	123 48 NW20	80	V	RD	fair	B W
private tract, Big Stone Bluffs	Big Stone	PRV	124 49 SW14	15	T	RD	good-degraded	G
Miscellaneous Sites								
Tympanuchus WMA	Polk	DNR	149 45 S28	20	T	DS, RD	good, but mixed with poorer quality habitat; small	B
private tract, Kittson Co	Kittson	PRV	164 49 NW36	10	T	RD	NW edge of MN range	I
Lake Bronson St Pk prairie	Kittson	DNR	161 46 NE34	100/5	V	RD	fair to good	B W
private tract, Kittson Co	Kittson	PRV	160 45 NE22	40	U	RD	brush prairie	I
Bluestem Prairie	Clay	TNC/DNR	139 46 NE15	15	T	DS, RD	mixed quality	B?
Prairie WPA	Big Stone	FWS	122 46 SE36	80	T, T, E	RD, DSk[4], DS	fairly good, small area	B W
private tract, Yellow Med. Co	Yellow Medicine	PRV	115 46 SE34	10?	U	RD		
Sioux Nation WMA	Yellow Medicine	DNR	114 46 W17	?	T, E	RD, DS		
Twin Valley Prairie SNA	Norman	TNC	143 45 W23	c15	U	RD		
private tract	Lac Qui Parle	PRV	120 46 SE26	40	T	RD	small area, isolated?	G H W
Hastad WPA	Lac Qui Parle	DNR	119 43 SE5		U	RD	wet prairie, not suitable? Lone observation may have been a stray.[6]	
Big Stone NWR	Lac Qui Parle	FWS	121 46 28	360/40	T	RD	small area good habitat	E B
private tract	Pipestone	PRV	106 46 NW24		U	RD	Right-of-way between highway and railroad.[6]	G H O
Lundblad Prairie	Murray	DNR	105 43 1W NW	80	U, T	RD, DS	poor, unsuitable habitat? Dakota skipper observed here may have strayed from suitable habitat elsewhere.[6]	
Jeffers Petroglyph Historic Site	Cottonwood	MHS	107 35 NW9		U	RD		
Strandness Prairie	Pope	TNC	125 38 NW6	40	U	RD		
Salt Lake WMA	Lac Qui Parle	DNR	117 46 NE8	20?	U[5], E	RD, DS	not suitable habitat	

[4] Dennis Skadsen
[5] Probably extirpated (R. Dana, pers. comm. 2001)

Table C.1. Minnesota sites continued

Site Name	County	Owner	Rng N, Twn W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Extirpated								
Roscoe Prairie	Stearns	DNR/TNC	123 32 SW35	20	E	DS, RD		
Pipestone Natl Monument	Pipestone	NPS	106 46 W1		E	DS, RD		
private tract	Pipestone	PRV	107 46 W36		E	RD		G H O
Pembina Trail Preserve	Polk	DNR	149 44 SW30	?	E, U	DS, RD		
Pankratz Prairie North	Polk	TNC	149 45 SE8	?	E, U	DS, RD	Good	B
Audubon Prairie	Clay	DNR	135 52 6	?	E	DS, RD		
Coleman Prairie	Stevens	PRV	124 42 NE12	15	E	RD	destroyed	

Table C.2. Dakota skipper sites in North Dakota. Two site complexes are indicated by bold type. Populations presumed to not be connected to other sites by dispersal are grouped into "Miscellaneous Sites."

Site Name	County	Owner	Twn N, Rng W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Towner-Karlsruhe								
Towner	McHenry	NDLD	157 76 NW20	80	T	RR[6]	good-excellent, fragmented	U E H
McHenry School Prairie	McHenry	NDLD	157 75 NE12	130	T	RR	good but in patches	E
Thompson Ranch	McHenry	PRV	156 77 N30	160	T	RR	fair	G N U
Cooperdahl Hill	McHenry	PRV	155 76 SE32	30	T	RR	good	C N I
Eidmann Ranch	McHenry	PRV-E	154 76 9,10,14parts	120	V	RR	good	H N
Swearson's Meadow	McHenry	PRV	154 76 NW21 SW16	80	T	RR	good-excellent	N C
Klein's Meadow	McHenry	PRV	154 76 SE29	160	T	RR	good-excellent	N U C
Schiller	McHenry	PRV	152 75 NW1	60	T	RR	fair, marginal type	F
Voltaire	McHenry	HWY	152 79 E4	1	T	RR	excellent but small	U I
Smokey Lake	McHenry	PRV-E	154 75 W3, 4	960	V	RR	excellent & extensive	N
Smokey Lake School Sec.	McHenry	NDLD	154 75 NW16	160	V	RR	excellent	
Anderson's Meadow	McHenry	PRV	155 75 NW22	80	T	RR	excellent	
Mt. Carmel Camp	McHenry	NDLD	156 78 SE16	160	V	RR	excellent	
Sheyenne Grasslands								
Venlo Prairie SNG	Ransom	FS	135 54 NW35	10	T	RR, SS[7]	Fair; islands okay	G E N
Brown Ranch	Ransom	TNC	133 53; 134 53 SW28		V	RR, TO	fair to good	E
Schultz	Ransom	PRV-E	134 54 SW24	20	T	RR, SS, TO	fair to good; suitable habitat in patches and on hills	G E C I M
Unnamed, SNG		FS	133 53 NE07	50	T	SS	Fair to good; patchy	G
Miscellaneous Sites								
Eagle Nest Butte	McKenzie	PRV	149 94 28 & 33	10	V	RR	very small	C N
Cross Ranch	Oliver	TNC	143 81 12	16+	T	RR	poor	G I B
New Rockford	Eddy	NDLD	149 65 S29	160	T	RR	poor	G E
Colvin Prairie	Eddy	PRV	149 62 NE32	60	T	RR	poor	G E C
Spring Creek	Eddy	?	149 62 11,13,14,22	100	U	RR	unknown	?
Hamar 1st	Eddy	PRV	150 62 NE23	20	T	RR	fair	C I
Hamar 2nd	Eddy	PRV	150 62 NE15	160	T	RR	poor	E
Lostwood NWR	Burke	FWS	160 91 SW35		T		highly varied, some ok	E B

[6] Dr. Ronald Royer
[7] Steve Spomer

Table C.2. North Dakota sites continued.

Site Name	County	Owner	Twn N, Rng W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Miscellaneous Sites Continued								
Kindred	Richland	PRV	136 51 NE24	120	T	RR	fair	I C U
Walcott	Richland	PRV	136 51 SW35	20	T	RR	fair, small	I C
Hartleben Prairie	Richland	FWS	130 50 NE17 NW16	200	V, T	RR, TO	excellent	I U E
Holywater Spring	Rolette	PRV	161 72 N2 N3	80	T	RR	good	I C
Oakes	Sargent	PRV	130 58 S18	(130)	T	RR, TO	little left	I C
Montpelier	Stutsman	PRV	138 63 36	40	T	RR	fair to good	I C M
Van Sickle Pasture	Ward	PRV	153 81 NE8	30	T	RR	good but very small	I
Extirpated Sites								
Valley City	Barnes	PRV	140 58 17	80	E	RR	very poor	
Bottineau Co. Fairgrounds	Bottineau	PRV	162 76 W12	600	E	RR	converted by 1985	
West Prairie Church	Richland	HWY	136 51 N6	10	E	RR	converted	
Johnson's North Pasture	Ward	PRV	155 84 SE2	80	E	RR	very degraded, sprayed	
Johnson's South Pasture	Ward	PRV	155 84 NW14	40	E	RR	very degraded, sprayed	
Prairie Coteau	Montrail	FWS	158 91 W23	160	E		good to excellent	B I
McLeod Prairie	Ransom	PRV	136 51 NE8	15	E	RR, SS	very poor; heavy spurge and bluegrass coverage	G E N C
Binford	Griggs	PRV	147 60 NW16	60	E	RR	poor	I E N C
Martin Site	Wells	HWY	150 73 SE17 NE20	0.5	E	RR	mostly lost	I H
Monteith Allotment	Ransom	FS	135 52 6		E	SS	Degraded; flooded in 2001	G E N
Killdeer Mountain	Dunn	GFD PRV	146 96 NW20	40	E	RR	disturbed, heavily grazed	

Table C.3. Dakota skipper sites in South Dakota. Five site complexes are indicated by bold type. Populations presumed to not be connected to other sites by dispersal are grouped into “Miscellaneous Sites.”

Site Name	County	Owner	Twn N, Rng W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
North End Coteau Des Prairies								
Sica Hollow East	Roberts	PRV	127 52 S30	20	U	DSk	Poor; overgrazed	G
Sica Hollow West	Marshall	PRV	127 53 NW36	10	T	DSk, SS	Small; fair	G
North Lamee WPA	Marshall	FWS	127 56 10, 15	c80	S	DSk	poor to excellent	I
Scarlet Fawn Prairie-Knapp's Pasture Complex								
East Blue Dog Lake Prairie	Day	TRIB	122 53 SE10	c.40	S	DSk	excellent, small	
Hayes Prairie	Roberts	TRIB	123 52 NW20	160/30	S	DSk	excellent	
North Owl Lake Prairie	Roberts	TRIB	123 52 15NE	160/40	S	DSk	good	
Oak Island Prairie	Roberts	TRIB	123 52 S3	160/40	S	DSk	excellent	
Goodboy Prairie	Roberts	TRIB	123 52 NW11	160/25	S	DSk	good	E
Scarlet Fawn Prairie	Day	TRIB	123 53 23	300/40	S	DSk	excellent	
Block's Pasture	Day	TRIB	123 53 SW3	c.40	S	DSk	good, small	
North Blue Dog Lake	Day	TRIB	122 54 16	c.40	U	DSk	small	E
Pickerel Lake State Rec Area	Day	GFP	124 53 S26, N35	20+	T, V	DSk, SS	Fair-good	W E
Waubay NWR	Day	FWS	123 53 S17	10	V	DSk	fair, small	W E
Hamman	Roberts	PRV	123 52 N36	160/80	S	DSk	excellent	
Knapp's Pasture	Roberts	PRV	123 52 SE5	320/150	S	DSk	excellent	
Phillip's Prairie	Roberts	PRV	123 52 NW26	160/15	S	DSk	excellent	
Wike WPA	Roberts	FWS	124 52 W22	640/40	S	DSk	fair	E
Skaarhaug Pasture	Day	PRV	124 53 E3	c25	S	DSk	fair-good	G E
Mundt Pasture	Roberts	PRV	122 52 N21	c45	S	DSk	fair-good	G E M U
East Fisher Pasture	Roberts	PRV	124 52 SE14	c60	S	DSk	fair-good	G E
Hanson Pasture	Roberts	PRV	124 52 SW14	c15	S	DSk	fair-good	G E
Tetankamoni Prairie	Day	TRIB	123 53 SE26	40	S	DSk	good, small	
Other Lake Traverse Reservation								
South Buffalo Lake	Marshall	TRIB	125 53 N20	320/10	S	DSk	good, small	E
North Enemy Swim Prairie	Day	TRIB	123 53 SW1	c20	S	DSk	good	U
Wakidmanwin Prairie	Day	TRIB	124 53 NW36	c10	S	DSk	good, small	

Table C.3. South Dakota sites continued.

Site Name	County	Owner	Twn N, Rng W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Bitter Lake Area								
Bitter Lake Ridge	Day	PRV	121 53 10	c30	T	DSk	poor	G M
East Bitter Lake	Day	PRV	121 53 S11	c40	T	DSk	poor	G M
East Hinkleman Bitter Lk Pasture	Day	PRV	121 53 SW11	c30	T	DSk	poor	G M
Southeast Bitter Lake	Day	PRV	121 54 26	c180	T	DSk	poor	G M
Crystal Springs Area								
Crystal Springs GPA	Deuel	GFP	116 49 NW36	25	V	SS	Varies within site depending on management	G B
Crystal Springs Preserve	Deuel	PRV[8]	115 48 9	1918/400	S	DSk		B E
Crystal Springs Ranch	Deuel	PRV	115 49 12	160/60	U	DSk		G? E?
Miscellaneous Sites								
Jensen WPA	Marshall	FWS	125 56 NE34	1100/20	S	DSk	fair, small areas ok	E
Rock Crandall GPA	Marshall	GFP	125 56 SW35	80/5	T	DSk	fair; 5 acres	E
North Red Iron Lake WPA	Marshall	FWS	126 53 N17	1000/30	S	DSk	poor-good, small areas	E
Hartford Beach St Pk	Roberts	GFP	122 48 SE3	160/35	T	DSk	poor	E I
O'Farrell WPA	Grant	FWS	121 50 NW31	1193/15	S	DSk	poor-good	E N
Meyer Lake	Grant	FWS	120 51 SE22	1325/25	S	DSk	good	E
Holscher Hay Prairie	Grant	PRV	120 50 27	unk	U	DSk		U
Yellow Bank Fens	Grant	PRV	118 50 35	unk	U	DSk		
Round Lake	Deuel	PRV	117 50 NW2	10+	U	DSk	small	G
Horseshoe Lake	Codington	PRV	118 54 NE32	c40	T	DSk	fair	G M
Goose Lake	Codington	PRV	116 53 N19	<100/40	U	DSk		G
Cox WPA	Hamlin	FWS	114 52 N6	160/60	S	DSk	excellent, small	E?
Ordway Prairie	McPherson	TNC	126 69 SW24	7800/300	S	DSk	excellent (to poor)	B?
Sioux Prairie	Moody	TNC	107 50 36	20	U	DSk	Small; may be extirpated	
Hecla Sandhills[9]	Brown	PRV?	128 60 1		U	DSk		
Tribitt WPA	Deuel	FWS	117 49 33		U	DSk		

[8] Owned by Ducks Unlimited as of April 3, 2002.
[9] This refers to a single site in the Hecla Sandhills region at which Dakota skipper was observed. It does not refer to the entire Hecla Sandhills region.

Table C.3. South Dakota sites continued.

Site Name	County	Owner	Twn N, Rng W, Sec.	Acres	Status	Status Source(s)	Habitat Quality	Threats
Extirpated								
Lost Prairie Site	Day	PRV	121 54 NW35		E	DSk	converted	
Waubay Lake	Day	PRV?	123 55 34		E	DSk		
Bitter Lake Game Pr. Area	Day	GFP	121 54 28	c10	E	DSk	flooded	
Chekapa Creek Ridge	Day	TRIB	124 53 E23	1.5	E	DSk	good, small	
Hayes Slough GPA	Hamlin	GFP	114 55 E21	20+	E	DSk	poor	

Table C.4. Dakota skipper sites in Manitoba. The status of these sites could not be confirmed by Manitoba Conservation.

Site Name	Owner	Twn N, Rng W, Sec.	Acres	Stat.	Habitat Quality	Threats
Sifton	PRV	008N 23W-1W SE24		U		
MacDonald	PRV	008N 2W-1W 18NE		U		
Coldwell	PRV	020N 5W-1W 2SW		U		
Coldwell	MAN	020N 5W-1W 11SE		U		
Coldwell	PRV	020N 4W-1W 8NW		U		
Coldwell	HWY	020N 4W-1W 16SE/9NE		U		
Armstrong	PRV	017N 2W-1W 36NE		U		
Franklin	PRV	001N 5E-1E 36SW		U		
Stuartburn	PRV	001N 6E-1E 31SW		U		
Stuartburn	MNS	001N 6E-1E 32SW		U		
Franklin	PRV	002N 5E-1E 1NW		U		
Stuartburn	PRV	002N 6E-1E 26SW		U		
Stuartburn	PRV	002N 6E-1E 14NE		U		

Table C.5. Survey data from Dakota skipper sites in Minnesota.

	Observations/Counts by Year (19__ or 20__)																							
		Heritage Database	Braker 1985 (In Dana 1997)	Heritage DB/Swengel in litt.	Glenn_Lewin & Selby 1989	Heritage DB/Swengel in litt.	Glenn_Lewin & Selby 1989	Glenn_Lewin & Selby 1990	A. Swengel *in litt.* 1993,94	Cuthrell 1991	A. Swengel *in litt.* 1993,94	A. Swengel *in litt.* 1993,94	Schlicht & Saunders 1994	A. Swengel *in litt.* 1994	Schlicht 1994 (Heritage DB)	A. Swengel *in litt.* 1994	Schlicht 1997a	Schlicht 1997a	Reiser 1997	Schlicht 1997c	Skadsen1997b, 1999	Skadsen 2000
Site Name	older	85	85	88	88	89	89	90	90	91	91	92	93	93	94	94	95	96	96	97	99	00
Frenchman's Bluff																						
Frenchman's Bluff Preserve	79			3										18								
private tract				8																		
Felton Prairie Complex																						
Bicentennial Prairie	65-85		x										3	56			4	33				
Blazing Star Prairie/Preserve	65-85		x	6									4				1	29				
Felton Prairie -County	87		x										3				9	14				
B--B Ranch			32														2	6				
private tract			2																			
Glacial Lakes Area																						
Blue Hills-Glacial Lakes St Pk	87												4				9	13		23		
Knutson Prairie																				1		
Pope County Highway Pit																				1		
Anderson Prairies, Wedum P.																				33		
Dodd Prairie																				1		
Thompson Prairies																				13		
Swartz Prairie																				5		
Glacial Lakes WPA **(2 in 2001)**																						

Table C.5. Minnesota survey data continued.

	Observations/Counts by Year (19__ or 20__)																					
Site Name	older	85	85	88	88	89	89	90	90	91	91	92	93	93	94	94	95	96	96	97	99	00
Chippewa Prairie																						
Chippewa Prairie Preserve													10				14	0				
Chippewa Prairie Wildlife Area												1	x	1		0	4	0				
private tract	67,81																					
private tract																	6	0				
Hole-in-the-Mountain																						
Hole-in-the-Mountain Preserve	67-83	x		2		11		x	2		0	7	2	4	10		40	32+	32+			
Hole-in-the-Mt. Wildlife Area – I & II	78-83																	x				
private tract	68-74																					
private tract		x																				
private tract		4																				
Hole-in-the-Mt. County Pk		6																				
Prairie Coteau																						
Prairie Coteau SNA	78,82				40+		40+	109								14	3	15				
private tract	78																					
Chanarambie Creek Hills																						
Chanarambie Camp																				1		
Griffin Prairie																				1		
Carney Prairie								10												5		
Chanarambie Creek	82							13						2		2						

Table C.5. Minnesota survey data continued.

	Observations/Counts by Year (19__ or 20__)																				
Site Name	older	85	85	88	88	89	89	90	90	91	91	92	93	93	94	94	95	96	96	97	99	00
Traverse County Coulees																						
private, Traverse Co Coulees				1																		
private, Traverse Co Coulees				6																		
Big Stone Wildlife Management Area																						
Big Stone WMA				2																		
private tract; by Big Stone WMA	80			4+																		
Bonanza Prairie/Big Stone Bluffs																						
Bonanza Prairie SNA				6																		
private tract, Big Stone Bluffs				2+																		
Miscellaneous Sites																						
Twin Valley Prairie SNA	79				0								0	2	0							
Tympanuchus WMA														4								
private tract, Kittson Co										2												
Lake Bronson St Pk prairie							2			x												
private tract, Kittson Co										1												
Bluestem Prairie			4	6								12		0		0	3	2				
Prairie WPA				8																		x
Salt Lake WMA	67,68												0		0							
private tract, Yellow Med. Co	75																					
Sioux Nation WMA	81												0		0							
Lundblad Prairie						0							1									
Big Stone NWR				5																	9	1
private tract				6																		
Hastad WPA				1																		
Jeffers Petroglyph Historic Site	70												0		0							
Strandness Prairie	77,78															0						

Table C.5. Minnesota survey data continued

Extirpated												
Roscoe Prairie	66-83									0		0
Pembina Trail Preserve	79											
Pankratz Prairie North			0									2
Pipestone Natl Monument	47			0	0							
Audubon Prairie	70s	0				0		0	0	0	0	0
Coleman Prairie	76											

Table C.6. Survey data from Dakota skipper sites in North Dakota

	Observations/Counts by Year (19__)														
		McCabe 1981 (# RM98)	McCabe 1981 In RR98	Royer and Marrone 1992	Royer and Marrone 1992	Royer and Marrone 1992	Royer and Marrone 1992	Royer and Marrone 1992	Orwig 1994 (in 1995)	Orwig 1995	Orwig 1996	Royer 1997	Royer 1997	Royer 1997	Royer and Royer 1998
Site Name	old	79	81	86	87	88	90	91	92	95	96	95	96	97	98
Towner-Karlsruhe															
Towner		x	-					>6					sev	9-14	9-14
McHenry School Prairie								sev					x	-	7
Thompson Ranch								3-8							3-8
Cooperdahl Hill								5					x		-
Eidmann Ranch								>30					x	x	
Swearson's Meadow								100					>14	>14	3
Klein's Meadow		x						100				x	3-8	x	3-8
Schiller								1							
Voltaire								-					15	1	-
Smokey Lake															9-14
Smokey Lake School Sec.															9
Anderson's Meadow															9.5/h
Mt. Carmel Camp															>14
Sheyenne Grasslands															
Venlo Prairie SNG													>6	-	
Brown Ranch										5					
Schultz										1					
Unnamed, SNG (1 in 2001)															

Table C.6. North Dakota survey data continued.

	Observations/Counts by Year (19__)														
Site Name	old	79	81	86	87	88	90	91	92	95	96	95	96	97	98
Miscellaneous Sites															
Eagle Nest Butte					>8			sev				9-14	9-14	9->14	
Cross Ranch									x	0				-?	-?
New Rockford		x						?						-	
Colvin Prairie		x						?						-	
Spring Creek		x													
Hamar 1st		x						?						-	
Hamar 2nd		x						?						-	
Kindred		x						1							-
Walcott		x						-							
Hartleben Prairie										4	1		x		
Holywater Spring								2					sev		
Oakes		x						-						1	
Montpelier								sev						3	
Van Sickle Pasture								4							
Lostwood NWR								<3				-	1		
Extirpated Sites															
Valley City						1		-						-	
Bottineau Co. Fairgrounds		x													
West Prairie Church					1			-							
Johnson's North Pasture				sev	2			1					-		
Johnson's South Pasture				sev				>8					-		
Prairie Coteau								2				-	-	-	
Killdeer Mountain					55	55	2	1					-	-	-
McLeod Prairie SNG		x					2	-		-					
Monteith Allotment	73														
Binford		x						3?						?	
Martin Site								2					1	-	

Table C.7. Survey data from Dakota skipper sites in South Dakota.

	Observations/Counts by Year (19__)												
		Royer and Marrone 1992	Royer and Marrone 1992	Royer and Marrone 1992	Royer and Marrone 1992	Royer and Marrone 1992	Reiser 1997	Skadsen 1997	Reiser 1997	Skadsen 1997	Skadsen 1997	Reiser 1997	Skadsen 1999
Site Name	older	86	87	89	90	91	95	95	96	96	97	97	98
North End Coteau Des Prairies													
Sica Hollow East	83					-					-		
Sica Hollow West	84					2					3		
North Lamee WPA											-		1
Scarlet Fawn Prairie-Knapp's Pasture Complex													
East Blue Dog Lake Prairie						2					3		
Hayes Prairie											12		
North Owl Lake Prairie											9		
Oak Island Prairie											9		
Goodboy Prairie											8		
Scarlet Fawn Prairie	85										34		
Block's Pasture										-	3		
North Blue Dog Lake	82-84												
Pickerel Lake State Rec Area										5	4		1
Waubay NWR		x								1	1		2
Hamman								2			7		
Knapp's Pasture											27		11
Phillip's Prairie											2		
Wike WPA								3			2		1
Skaarhaug Pasture													5
Mundt Pasture													3
East Fisher Pasture													1
Hanson Pasture													6
Tetankamoni Prairie											3		

Table C.7. South Dakota survey data continued.

Site Name	older	86	87	89	90	91	95	95	96	96	97	97	98
Other Lake Traverse Reservation													
South Buffalo Lake											1		
North Enemy Swim Prairie													1
Wakidmanwin Prairie								-		-	-		2
Bitter Lake Area													
Bitter Lake Ridge						1					-		
East Bitter Lake	84										1		
East Hinkleman Bitter Lk Pasture											1		
Southeast Bitter Lake	84										3		
Crystal Springs Area													
Crystal Springs GPA		11											
Crystal Springs Preserve			3			-	>50		1				
Crystal Springs Ranch			4										
Miscellaneous Sites													
Jensen WPA										1			
North Red Iron Lake WPA										1			
Rock Crandall GPA											9		
Hartford Beach St Pk										3	4		9
O'Farrell WPA										3			
Meyer Lake										2			
Holscher Hay Prairie						x							
Yellow Bank Fens				x									
Round Lake				9									
Horseshoe Lake				18	>45			1			-		
Goose Lake					1								
Cox WPA		sev		10	>40	-					23		
Hecla Sandhills	66-69												
Tribitt WPA	76												
Sioux Prairie	84												
Ordway Prairie	80	3				-							1

Table C.7. South Dakota survey data continued.

Site Name	older	86	87	89	90	91	95	95	96	96	97	97	98
Extirpated													
Lost Prairie Site	84												
Waubay Lake	66-69												
Bitter Lake Game Pr. Area						1					-		
Chekapa Creek Ridge											2		
Hayes Slough GPA				sev							-		