

**2018 Dakota Skipper (*Hesperia dacotae*)
North Dakota Survey Protocol**



Dakota Skipper (*Hesperia dakotae*) perched on a purple coneflower (*Echinacea augustifolia*)

Photo credit: Scott Krych

**U. S. FISH AND WILDLIFE SERVICE
Mountain-Prairie Region, Region 6
Denver, Colorado**



North Dakota Field Office
Ecological Services
3425 Miriam Avenue
Bismarck, North Dakota 58501
NDFieldOffice@fws.gov
Office: 701-250-4402 Fax: 701-355-8513

2018 Dakota Skipper Survey Protocol

Assessing Sites for Dakota Skipper Presence in North Dakota

Background & Purpose

This protocol is offered as a recommended approach when conducting occupancy surveys on grasslands in North Dakota where and when the objective is to detect the presence of the Dakota skipper (*Hesperia dacotae*) at the site scale. This protocol is designed to address the species' likelihood of occupancy at the site scale when and where little or no pre-existing information is available to determine if the species is present. Use of this protocol may be occur other states if agreed to by Ecological Services field office personnel in those states.

Information obtained from surveys that follow this protocol may help facilitate cooperation between U.S. Fish and Wildlife Service (Service) and other federal agencies to conserve Dakota skipper under section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA). The protocol may also help to ensure that the actions of non-federal agencies have incorporated the appropriate conservation measures to avoid any unauthorized incidental take as prohibited pursuant to section 9 of ESA. This protocol should not be used for surveys for which the primary objective is to monitor the species' abundance or population status and trend over extended timeframes or large spatial scales.

This document provides the user with information to decide where surveys for the Dakota skipper may be warranted; standardized 'ground rules' to help ensure that survey methods are repeatable and result will be as reliable as possible; and, outline how to report survey data to the Service. The reliability of survey results for Dakota skippers depends on several factors, including: the abilities and expertise of observers; survey timing relative to the species' flight period; time of day and weather conditions; and, the species' density. The species' flight period varies somewhat from year to year depending on annual variations in weather (Dearborn and Westwood 2014, entire).

For additional information on Dakota skipper ecology and threats to its continued existence contact the U.S. Fish and Wildlife Service North Dakota Ecological Services Field Office (NDFO) or visit the following website:

<http://www.fws.gov/midwest/endangered/insects/dask/index.html>.

Historical and Current Dakota Skipper Distribution in North Dakota

The Dakota skipper inhabits patches of remnant native prairie in north-central United States and southern Canada. In the United States, the species occurs in portions of Minnesota, North Dakota, and South Dakota. The species is currently believed to be extirpated from Illinois, Iowa and eastern Minnesota (79 FR 63672:63667).

Table 1 depicts the current status of the Dakota kipper in the 20 counties in North Dakota where the species has occurred within the last 30 years (McCabe 1981, p. 179-193). The counties in Table 1 contain sites where the Dakota skipper is extirpated, possibly extirpated, and where it may still be present based on the best available information.

Table 1. North Dakota counties in which Dakota skipper is currently and/or possibly present.

North Dakota County	Species Status
Barnes	Extirpated
Bottineau	Extirpated
Burke	Possibly Extirpated
Dunn	Present
Eddy	Extirpated
Griggs	Extirpated
McHenry	Present
McKenzie	Present
McLean	Possibly Extirpated
Mountrail	Present
Oliver	Extirpated
Pembina	Extirpated
Pierce	Possibly Extirpated
Ransom	Present
Richland	Extirpated
Rolette	Present
Sargent	Possibly Extirpated
Stutsman	Present
Ward	Present
Wells	Present

Making a Decision to Conduct an Occupancy Survey

Site Assessments and Delineating the Survey Areas

To determine whether surveys for Dakota skippers are warranted, we recommend first delineating the area that may be affected (directly or indirectly), by the proposed or ongoing action referred to as the action area¹. If the action area occurs in a county listed as ‘Present’ or ‘Possibly Extirpated’ in North Dakota (Table 1), the second step would be to assess whether Dakota skipper habitat is present. Otherwise, when in a county listed as ‘Extirpated,’ surveys may not warranted. We recommend contacting the NDFO for assistance for survey decisions in the counties listed as ‘Extirpated’ in Table 1². A map depicting current and historic locations of occupied Dakota skipper townships in North Dakota can be found in Appendix A of this document.

¹ Action area is defined as all areas that may be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. It encompasses the geographic extent of environmental changes (i.e., the physical, chemical and biotic effects) that will result directly and indirectly from the action. The action area may be up to 1 km (0.6 mi) larger than the area

² There remains a remote potential that the species may currently reside in some counties listed as ‘extirpated’ due to the incomplete nature of past survey efforts.

Determining if Dakota skipper habitat is present requires an assessment of the vegetation. Sites containing native prairie grassland and having features indicative of Dakota skipper habitat, described on pages 7-9 of this document, may harbor the species². Dakota skippers are not likely to be present in cropped areas, previously cropped areas, non-native haylands, pasture or other grassland that is dominated by non-native species, or in areas where trees or shrubs predominate. The species occurs in some grazed lands that are dominated by native prairie vegetation.

Dakota skipper habitat often occurs in a patchy mosaic pattern on the landscape due to underlying site characteristics, prior land management, and other factors. Occupancy surveys are conducted during the flight period and are performed within the patches that contain features and conditions typical of Dakota skipper habitat (Fig. 1). Surveys may also encompass dispersal

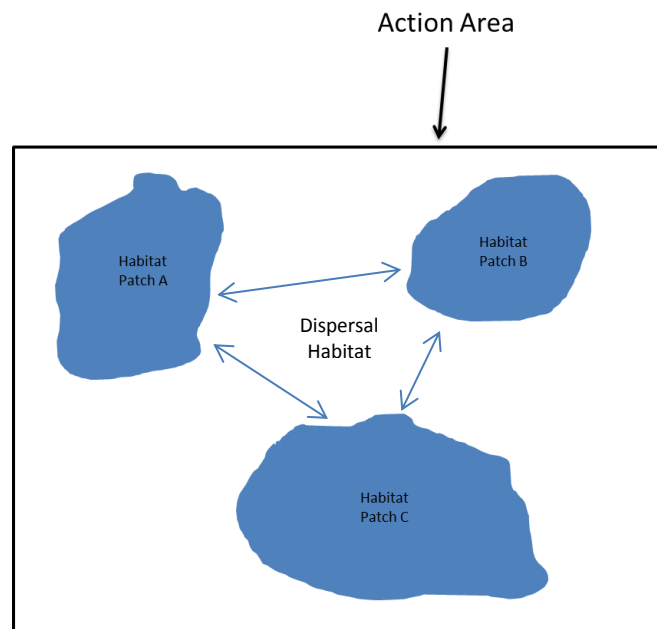


Figure 1. Schematic of an action area that contains patches with features of Dakota skipper habitat that would warrant surveys for the Dakota skipper. Reconnaissance of an action area before the flight season could identify parts of the area where surveys would not be necessary. Habitat patches, as shown above, is generally synonymous with *survey area* as used in the text.

habitat when nectar sources are present, in bloom, and in close proximity to reproductive habitat. The habitat patches should be mapped (location and size) in order to evaluate the landscape habitat connectivity.

The proximity of habitat patches informs how a site of interest may play a role in the species viability in a given landscape, in regards to reproduction, movement and persistence (Haddad

² For a more detailed description of typical Dakota skipper habitat features, see 79 FR 63672:63674-63675.

1999, entire). The detection rate for the species has not been modeled under differing densities (due to habitat, weather, or population factors), so the only means of reducing the risk of incorrectly concluding the species is not present, when it actually is present (Type II error), is to increase survey effort. For this reason, we recommend surveys be conducted for a minimum of two consecutive seasons (flight periods).

Alternatively, if it is not practicable to complete two seasons of surveys, the survey effort within one season of surveys should be increased by surveying all suitable Dakota skipper habitat out to a minimum of 250 m (820 ft) from the site of interest. In the special case when the site of interest is within 1 km (0.6 mi) of an established population of Dakota skippers, we recommend the buffer distance be increased to 500 m (0.3 mi) due to the importance of knowing the precise distribution of occurrence of the species in these areas.

In some cases, occupancy survey results from prior years may be available for the site, section, or township of interest. This may be sufficient to inform the likelihood of occupancy at the site without expending the resources to conduct an occupancy survey. For example, if there is a known location where the species has been documented within 1 km (0.6 mi) of the site of interest, and there is sufficient connectivity between the two sites, occupancy may be assumed. In other instances, there may be three or more years of pre-existing surveys at a site that resulted in no detections of Dakota skippers, which may be sufficient to conclude the species is not present. We recommend that you coordinate with the NDFO to complete to ensure survey results being considered are reliable with regard to the Dakota skipper's status at a site.

Persons with sufficient expertise in prairie ecology, Dakota skipper ecology, or both should preview sites before the flight period to delineate survey areas. Pre-survey reconnaissance of action area and adjacent habitat could facilitate efficient use of limited surveyor time by delineating habitat patches that should be surveyed during the flight period. In some cases, occupancy surveys may be limited to those habitat patches directly affected by the footprint of the action.

Minimum Qualifications for Surveyors

Dakota skippers are not readily identified in the field without specialized training and experience. Therefore, agencies and others who want to determine whether or not the species is present in an area must secure the assistance of individuals who are qualified to carry out scientifically credible surveys and who are permitted to complete these surveys.

The Service assesses the qualifications of individuals pursuant to the following criteria:

1. Demonstrated ability to complete surveys for Dakota skippers or similar species and prepare technical reports to convey results; and,
2. Previous experience surveying and identifying Dakota skippers. Exceptions may be made for persons with prior experience with similar species and/or extensive experience with other butterfly species – e.g., extensive experience conducting surveys for other rare butterfly species.

Persons who may attempt to capture Dakota skippers during surveys need to obtain a permit from the Service (see, <http://www.fws.gov/endangered/permits/how-to-apply.html>). A list of persons who have obtained such permits and who have agreed to allow the Service to release their contact information may be obtained from the NDFO. To obtain a permit please contact the Service's Endangered Species Permit Coordinators in the Midwest and Mountain-Prairie regional offices or download the permit application form at <http://www.fws.gov/forms/3-200-55.pdf>.

Survey Ground Rules

We recommend that surveys adhere to the following 'ground rules' to ensure that results will be useful for determining whether Dakota skippers may be present in the survey area.

Timing & Number of Surveys

The initiation date for surveys is a critical component of data reliability for the Dakota skipper. Multiple surveys (minimum of three (3) during each flight period) are necessary to determine the species' likelihood of occurrence at a site because the species is exceptionally difficult to detect because the species often occurs at low density and it is difficult to identify. The start of the flight period varies considerably among years (Rigney 2013, p. 138; Dearborn and Westwood 2014, entire), but typically begins in mid to late June in North Dakota. The flight period occurs one time period per year and may last 13-19 days or less at any given site (e.g., Rigney 2013, p. 138). Recent information related to emergence in North and South Dakota (Skadson 2018, pers. comm.) place the flight period sometime between June 12th to July 15th.

- To ensure that surveys are initiated at the proper time (encompassing the peak of the flight period) requires documentation of the following:
 - emergence at one or more reference sites in North Dakota³, where the species occurs on an annual basis, and
 - the flowering plants within the action area are at the optimum phenological stage (see the section entitled *Phenological Indicators*).
- In survey areas where Dakota skipper surveys have never been conducted, continue surveys at least until:
 - One or more Dakota skippers is identified (complete the entire day of planned surveys to address the extent of occupancy at the site);
 - three (3) survey days have been completed at the site during the *peak*⁴ of the flight period; orat least two (2) surveys of the entire survey area have been conducted during the peak flight period over a two-year period (this option is available in cases where prolonged

³ Select the reference sites that are nearest to the site in question;

⁴ The likelihood of detecting Dakota skippers is low during the early and late stages of the 13-19-day flight period and may be highest during an approximately five-day period when the male flight overlaps with the peak of the female flight (Rigney 2013, p. 140).

unfavorable weather conditions may preclude three surveys at a location during the flight period).

Surveys:

- should be conducted between 1000 and 1730 hours (10:00 am – 5:30 pm);
 - should never be conducted during periods of fog, drizzle, or rain;
 - are recommended to be conducted only during periods of sustained or gusting winds that average *less than* 30 km/hr (19 mi/hr) measured during a 30 second period, at a height of 1.2-1.8 m (4-6 ft) above ground level (*corresponding to a Beaufort Scale of 4 or less*);
 - are recommended to be conducted when temperature in the shade at ground level is less than 21⁰ C (70⁰ F) and the cloud cover is less than 50 percent, or less than 30⁰ C (86⁰ F) when cloud cover is 50 percent or more..
 - Survey transect coordinates are available from NDFO for verifying Dakota skipper flight dates for permitted surveyors (included coordinates and access procedures).
- The three (3) surveys during one flight period should be separated by 48 hrs unless doing so would result in subsequent surveys occurring past the *peak* of the flight period. This recommendation to conduct field surveys on separate days is intended to increase the likelihood of detection. Given the short duration of the Dakota skipper flight period, surveys will not be rejected when they are not separated by 48hrs *if* justification is given, and, surveys are conducted under optimal weather conditions.

Phenological Indicators

Documentation of the phenological indicators is typically ***the most important consideration*** when deciding the date to initiate the first survey of the flight period. Phenological indicators also can aid a retrospective assessment of whether a previous survey for Dakota skipper was appropriately timed. There are two types of phenological indicators to consider: the emergence of other butterflies and the availability/abundance of nector sources.

The phenological progression of adult butterfly emergence in a Manitoba, Canada study area occurred as follows: European skipper (*Thymelicus lineola*), long dash (*Polites mystic*), tawny-edged skipper (*P. themistocles*), Peck's skipper (*P. peckius*), Dakota Skipper, silver-spotted skipper (*Epargyreus clarus*) and dun skipper (*Euphyes vestris*; Rigney 2013, p. 14). Peck's skipper, which is similar in appearance to Dakota skipper, emerged "immediately before and at the same time as Dakota Skipper" and that dun skipper emerged "near the end of the Dakota Skipper flight period" (Rigney 2013, p. 141). Notably, the peak flight period for the wood nymph (*Cercyonis pegala*), a conspicuous species in many Dakota skipper habitats, corresponded to the emergence of Dakota skippers (Rigney 2013, p. 141). Thus, life history of other butterfly species can be very useful towards informing the timing of the peak flight period for Dakota skippers

Plant phenology is also a reliable means to establish the timing of Dakota skipper surveys. The abundance and diversity of flowering plants should be used to better understand the preferred

nectar sources of butterflies. Therefore, all floristic data (numbers of individual flowering stems of plants observed) should be reported as part of the data collection for each survey (Appendix B).

In North Dakota, Dakota skippers are found in the following two general habitat types:

1. Type A Habitat

The first type is a low-lying, wet-mesic prairie with little topographic relief that occurs on near-shore glacial lake deposits. Royer et al. (2008, p. 14-16) referred to this as Type A Dakota skipper habitat.

Although Type A habitats vary throughout the growing season (Rigney 2013), during Dakota skipper's flight period, three plant species are almost always present and blooming: prairie lily (*Lilium philadelphicum*), bluebell bellflower (*Campanula rotundifolia*), and mountain deathcamas (smooth camas; *Zigadenus elegans*) - the latter appears to be an especially strong indicator of Dakota skipper Type A habitat in North Dakota (McCabe 1981, p. 190; Royer et al. 2014, p. 1).

Later in the season, common forbs in bloom in Type A habitat include Rocky Mountain blazing star (*Liatris ligulistylis*), Canada goldenrod (*Solidago canadensis*), strict blue-eyed grass (*Sisyrinchium montanum*), common goldstar (yellow star grass; *Hypoxis hirsuta*), and blackeyed Susan (Lenz 1999, p. 6). Type A habitats also contain small patches of dry-mesic prairie inhabited by Dakota skippers. Stiff sunflower (*Helianthus pauciflorus* Nutt. ssp. *pauciflorus*) and candle anemone (*Anemone cylindrica*) are typical in these dry-mesic habitats; purple coneflower (*Echinacea angustifolia*), an indicator of Type B habitats (see below) may be present, but is rare in these dry-mesic 'inclusions' (Lenz 1999, p. 6-11).

Plants that are important as nectar sources for Dakota skipper 'Type A' habitats appear to vary geographically, but blackeyed Susan (*Rudbeckia hirta* L. var. *pulcherrima*) is significant throughout the range of this habitat type. Habitat conservation value for Dakota skippers may be greater at sites where the presence of a variety of species that serve as nectar sources occurs because plant species likely vary in their energetic value or availability during the adult flight period (Dana 1991, p. 48).

Big bluestem (*Andropogon gerardii*) and little bluestem (*Andropogon scoparius*) are typically the dominant grasses in North Dakota 'Type A' habitats and indiagrass (*Sorghastrum nutans*) may also be present (Royer et al. 2014, p. 1). Dakota skipper adults are typically encountered in "pre-floral stands" of these grass species where they are associated with the forb species described above (Royer et al. 2014, p. 1).

2. Type B Habitat

Dakota skipper Type B habitat (Royer et al. 2008, p. 14), typically supports a high diversity and abundance of native forbs, including purple coneflower, purple prairie clover (*Dalea pwpurea*), white prairie clover (*D. candida*), yellow sundrops (*Calylophus serrulatus*), prairie groundsel (*Packera luttensis*), groundplum milkvetch (*Astragalus crassicaerpus*), eastern pasqueflower (*Pulsatilla patens*), old man's whiskers (prairie

smoke, *Geum triflorum*), western silver aster (*Symphotrichum sericeum*), dotted blazing star (*Liatris punctata*), tall blazing star (*L. aspera*), meadow zizia (heartleaf golden alexanders; *Zizia aptera*), blanket flower (*Gaillardia sp.*), prairie sagewort (*Artemisia frigida*), and leadplant (*Amorpha canescens*) (Skadsen 2006, p. 1-2). Prairie milkvetch (*Astragalus laxmannii* Jacq. var. *robustior*) also occurs in 'Type B' habitats in Minnesota (Dana 1997, p. 8).

In the rolling terrain of river valleys and the Missouri Coteau of North Dakota, on the western edge of the species' known range, Dakota skippers inhabit a variant of 'Type B' habitats (Fig. 5). These habitats typically contain an association of little bluestem, big bluestem, and needlegrasses that is often invaded by Kentucky bluegrass (*Poa pratensis*) (Royer and Marrone 1992, p. 22). These prairies, also typically contain prairie lily, bluebell bellflower, coneflowers, and other asters as nectar sources; in some areas, mountain death camas also occurs (Royer and Marrone 1992, p. 22).

Type B habitat (Royer *et al.* 2008, p. 14), occurs primarily on rolling terrain over gravelly glacial moraine deposits and is dominated by big bluestem, little bluestem, and needle or porcupine grasses (*Hesperostipa spp.*) (Fig. 4). As in 'Type A' habitats, bluebell bellflower and prairie lily are present in 'Type B' habitats, but they support more extensive stands of purple coneflower, upright prairie coneflower (*Ratibida columnifera*), and common gaillardia (blanketflower; *Gaillardia aristata*) (Royer *et al.* 2014, p. 1-2). Each of these is a documented nectar source for the Dakota skipper in 'Type B' habitats (McCabe 1981; Dana 1991).

Little bluestem and porcupine grass (*Hesperostipa spartea*) are the predominant grass species in South Dakota 'Type B' habitats, but side oats grama, needle-and-thread grass (*H. comata*), and prairie dropseed are also typical (Skadsen 2006, p. 1-2). In a variant of 'Type B' habitats found in western North Dakota (Fig. 5), western wheatgrass (*Pascopyrum smithii*) is also typical (Royer *et al.* 2014, entire).

Survey Routes and Survey Area

Data to Collect

- Record the location (GPS coordinates and projection); time of day; and *the plant upon which the individual was observed (if applicable)*.
- Record the *numbers of other butterfly species observed* in each survey area. Data regarding the identity and numbers of other butterfly species present during surveys should be collected because it may be useful in evaluating survey results. Rigney (2013, p. 142), for example, indicated that the ratio of Dakota skippers to long dash, tawny-edged skippers, Peck's skippers, and European skipper may be indicative of habitat quality for Dakota skipper.
- Record the route surveyed (GPS track log), number of surveyors, weather conditions (temperature, cloud cover, and wind speed), and observations about habitat conditions, threats, or

management *pre- and post-survey*. To the extent feasible, record the sex and condition of each Dakota skipper observed.

- Handling affects the behavior of some butterflies after their release (Mallet et al. 1987, p. 328). Therefore, we are seeking information with respect to the post-release behavior of any Dakota skippers that are captured and released. The behavior of each captured and released butterfly will be noted and reported annually as follows:
 - Flew to and perched on herbaceous vegetation, low shrubs, or to out-of-sight location in herbaceous vegetation (e.g., into plant litter or duff layer or into bases of grasses);
 - Flew into tall shrubs or trees and out-of-sight;
 - Flew away – did not see butterfly perch or fly into vegetation; or,
 - Post-release behavior unknown
- If the survey is conducted under the authority of an ESA section 10(a)1(a) permit issued by the Service for work in North Dakota, the surveyor must meet any additional requirements for collection and reporting per the conditions specified in the permit.

Additional Recommendations

- Surveys should be conducted by qualified surveyors walking along routes through the survey area (patches). Survey routes can cover up to 5 m (16.4 ft) meters on each side of the observer. Establish enough routes to ensure that the survey will cover all of the survey area. If a Dakota skipper sighting has been confirmed, no additional survey days are required. However, the entire day of surveys should be completed to address the extent of site occupancy.
- Conduct surveys at an average rate of 1-3 ha/hr (2-7 ac/hr, based on the 35 meters/minute survey pace and the assumption that five meters are effectively surveyed on either side of the observer, as reported by Royer and Royer 2012).
- Survey routes should be roughly parallel to each other, spaced approximately 10 m (32.8 ft) apart, and within 5 m (16.4 ft) of the survey area boundary to ensure complete coverage of the habitat.
- Do not conduct Dakota skipper surveys concurrently with any other focused survey, such as plant surveys, bird surveys, etc.
- Adjustments to the survey area boundaries may be made during the survey if areas that do not contain Dakota skipper habitat are encountered. Areas of no habitat should be mapped and described in the final survey report.

Identification of Dakota Skippers

- Positive identification of Dakota skippers may be confirmed by capture (netting) and release, close-up (perched) examination, or photo-documentation.

- Persons not qualified to conduct typical surveys for Dakota skipper may attempt to document the species' presence with photography. Surveys sufficient to support a presumption of absence, however, should follow the netting and release protocol.
- To ensure that species identity may be confirmed, multiple photos should be taken from both the dorsal and ventral perspective (Rigney 2013, p. 141). Negative surveys conducted by persons who do not meet the minimum qualifications for surveyors, described above, would not be considered sufficient as a basis for the species absence.

Results from surveys conducted under environmental conditions that do not conform to the optimum climatic and phenological conditions, or time of day and other recommended methods described herein may be considered *unreliable*.

Reporting Results

Provide in survey reports to the North Dakota Field Office. The following information should be included:

- Geographic coordinates of any Dakota skipper observed and a map depicting the survey area(s), and survey route(s).
- Provide maps depicting the location and extent of Dakota skipper habitat at the survey site. If possible, also provide the associated GIS data that could be used to identify the location and extent of Dakota skipper habitat, the survey area, and survey routes. Include coordinate system, projection and datum with all GIS data.
- For each survey include weather conditions: wind speed (or Beaufort Scale), air temperature, cloud cover, and the time at beginning and end of each survey route. In addition, include the number of flowering plants encountered during the survey (see Data Sheet in Appendix B).

Conclusion: Implication of Survey Results

If Dakota skippers are not detected at a site using the methods described herein (for either 1 or two seasons of surveys), the Service will consider the species absent from a site subject to the following circumstances:

- For sites > 1 km (0.6 mi) from a previously confirmed Dakota skipper sites:
 - Additional survey seasons of a site are unnecessary if the species has not been detected during three prior seasons of surveys. In this case, the site (plus the 200 m buffer) is considered 'not occupied by Dakota skippers' for a minimum of two (2) additional seasons (three (3) full seasons including the year of the last survey).
 - Additional survey seasons may be recommended to reassess species status at a site if the species is later confirmed to be present within 1 km (0.6 mi) of the site following the date of the last negative survey.

-
- For sites ≤ 1 km (0.6 mi) from a previously confirmed Dakota skipper sites:
 - Additional survey seasons of a site are unnecessary if the species has not been detected during three prior seasons of surveys. In this case, the site (plus the 500 m buffer) is considered ‘not occupied by Dakota skippers’ for a minimum of two (2) additional seasons (three (3) full seasons including the year of the last survey).

If one or more Dakota skippers are detected at a site, the Service will assume the site is occupied for a minimum of two additional years (three years total). Additional surveys before the three year minimum occupancy period are not recommended, but if completed and negative (no detections), the results will *not* supersede the occupied status. After three years, additional Dakota skipper surveys are recommended to update the occupancy status. A flowchart describing this process is included in Appendix C.

Literature Cited

- Dana, R. P. 1991. Conservation management of the prairie skippers *Hesperia dacotae* and *Hesperia ottoe*. Minnesota Agricultural Experiment Station, University of Minnesota, St. Paul, Minnesota. 63 p.
- Dana, R. 1997. Characterization of three Dakota skipper sites in Minnesota. Minnesota Department of Natural Resources, Natural Heritage and Nongame Research Program, St. Paul, MN. 17 p.
- Dearborn, K. and R. Westwood. 2014. Predicting adult emergence of Dakota skipper and Poweshiek skipperling (Lepidoptera: Hesperidae) in Canada. *Journal of Insect Conservation* 18:875-884.
- Haddad, N.R., 1999 "Corridor Use Predicted from Behaviors at Habitat Boundaries.," *The American Naturalist* 153, no. 2 (February 1999): 215-227.
- Lenz, D. 1999. Characterization of Dakota skipper habitat in the Towner-Karlsruhe prairie complex. Natural Heritage Inventory, Nature Preserves Program, North Dakota Parks and Recreation Department, Bismarck, North Dakota. 23 p.
- Mallet, James, and Michael C. Singer. "Individual selection, kin selection, and the shifting balance in the evolution of warning colours: the evidence from butterflies." *Biological Journal of the Linnean Society* 32, no. 4 (1987): 337-50.
- McCabe, T. L. 1981. The Dakota skipper: range and biology, with special reference to North Dakota. *Journal of the Lepidopterists' Society*. 35(3):179-193.
- Rigney, C. L. 2013. Habitat characterization and biology of the threatened Dakota skipper (*Hesperia dacotae*) in Manitoba. Masters of Science. The University of Winnipeg, Winnipeg, Manitoba, Canada. 259 p.
- Royer, R.A. and G.M. Marrone. 1992a. Conservation Status of the Dakota skipper (*Hesperia dacotae*) in North and South Dakota. U.S. Fish and Wildlife Service Endangered Species Office. Denver, CO. 44pp, plus maps and appendices.
- Royer, R.A., R.A. McKenney, and W.E. Newton. 2008. A characterization of non-biotic environmental feature of prairies hosting the Dakota skipper (*Hesperia dacotae*) across its remaining U.S. range. *Journal of the Lepidopterists Society*. 62:1-17.
- Royer, R.A., M.R. Royer, and E.A. Royer. 2014. Dakota skipper field survey and habitat assessment at twelve North Dakota sites during the 2014 season. A final report submitted to the Twin Cities Field Office, U.S. Fish and Wildlife Service, Bloomington, Minnesota. Minot State University, Minot, ND. 53p.

Skadson, D.R. 2006. Surveys for Butterflies Listed as Endangered, Threatened of Species of Tribal Concern on the Sisseton-Wahpeton Oyate lake Traverse Reservation. Natural History Investigations and Biological Services, Inc., Webster, SD. 18p.

Skadson, D.R 2018. Private consultant, Dakota skipper surveyor specialist. Telephone conversation with Jerry Reinisch, seasonal employee, US Fish and Wildlife Service, Ecological Services, Bismarck, North Dakota, January 18, 2018. Topic: survey methodology.

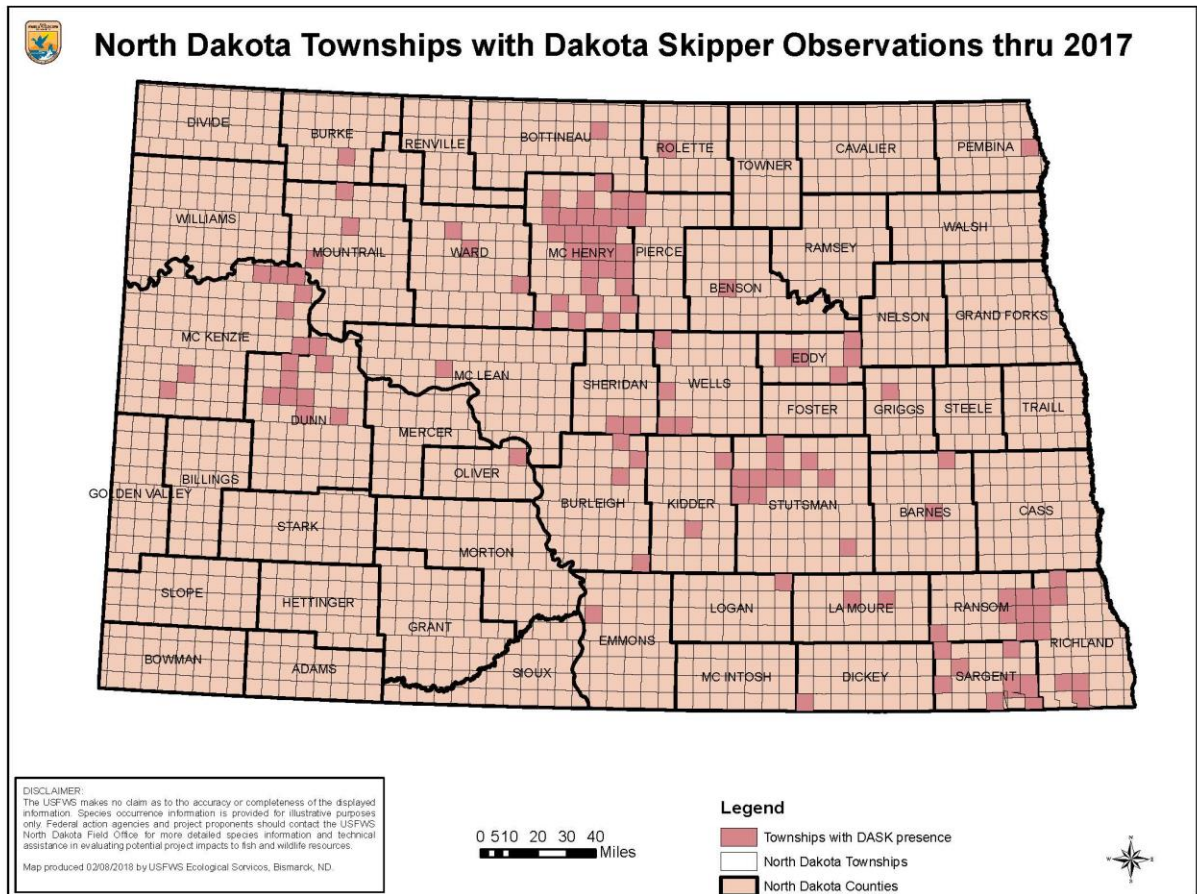
USFWS. 2017. County Occurrence of Endangered, Threatened, Proposed, and Candidate Species and Designated Critical Habitat in North Dakota. USFWS website. 1p.

USFWS. 2014. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Dakota Skipper and Endangered species Status for Powershiek Skipperling; Final Rule Federal Register 79:63672-63748.

APPENDICES

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix A



**Appendix B
Dakota Skipper Flowering Plant Line Count Data Sheet**

Site name/ID _____ Date _____
 County _____ Legal: ¼S, T, R _____
 Survey ___ of ___ Observer(s) _____

Species	Tally: flowering stems	n	Tally: non-flowering stems	n
Purple coneflower				
Milkweed (all spp.)				
Vetch (all spp.)				
Alfalfa*				
Thistle (all spp.)				
Yellow coneflower				
Prairie Violet				
Goldenrod				
Wild Rose				
Curlycup gumweed				
Blazing star				
Penstemon spp.				
Smooth fleabane				
Western wallflower				
Prairie lily				
Purple prairie clover				
Black-eyed Susan				
Scarlet globemallow				
Maximilian sunflower				
Spiderwort				
Harebell				
Silverleaf scurfpea				
Leadplant				
Wild bergamot				
R. Mtn. bee-plant				
Blanket flower				
Dandelion				

NOTES:

Appendix C

