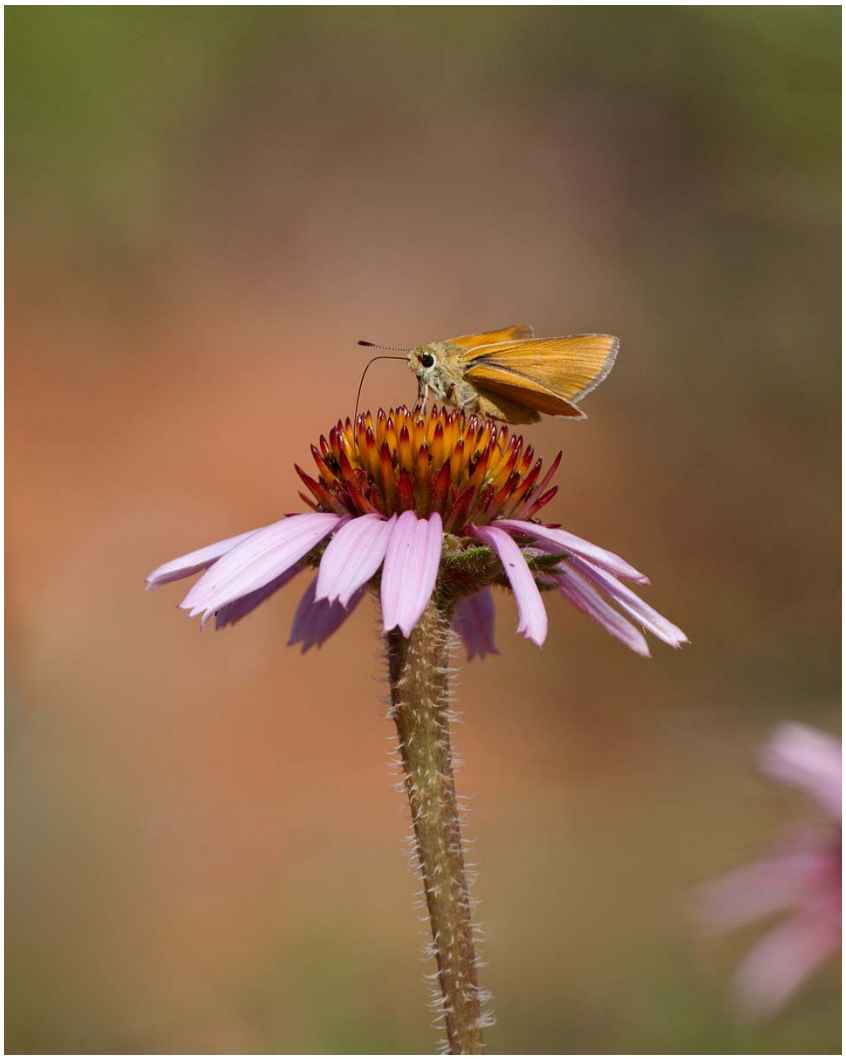
Monitoring Butterfly Species of Greatest Conservation Concern in South Dakota
2005-2009



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Federal Aid Report T-17-R
Study #2602 Monitoring Butterfly Species of Concern

Cover Photo: Arogos Skipper nectaring on *Echinacea purpurea*, Lawrence Co., SD
Photo by Doug Backlund

OBJECTIVE 1. By October 1, 2009, survey suitable habitat throughout the Black Hills and northeast South Dakota for the four target species.

See included reports summarizing the accomplishments of this objective.

OBJECTIVE 2. By October 1, 2009, collect information on plant species that are used as larval food sources and adult nectar sources.

See included reports summarizing the accomplishments of this objective.

OBJECTIVE 3. By October 1, 2009, develop a monitoring plan for the target species, if populations found that warrant monitoring.

See included reports summarizing the accomplishments of this objective. Pollard Count routes were established in the Black Hills and in northeast South Dakota.

OBJECTIVE 4. By October 1, 2009, collect and develop a list of other species at monitoring sites.

See included reports summarizing the accomplishments of this objective.

Summary of Five Years of Butterfly Monitoring in the Black Hills with Emphasis on Species Monitored by the South Dakota Natural Heritage Program

Report Submitted to:

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October 2009

Cover photo – male Regal Fritillary (*Speyeria idalia*) nectaring on purple coneflower

In 2005, the South Dakota Dept. of Game, Fish and Parks initiated a five-year study to conduct a butterfly survey of the Black Hills. The primary purpose of the survey was to determine the presence or absence of three species listed on the new Sensitive Species List and monitored by South Dakota Game, Fish and Parks Natural Heritage Program. The three species are: the Regal Fritillary (*Speyeria idalia*), Ottoe Skipper (*Hesperia ottoe*), and Dakota (Atlantis) Fritillary (*Speyeria atlantis pahasapa*). The Argos Skipper (*Atrytone arogos iowa*), another species monitored by the Heritage Program, was later added to the list of target species.

The objectives of the study and the subsequent work accomplished are included in this report.

OBJECTIVE 1. By October 1, 2009, survey suitable habitat throughout the Black Hills for the four target species.

Accomplishments: Three sampling periods (early July, mid July, and late August) were selected to coincide with the flight periods of the four target species. The northern and the southern portions of the Black Hills were surveyed in 2005 and 2006, respectively (Marrone 2005 and Marrone 2006).

In 2005, a total of 66 butterfly species, including two new county records, were encountered. Three of the four target species were found - the Dakota Fritillary, Ottoe Skipper, and Arogos Skipper. The Regal Fritillary was not found. The Dakota Fritillary was found at seven previously unknown sites, including two new county records – one in Meade County, South Dakota and another in Crook County, Wyoming. The Ottoe Skipper and Arogos Skipper were found at 3 and 5 new locations, respectively.

During 2006, a total of 55 butterfly species were found, including all four target species. The Dakota Fritillary was discovered at 12 new sites. The Regal Fritillary was found at one new site, while the Ottoe Skipper and the Arogos Skipper were found at 3 and 6 sites, respectively.

A total of 85 butterfly species were reported for the two years (Appendix A).

OBJECTIVE 2. By October 1, 2009, collect information on plant species that are used as larval food sources and adult nectar sources.

Accomplishments: During the five-year survey six nectar sources for the target species were documented (Table 1). For records of additional butterfly nectar sources refer to Marrone, 2005, and 2006.

No larval host plants were documented for any of the target species during the surveys. However, a female Dakota Fritillary was observed and photographed ovipositing near Viola spp. (likely northern bog violet) at the Dumont transect on July 16, 2007 (Marrone, 2007). Violets, including northern bog violet, meadow violet, and Canada violet are reported larval host plants for this species (Marrone 2002).

Adults of Ottoe Skipper and Arogos Skipper were observed near their known larval plants on numerous occasions during the five years of the study.

Table 1. Nectar sources for the target butterfly species documented during the five-year study.

SPECIES	NECTAR SOURCE	LOCATION	DATE
Regal Fritillary	wild bergamot	Wind Cave NP	07/23/06
Ottoe Skipper	none observed		
Dakota Fritillary	black-eyed Susan	Dalton Lake	07/03/05
Dakota Fritillary	Rocky Mountain gayfeather	McIntosh Fen – ungrazed wet meadow	07/23/09 08/03/09
Arogos Skipper	purple coneflower	Mirror Lake GPA	07/19/05
Arogos Skipper	purple coneflower	Elk Mt. campground, Wind Cave NP	06/25/06

Arogos Skipper	blue lettuce	Mirror Lake GPA	07/22/05
Arogos Skipper	woolly vervain	Mirror Lake GPA	07/22/05

OBJECTIVE 3. By October 1, 2009, develop a monitoring plan for the target species, if populations found that warrant monitoring.

Accomplishments:

Only one of the four target species were found to have populations at levels high enough to enable use of a census technique. Monitoring surveys for the Dakota Fritillary began in 2007 with the establishment of five Pollard Count surveys (Marrone 2007). Another three transect routes were added in 2008 at McIntosh Fen near Deerfield Lake. "Pollard Walk" surveys provide a systematic approach to monitoring the distribution and abundance of native butterflies (Pollard, 1977). The Pollard survey method was developed to assess changes in abundance of butterflies from year to year. The survey method can also provide considerable information on the phenology and ecology of target species.

The technique used to monitor butterflies in this survey was similar to that described by Pollard and Yates (1993) and Thomas (1983). A Global Position System (GPS) unit was used to locate longitude and latitude at the beginning and ending of each transect. Three sampling periods were selected during each year to encompass the entire flight period for the Dakota Fritillary. Each transect was traveled once during each sampling period. The following criteria were used in order to provide a degree of standardization:

(1) Counts were started after 1000 h Mountain Time and completed before 1600 h.
(2) Counts were made when temperatures were above 65°F.
(3) Transect length was a minimum of 0.50 miles.
(4) All butterflies were counted within a 16-ft. width, 16 ft. above ground, and within 16 ft. in front of the recorder.
(5) The aim of recording was not to count all butterflies present while the recorder traversed the route; rather, those butterflies were counted that the recorder saw while walking at a steady pace.

A standardized data form was used to record butterfly species on each site. Information regarding number per species, sex, condition of individuals, nectar sources, and behavioral aspects was recorded. Additional data was also collected on temperature, time of day, length of survey transect, habitat type(s), and weather conditions.

Dakota Fritillary abundance was measured by the number of individuals observed per mile traversed for each transect. The number of Dakota Fritillarys was then totaled for each site during the sampling periods and an average calculated for each site for each survey year (Tables 2 and 3).

During the three years of monitoring, Dakota Fritillary abundance (density) was greater in the southern Hills (Baker Draw and Spring Creek GPA transects) than in the northern Hills (Mt. Roosevelt and Little Spearfish Creek transects).

Additional years of data are needed before long-term trends for Dakota Fritillary populations can be evaluated.

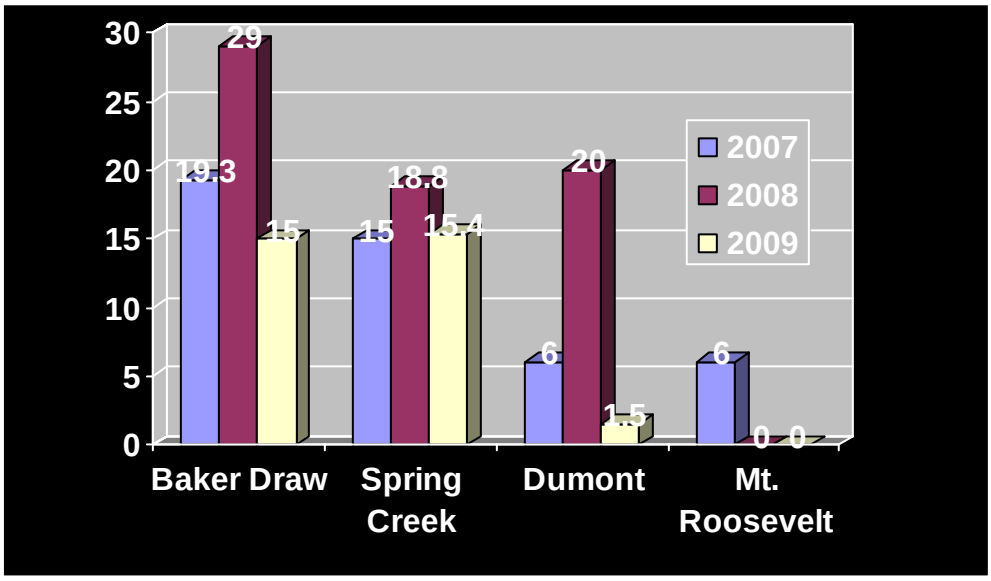

Table 2. Average number of Dakota Fritillarys observed per mile of transect (sampling periods for each year combined) for Baker Draw, Spring Creek GPA, Dumont, and Mt. Roosevelt transects.

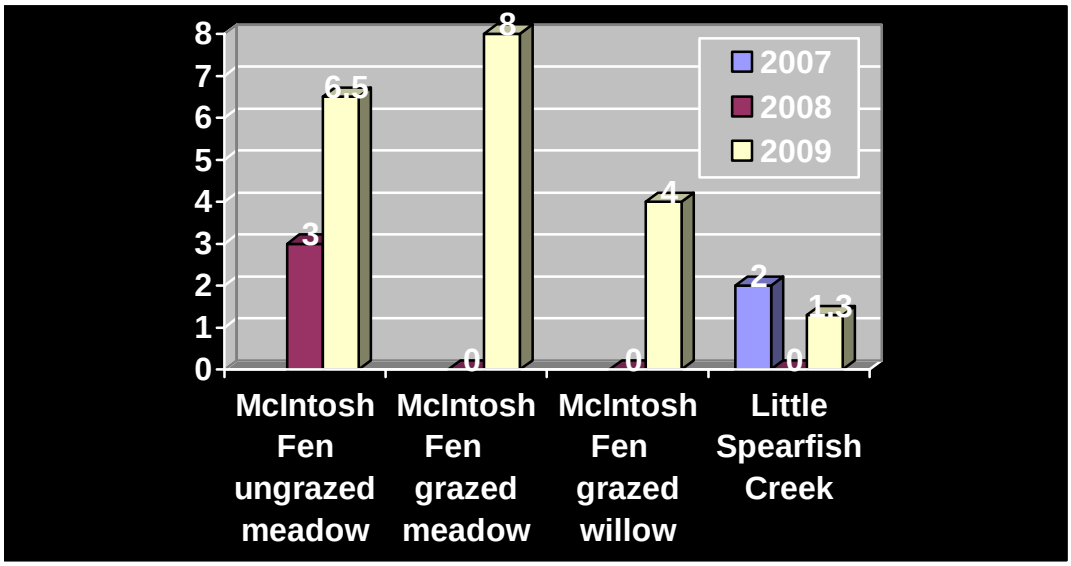

Table 3. Average number of Dakota Fritillarys observed per mile of transect (sampling periods for each year combined) for McIntosh Fen – ungrazed meadow, McIntosh Fen – grazed meadow, McIntosh Fen - grazed willow, and Little Spearfish Creek transects.

OBJECTIVE 4. By October 1, 2009, collect and develop a list of other species of butterflies at monitoring sites.

Accomplishments:

There are approximately 14,500 species of butterflies worldwide, with almost 700 of them occurring in the United States and Canada (Scott 1986). One hundred seventy-seven species have been reported for South Dakota (Marrone 2002). The number of butterflies documented for the Black Hills counties are: Custer – 118, Fall River – 94, Lawrence – 121, Meade – 91, Pennington – 127. A total of eighty-six butterfly species were encountered during this study (Appendix A).

RECOMMENDATIONS TO RESOURCE MANAGERS

1. Continue to conduct monitoring surveys for the Dakota Fritillary at the eight transect sites during two to three year intervals to determine long-term population trends.
2. Conduct future transect surveys at weekly intervals throughout the flight period of the Dakota Fritillary in order to determine population size and timing of peak emergence.
3. Protect and/or enhance habitats important to butterflies, especially springs or headwaters of small streams which have wet/boggy areas and open meadows with an abundance of flowering forbs. Eliminate livestock grazing in these areas by construction of fenced exclosures.
4. Control the encroachment of ponderosa pine/spruce into native prairie and streamside meadows.
5. Investigate alternatives to the use of herbicides for noxious weed control in order to protect larval host plants (violets) and nectar sources for the Dakota Fritillary.

Table 1. Sites where *Speyeria atlantis pahasapa* have been found with numbers of individuals recorded for each date visited from 2005 – 2009.

Table 4. Sites of additional observations of Dakota Fritillary

Site #	2005	2006	2007	2008	2009
#1 Little Spearfish Creek Hiking Trail	7/4, 7/12 0 2	7/7 5	6/26, 6/28, 7/5, 7/6, 7/15, 7/24, 8/6, 8/14 0 0 2 1 1 2 6 1	7/2, 7/11, 7/19, 7/26, 7/31, 8/12, 8/24 0 0 0 0 1 2 0	7/4, 7/12, 7/24, 8/4, 8/11 0 0 1 0 0
#2 Trail off USFS Rd. 133 to Mt. Roosevelt	7/19 10+	7/11 6	6/27, 6/30, 7/12, 7/15, 7/24 0 0 0 4 2	7/2, 7/19, 7/27, 8/6, 8/16 0 0 0 0 0	7/12, 7/24, 8/4 0 0 0
#3 Strawberry Picnic Area	7/19 <12	7/11, 7/17 0 1	7/12 1	7/7, 7/25, 8/6, 8/16 0 0 0 0	7/7, 7/22 0 0
#4 USFS Rd. 534, south of Galena	7/20 1	7/17 0	7/12 0		
#5 USFS Rd. 214 in Higgins Gulch, .2 mi. S of Crow Peak trail head	7/21 12	7/15 2	6/28, 7/13, 7/19, 7/31, 8/5 0 0 0 2 0	7/24, 8/11, 8/17 0 0 0	7/11, 7/27, 8/7 0 0 0
#6 USFS Rd. 214 in Higgins Gulch, 1 mi. SW of Griggs Gulch	7/21 2	7/15, 7/19 0 5	7/13, 7/19, 7/31, 8/5 0 0 6 0	8/11, 8/17 0 0	7/11, 7/27, 8/7 0 0 0
#7 Dugout Gulch Botanical Trail, Crook Co., WY	7/22 1	7/12 6	7/20, 7/31, 8/25 0 1 0	7/24 1	
#8 USFS Rd. 801 Crook Co., WY	7/22 1				
#9 USFS Rd. 222 near Potato Creek/Spring	7/22 1	7/12 6-10	7/31 0		
#10 #21533 along Hanna Road and also near #21577	7/6, 7/14, 7/28 0 0 1	7/14 1	7/2, 7/13, 7/23, 7/29 0 0 0 0	7/4, 7/5, 7/14, 7/27 0 0 0 0	7/6 0
#11 Hanna Campground	7/6, 7/8,	7/13	7/23	7/4, 7/10	7/6

	7/28 0 0 1	0	0	0 0	0
#12 Near Buck Spring Rd., .5 mi. NE of Black Fox Campground	7/30 15-20+	7/25 20+	6/27, 7/29, 8/7 0 0 1	8/5, 8/13, 8/26 0 0 0	7/15, 8/5 0 0
#13 USFS Rd. 232 off Hwy. 85	8/2 1	7/26 3	8/7 0		
#14 USFS Rd. 214, south end of Higgins Gulch	8/2 1				
#15 USFS Rd. 214-1F in Higgins Gulch	8/2 1	7/12 0	7/31 0		
#16 Dalton Lake, trail near USFS Rd. 704		7/6 5-10	7/10, 8/1 0 3	7/15, 7/29, 8/13 0 0 0	7/8, 7/26 0 5
#17 Boxelder Creek Walk In Fishery		7/6 6	8/1 2	7/15, 7/29, 8/13 0 0 0	7/8, 7/26 0 0
#18 Iron Creek Trail	7/4, 7/12, 7/14 0 0 0	7/5, 7/7 0 6	7/3, 7/6, 7/9, 7/11, 7/17, 7/23, 7/30 0 0 0 0 0 0 0	7/11, 8/18 0 0	7/5, 7/16, 7/19 0 0 0
#19 Intersection at USFS Rd. 222 and Iron Creek Lake Rd.		7/12 1	7/31 0	8/12 0	7/21, 8/4 0 0
#20 Higgins Gulch, .6 mi. from north entrance to State land		7/15 1			
#21 #21454 off Hwy. 85	7/29, 7/31 0 0	7/18, 8/2 1 0	7/2, 7/30 0 0		
#22 Ward Draw		7/22 1	6/30, 7/9, 7/20, 7/23, 7/24, 8/1, 8/7 0 0 0 0 0 4 1	7/10, 7/30, 8/5 0 0 6	7/6, 7/19, 8/1, 8/5 0 0 0 0

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LITERATURE CITED

Marrone, G.M. 2002. Field Guide to Butterflies of South Dakota. South Dakota Dept. of Game, Fish and Parks. 478 pp.

Marrone, G.M. 2005. A butterfly survey of the northern Black Hills and adjacent areas with emphasis on species monitored by the South Dakota Natural Heritage Program. A report to the Dept. of Game, Fish and Parks, Pierre, South Dakota.

Marrone, G.M. 2006. A butterfly survey of the southern Black Hills and adjacent areas with emphasis on secies monitored by the South Dakota Natural Heritage Program. A report to the Dept. of Game, Fish and Parks, Pierre, South Dakota.

Marrone, G.M. 2007. Monitoring surveys for the Dakota Fritillary (*Speyeria atlantis pahasapa*) in the Black Hills of South Dakota. A report to the Dept. of Game, Fish and Parks, Pierre, South Dakota.

Marrone, G.M. 2008. Monitoring srveys for the Dakota Fritillary (*Speyeria atlantis pahasapa*) in the Black Hills during the 2008 flight season. A report to the Dept. of Game, Fish and Parks, Pierre, South Dakota.

Marrone, G.M. 2009. Monitoring suveys for the Dakota Fritillary (*Speyeria atlantis pahasapa*) in the Black Hills during the 2009 flight season. A report to the Dept. of Game, Fish and Parks, Pierre, South Dakota.

Pollard, E. 1977. A method of assessing changes in the abundance of butterflies. Biol Conserv., 12:115-124.

Pollard, E. and T.J. Yates. 1993. Monitoring butterflies for ecology and conservation. Chapman and Hall, London, 274 pp.

Scott, J.A. 1986. The Butterflies of North America, A Natural History and field guide, Stanford, California: Stanford University Press.

Appendix A. List of common and scientific names of eighty-six butterfly species found during the five-year survey of the Black Hills.

COMMON NAME	SCIENTIFIC NAME
Black Swallowtail	*Papilio polyxenes asterius*
Old World Swallowtail	*Papilio machaon bairdii*
Anise Swallowtail	*Papilio zelicaon nitra*
Eastern Tiger Swallowtail	*Papilio glaucus*
Canadian Tiger Swallowtail	*Papilio canadensis*
Two-tailed Swallowtail	*Papilio multicaudatus*
Pale Swallowtail	*Papilio eurymedon*
Checkered White	*Pontia protodice*
Western White	*Pontia occidentalis*
Cabbage White	*Pieris rapae*
Large Marble	*Euchloe ausonides palaeoreios*
Clouded Sulphur	*Colias philodice*
Orange Sulphur	*Colias eurytheme*
Christina Sulphur	*Colias christina krauthii*
Dog Face	*Zerene cesonia*
Dainty Sulphur	*Nathalis iole*
Gray Copper	*Lycaena dione*
Bronze Copper	*Lycaena hyllus*
Purplish Copper	*Lycaena helloides*
Coral Hairstreak	*Satrium titus*
Striped Hairstreak	*Satrium liparops aliparops*
Juniper Hairstreak	*Callophrys gryneus siva*
Western Pine Elfin	*Callophrys eryphon*
Gray Hairstreak	*Strymon melinus franki*
Reakirt's Blue	*Hemiargus isola*
Western Tailed-Blue	*Everes amyntula valeriae*
Silvery Blue	*Glaucopsyshe lygdamus oro*
Melissa Blue	*Lycaeides melissa*
Greenish Blue	*Plebejus saepiolus amica*
Boisduval's Blue	*Icaricia icarioides pembina*
Lupine Blue	*Icaricia lupini*
Mormon Metalmark	*Apodemia mormo*
Variegated Fritillary	*Euptoieta claudia*
Great Spangled Fritillary	*Speyeria cybele*
Manitoba Fritillary	*Speyeria aphrodite manitoba*
Regal Fritillary	*Speyeria idalia*
Edwards' Fritillary	*Speyeria edwardsii*
Callippe Fritillary	*Speyeria callippe calgariana*
Dakota Fritillary	***Speyeria atlantis pahasapa***
Northwestern Fritillary	*Speyeria hesperis lurana*

Appendix A. (continued).

COMMON NAME	SCIENTIFIC NAME
Lakota (Mormon) Fritillary	*Speyeria mormonia kimimela*
Kohler's Fritillary	*Boloria selene sabulocollis*
Gorgone Checkerspot	*Chlosyne gorgone carlota*
Silvery Checkerspot	*Chlosyne nycteis*
Pearl Crescent	*Phyciodes tharos*
Northern Crescent	*Phyciodes cocyta*
Tawny Crescent	*Phyciodes batesii*
Pale Crescent	*Phyciodes pallida barnesi*
Green Comma	*Polygonia faunus hylas*
Hoary Comma	*Polygonia gracilis zephyrus*
Compton Tortoiseshell	*Nymphalis vaualbum j-album*
Mourning Cloak	*Nymphalis antiopa*
Milbert's Tortoiseshell	*Nymphalis milberti*
Red Admiral	*Vanessa atlanta rubria*
American Lady	*Vanessa virginiensis*
Painted Lady	*Vanessa cardui*
Viceroy	*Limenitis archippus*
Weidemeyer's Admiral	*Limenitis weidemeyerii oberfoelli*
Prairie Ringlet	*Coenonympha tullia benjamini*
Common Wood-Nymph	*Cercyonis pegala nephele*
Dark Wood-Nymph	*Cercyonis oetus charon*
Monarch	*Danaus plexippus*
Silver-spotted Skipper	*Epargyreus clarus*
Juvenal's Duskywing	*Erynnis juvenalis*
Afranius Duskywing	*Erynnis afranius*
Common Checkered Skipper	*Pyrgus communis*
Common Sootywing	*Pholisora catullus*
Garita Skipperling	*Oarisma garita*
Uncas Skipper	*Hesperia uncas*
Western Branded Skipper	*Hesperia colorado idaho*
Ottoe Skipper	*Hesperia ottoe*
Leonard's Skipper	*Hesperia leonardus pawnee*
Pahaska Skipper	*Hesperia pahaska*
Sachem	*Atalopedes campestris*
Peck's Skipper	*Polites peckius*
Tawny-edged Skipper	*Polites themistocles*
Crossline Skipper	*Polites origenes rhena*
Long Dash	*Polites mystic dacotah*
Arogos Skipper	*Atrytone arogos iowa*
Delaware Skipper	*Anatrytone logan lagus*
Woodland Skipper	*Ochlodes sylvanoides napa*
Hobomok Skipper	*Poanes hobomok*
Taxiles Skipper	*Poanes taxiles*
Kiowa Skipper	*Euphyes vestries kiowah*
Common Roadside Skipper	*Amblyscirtes vialis*
Strecker's Giant Skipper	*Megathymus streckeri leussleri*

Monitoring Tallgrass Prairie Lepidoptera Populations In Northeast South Dakota - 2009 Survey Results and Final Project Report

31 December 2009

Submitted to
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Regal Fritillary (*Speyeria idalia*)

Monitoring Tallgrass Prairie Lepidoptera Populations 2009 Survey Results And Final Project Report: 2005-2009

by
Dennis R. Skadsen

Introduction

This report documents data collected during a five year study to monitor prairie-dependent butterfly populations on remnant tallgrass prairies located in northeast South Dakota. Five sites were monitored utilizing Pollard Counts to monitor butterfly populations and Floristic Quality Assessments to monitor vegetative conditions. Sites were surveyed during three flight periods; late spring May 15 to June 15, early summer June 28 to July 15, and late summer August 15 to September 15, for ten target butterfly species deemed tallgrass prairie-dependent species.

Methods

Butterfly surveys were conducted from 2006 through 2009 using a modified Pollard Count along an established transect. Transects were established during the studies first year in 2005 and were located in areas where prairie-dependent species had previously been reported and where suitable habitat for these butterflies occurred. All butterflies observed in a 15 meter square in front of the observer along the transect route were recorded. An attempt was made to survey each site at least twice during the reported flight periods of the target species. When target species were encountered, the latitude and longitudes of the observation site were obtained using a Garmin eTrex Summit GPS Receiver. Individuals and multiple observations were not recorded if the sighting was less than 15 meters from the previous recorded sighting.

Floristic Quality Assessments were conducted along each survey route in 2006 to compare habitat quality between sites, and provide a means of monitoring the quality of each site over time as management practices change or are implemented to improve habitat quality. These results are given in Figure 4.

2009 Survey Results

A total of twenty-two days were spent in the field conducting Pollard Count or walk-through surveys, and three days were spent working with Game, Fish, and Parks personnel at Hartford Beach State Park and Pickerel Lake State Recreation Area implementing management plans to improve prairie habitat. Table 2 lists all species observed during 2009 Pollard Counts.

Many butterfly species were completely absent or extremely rare during this years survey due to weather. The National Weather Service's Aberdeen Forecast Office lists the summer of 2009 as being the fourth coldest on record for northeast South Dakota. The unusually cool temperatures that occurred throughout the spring and summer months of 2009 apparently had a significant impact on butterfly's especially multivoltine species whose first broods typically emerge in late spring. Many of these species were rare or

absent until late summer and included the Red Admiral, Tiger Swallowtail, and Black Swallowtail. The first Black Swallowtail was not observed until 4 September and the first Red Admiral was not observed until 5 September. Single brood species that typically emerge as adults in late June and early July like the Prairie Ringlet, Common Wood-Nymph, and Dakota Skipper were apparently unaffected by these weather patterns.

Walk through surveys were conducted at three sites in Roberts County in mid-July to locate the Poweshiek Skipperling after adults failed to appear at Scarlet Fawn Prairie. A walk through survey was also conducted on the Waddell Pasture located in Grant County. The landowner collects wildflower and native grass seeds from this site to sell to nurseries. Target species observed at these sites are listed in Table 1.

Table 1. Additional Survey Site Results

Site	County	Date Surveyed	Poweshiek Skipperling	Dakota Skipper	Regal Fritillary
Goodboy Prairie	Roberts	7/12/09	-	X	X
Hayes Prairie	Roberts	7/12/09	-	X	X
Oak Island Prairie	Roberts	7/12/09	-	X	-
Waddell Pasture	Grant	7/17/09	-	-	X

Table 2. 2009 Pollard Count Results

		Target Species																									
	Date	**Arogos skipper**	**Dakota skipper**	**Dusted skipper**	**Leonard's skipper**	**Plains skipper**	**Poweshiek skipperling**	**Regal fritillary**	Bronze Copper	Cabbage white	Clouded sulphur	Common wood-nymph	Long dash	Meadow fritillary	Melissa blue	Monarch	Orange sulphur	Painted lady	Pearl crescent	Prairie ringlet	Spotted skipper	Silvery Blue	Eastern Tiger swallowtail	Tawny-edged skipper	Variegated fritillary
Hartford Beach SP	6/3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6/10	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
	6/18	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
	6/24	0	**6**	0	0	0	0	**1**	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	6/29	0	**7**	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0
	7/1	0	**14**	0	0	0	0	**1**	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	7/10	0	**2**	0	0	0	0	**1**	0	0	0	3	0	0	0	0	6	0	0	0	1	0	0	0	1	1	1
	7/31	0	0	0	0	0	0	**1**	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Pickerel Lake SRA	6/5	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	6/17	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	4	0	0	0	0	0	0	0
	6/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7/4	0	0	0	0	0	0	0	0	1	0	0	2	0	0	1	0	0	2	0	0	0	0	0	0	0	0
	7/8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	7/9	0	0	0	0	0	0	0	0	0	4	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	7/11	0	0	0	0	0	0	**4**	0	0	2	3	3	0	0	1	8	0	4	0	0	0	0	0	0	0	1
	7/19	0	0	0	0	0	0	**1**	0	0	5	1	0	2	0	0	9	1	0	0	0	0	0	0	0	0	0
	8/22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	0	0	0	0	0	1	0	0	0	0
	9/4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	12	0	0	0	0	0	0	0	0	0	1
Scarlet Fawn	6/17	0	0	0	0	0	0	0	0	0	1	0	0	0	19	0	2	0	3	134	0	0	0	0	0	0	0
	6/23	0	0	0	0	0	0	0	1	0	0	0	5	0	21	2	0	0	1	59	0	0	0	0	0	0	3
	6/30	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7/4	0	**7**	0	0	0	0	0	0	0	0	0	5	0	2	0	0	0	0	0	0	0	0	0	0	2	0
	7/9	0	**16**	0	0	0	0	**6**	0	0	7	3	0	14	1	0	0	0	0	1	0	0	0	0	2	0

Main Study Site Locations and Descriptions

Hartford Beach State Park

Location: Roberts County, 6.5 miles east, 1 mile southeast, and 1 mile west of Wilmot, SD, U.S.G.S. 7.5 minute Big Stone Lake West, MN-SD, 1:24,000 topographic map quadrangle, 1971, NW ¼ SE ¼ Section 3, T122N R48W
Ownership: SD Dept. Game, Fish & Parks – Parks Division
Site Size: 12 acres
Habitat Type: Little Bluestem-Porcupine Grass Dry-Mesic Hill Prairie

Butterflies observed during the study:
Prairie-dependent species observed during study; Arogos Skipper, Dusted Skipper, Dakota Skipper, and Regal Fritillary. Both the Arogos Skipper and Poweshiek Skipperling formerly occurred at this site and were last observed in 2007 and 2002 respectively. Regal Fritillaries were rarely observed with an average observation of 1.5 per km. At 9 observations per km, Hartford Beach had the second highest number of Dakota Skipper observations of the four sites surveyed. Because this population of Dakota Skipper's is located on one of the smallest and most isolated prairie remnants, this population is most at risk of being extirpated in the future if not carefully managed and monitored. Twenty-three species of butterflies were observed during Pollard Counts on Hartford Beach's prairie.

Habitat Management
A management plan was implemented in 2008 to restore the parks remnant prairie (Figure 1). A prescribed burn was conducted on the west half of Unit 2 the spring of 2008, and mechanical shrub removal was implemented on Units 2 and 3. The east half of Unit 2 was burned the spring of 2009 and chemical control of shrubs was completed on Unit 3. A prescribed burn on Unit 3 is planned for spring 2010.

Pickerel Lake State Recreation Area – East Unit

Location: Day County, 6.75 miles east, 0.75 miles north, and 0.5 miles west of Grenville, SD, SW ¼ SE 1/4 Section 26 and N 1/2 Section 35, T124N R53W
Ownership: SD Dept. of Game, Fish & Parks – Parks Division
Site Size: 98 acres
Habitat Type: Little Bluestem-Porcupine Grass Dry-Mesic Hill Prairie.

Butterflies observed during study:
Prairie-dependent species observed during study; Dakota Skipper, Plains Skipper, and Regal Fritillary. Both the Arogos Skipper and Poweshiek Skipperling formerly occurred at this site and were last observed in 2004. The Regal Fritillary was rare with an average of only 0.5 observations per km during the study. Dakota Skippers had not been observed at this site since 2002. However a year after Unit 1 was burned the species was again observed on the site although in low numbers at 1.8 observations per km. The species may have returned to the site due to the increase in native forbs, especially Purple coneflower (*Echinacea angustifolia*), the year following the burn from a nearby pasture or from Unit 2 where two females were observed in 2009. Dakota skippers have been observed in the past on all three management units. Twenty-one species of butterflies were observed during Pollard Counts on Pickerel Lake State Park's prairie.

Habitat Management
A management plan has been implemented for Pickerel Lake State Recreation Area's east unit (Figure 2) to increase the diversity and abundance of native prairie forbs and grasses, and improve butterfly habitat. A prescribed burn was conducted in May 2007, and the site was fall hayed in September 2008 along with mechanical removal of trees and shrubs. Unit 2 was burned during May 2009, and fall hayed in September. Removal of trees and shrubs began fall 2009. A prescribed burn is planned for Unit 3 the spring of 2010.

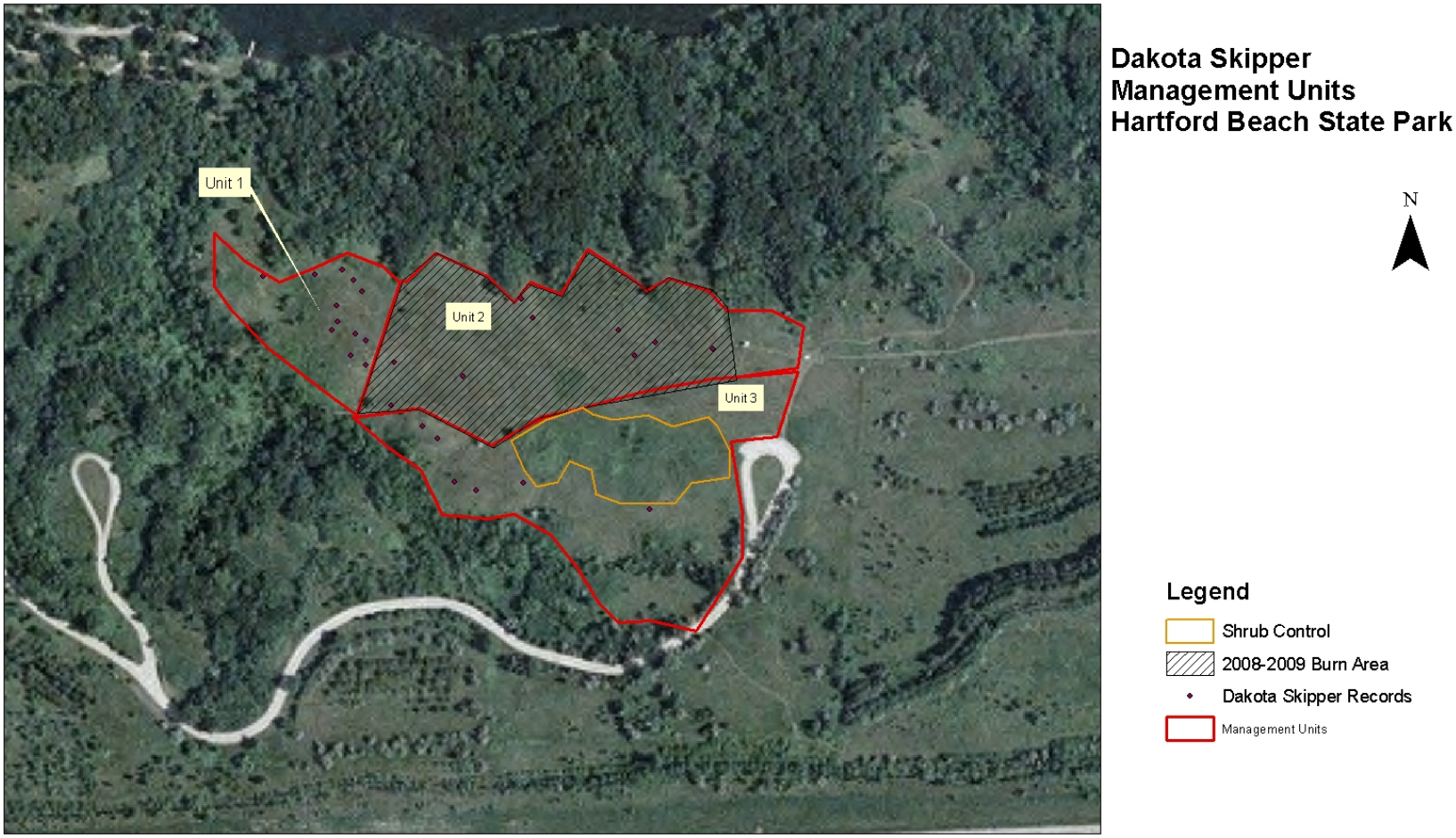

Unit 1
Unit 2
Unit 3
Dakota Skipper
Management Units
Hartford Beach State Park
N
Legend
Shrub Control
2008-2009 Burn Area
Dakota Skipper Records
Management Units

Figure 1.

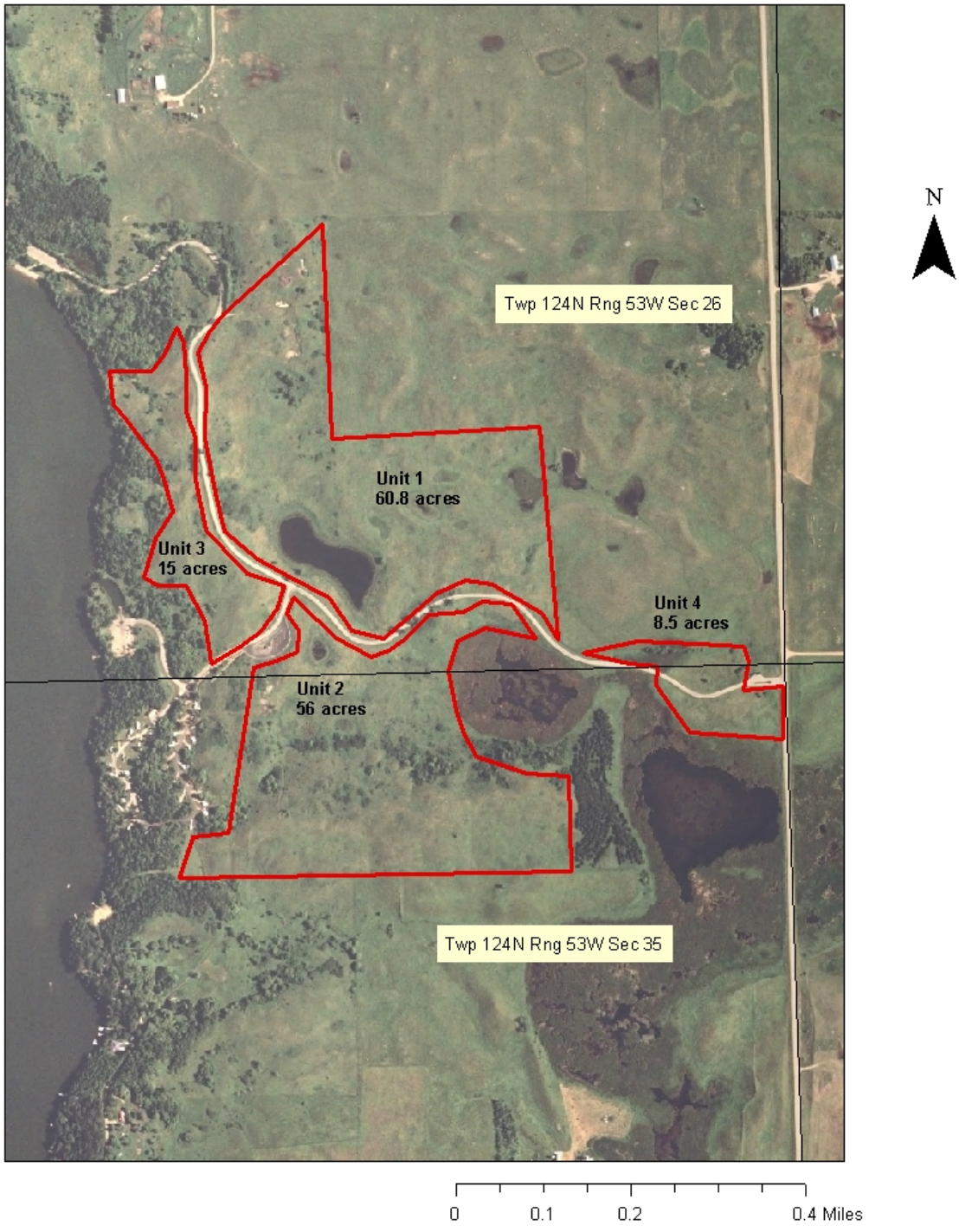

N
Twp 124N Rng 53W Sec 26
Unit 1
60.8 acres
Unit 3
15 acres
Unit 4
8.5 acres
Unit 2
56 acres
Twp 124N Rng 53W Sec 35
0
0.1
0.2
0.4 Miles
Pickerel Lake SRA - Prairie Mgt. Units

Figure 2.

Scarlet Fawn Prairie

Location: Day County, 1.5 miles east of Enemy Swim Village, SD, U.S.G.S. 7.5-minute Enemy Swim Lake West, SD, 1:24,000 topographic map quadrangle, 1970, NE ¼ Section 23, T123N R53W
Ownership: Sisseton-Wahpeton Oyate – Agency Village, SD.
Site Size: 273 acres
Habitat Type: Little Bluestem-Porcupine Grass Dry-Mesic Hill Prairie.

Butterflies observed during study:
Prairie-dependent species observed during study; Arogos Skipper, Dusted Skipper, Leonard's Skipper, Dakota Skipper, Poweshiek Skipperling, and Regal Fritillary. Both the Arogos Skipper and Poweshiek Skipperling have apparently been extirpated from this site. Only two Arogos Skippers were observed during the study in 2006 and the Poweshiek Skipperling disappeared in 2009. This prairie had the highest number of Dakota Skippers observed during the study with an average count of 10.3 observations per km. Both Prairie Ringlet and Melissa Blue butterflies were abundant at this site. On 17 June 2009 134 Prairie Ringlets were observed along the transect route. Twenty-five species of butterflies were observed during Pollard counts on the Scarlet Fawn Prairie.

Habitat Management
Site managed by annual fall haying typically started in late August or early September. This practice is probably detrimental to some prairie-dependent species like the Arogos Skipper and late flying species like the Plains and Leonard's Skippers. This management regime also seems to be favoring the growth of cool season grasses like Green Needlegrass (*Stipa viridula*). At least 50% of this site should be left uncut every year on a rotational basis to allow warm season grasses and forbs to seed, and leave enough vegetative habitat for food and shelter for both adult and larval stages of the abovementioned species. Some harvesting of native forbs by members of the Sisseton-Wahpeton Oyate occurs here and a portion of the site is utilized for ceremonies including sun dances. Surveys along the northern portion of the Pollard count route were not conducted during sun dances in mid-July.

Wattier Pasture

Location: 4 miles west, 7.5 miles south, and .75 miles east of Bristol, SD., U.S.G.S. 7.5-minute Crandall SD., 1:24,000 topographic map quadrangle, 1958, E ½ SE ¼ Section 5, T120N R59W.
Ownership: private
Site Size: 440 acres
Habitat Type: Little Bluestem-Porcupine Grass Dry-Mesic Hill Prairie.

Butterflies observed during study:
Prairie-dependent species observed during study; Dusted Skipper, Plains Skipper, Leonard's Skipper, and Regal Fritillary. Single male Dakota skippers were observed on this prairie in 2003 and 2004, however the species was not observed during this study despite suitable habitat. It is unclear why Dakota Skippers no longer occur on this site. Several Dakota skippers were observed on the adjacent Peckham Ranch prairie in 2007. The Wattier Pasture had the highest number of Regal Fritillary observations with a peak number of 119 observed during a Pollard count conducted on 10 July 2006. On average 20.3 Regal Fritillaries per km were observed during surveys at this site. The higher numbers of Regal Fritillaries is probably due to the fact this prairie is adjacent to several thousand acres of contiguous habitat and has a diverse and abundant population of tallgrass and mixed-grass prairie forbs and grasses. Twenty species of butterflies were observed during Pollard Counts on the Wattier Pasture.

Habitat Management
Managed with a rotational grazing system. Ownership of this site changed during the second year; however management of rotational grazing system remained unchanged. Site is currently being developed for wind energy with turbines expected to be installed on site by summer 2010.

Wike Waterfowl Production Area

Location: Roberts County, 0.5 miles west, 11.5 miles north, 1.5 miles east of Ortley, SD, U.S.G.S. 7.5-minute Drywood Lakes, SD, 1:24,000 topographic map quadrangle, 1970, East ½ Section 21, W ½ SW ¼ and NW ¼ Section 22, T124N R52W
Ownership: U.S. Fish & Wildlife Service – Waubay Wetland Management District, Waubay National Wildlife Refuge
Site Size: 406 acres
Habitat Type: Little Bluestem-Porcupine Grass Dry-Mesic Hill Prairie

Butterflies observed during study:
Prairie-dependent species observed during study; Dakota Skipper, Plains Skipper, Poweshiek Skipperling, and Regal Fritillary. All species listed above except for the Plains Skipper were rare at this site. On 23 August 2006, 25 Plains Skippers were counted with a frequency of 8.6 observations per km. Both Dakota Skipper and Poweshiek Skipperling had become absent by the studies third year, the Poweshiek was last observed in 2006 and the Dakota Skipper in 2007. The Regal Fritillary was also rare with an average of only 0.6 observations per km during the study. The low number of Regal Fritillaries observed and extirpation of the Dakota Skipper and Poweshiek Skipperling is most likely due to the deteriorating quality of the sites native vegetation as noted below. Twenty-four species of butterflies were observed during Pollard Counts on the Wike Waterfowl Production Area prairie.

Habitat Management
Managed in the past by prescribed grazing, however during the study the site was idle. The terrain of this WPA prohibits the use of fall haying as a management tool. Smooth brome has invaded much of the survey site and a lack of disturbance has led to a very low diversity and abundance of prairie forbs that are utilized as larval food and nectar sources for adults of prairie-dependent butterflies. Prairie-dependent species may return to this site if the vegetative quality were to improve.

Status of Tallgrass Prairie-Dependent Species in Northeast South Dakota

All of the species listed below depend on remnant tallgrass prairie for survival in northeast South Dakota. Some species like the Poweshiek Skipperling and Dakota Skipper only occur in this area of the state while other species like the Ottoe and Uncus Skippers occur statewide. A table listing the species and number of prairie-dependent butterflies observed for each site is given in the Appendix 1 with quantitative data on observations per hour and per kilometer for each survey. Common and scientific names used in this report follow Marrone (2002).

Arogos Skipper (*Atrytone arogos iowa*)

During the five-year study the Arogos Skipper was extremely rare with only one individual observed in 2006 at Scarlet Fawn Prairie, and two observed at Hartford Beach State Park in 2007. Royer and Marrone (1992) note the Arogos Skipper is nearly always encountered in low numbers, however with the number of surveys undertaken during this study the author expected to find this species more frequently. Due to the fact Arogos larvae build leaf shelters for pupation above ground, larvae are more at risk of being destroyed by grazing and fall haying. This may account for the absence of Arogos Skippers from Scarlet Fawn Prairie and the Wattier Pasture. The species formerly occurred at Pickerel Lake State Recreation Area where it was last observed in 2004 and may have become extirpated due to habitat degradation and the resultant loss of native forbs and grasses for larval and adult food. Royer (2003) stated that the Arogos Skipper was the most in danger of extirpation from North Dakota and based on this study the species may have become extirpated in northeast South Dakota. The species however is not restricted to northeast South Dakota and may still occur elsewhere throughout the state.

Dusted Skipper (*Atrytonopsis hianna*)

Marrone (2002) lists the Dusted Skipper as being locally uncommon in tallgrass prairies of northeast South Dakota. The Dusted Skipper was observed at Hartford Beach State Park in 2006, 2008 and 2009, Scarlet Fawn Prairie in 2007 and on the Wattier Pasture in 2006. During this survey the number of individuals observed was very low with an average of only 1.2 observations per km. This is one of the earliest prairie-dependent species to emerge in the spring with adults typically flying by late May. Dusted Skipper adult emergence dates may be more influenced by weather than mid-summer species like the Dakota Skipper. Cool wet spring weather and late frosts may delay adult emergence or shorten flight periods that may have been missed during this study due to the timing and number of surveys conducted. Adult flights seem to correspond with the blooming of Prairie turnip (*Psoralea esculenta*).

Plains Skipper (*Hesperia assiniboia*)

Marrone (2002) lists the Plains Skipper as rare or very local in northeast South Dakota. During this study the species was observed at Pickerel Lake State Recreation Area in 2006 and 2007; Scarlet Fawn Prairie, Wattier Pasture, and Wike Waterfowl Production Area in 2006. This butterfly was not found at Hartford Beach State Park. Observations made during this study indicate the Plains Skipper is probably more widespread and common then previously thought. The species apparently can survive on fairly degraded prairie remnants. Royer (2003) reports this butterfly can tolerate grazing pressure better than any of the other *Hesperia* species. Some taxonomists consider this butterfly a distinct species *Hesperia assiniboia* using the common name of Plains or Assiniboia Skipper. Others taxonomists treat this butterfly as a subspecies of *Hesperia comma*; *Hesperia comma assiniboia*.

Dakota Skipper (*Hesperia dacotae*)

Generally considered one of the rarest tallgrass prairie butterflies, however during this study it appears the Dakota Skipper is faring better than some of the other prairie-dependent butterflies in northeast South Dakota. The highest number of Dakota Skipper observations occurred on the fall hayed Scarlet Fawn Prairie with an average of 10.3 observations per km. Surprisingly the second highest number of observations is from Hartford Beach State Park which averaged 9.0 observations per km. Because of the difference in management between these two sites and their location in relation to contiguous habitat, it was expected Scarlet Fawn Prairie would have the largest population of Dakota Skippers. This species seems to slowly decrease as the vegetative quality of a site wanes as seen at Pickerel Lake Recreation Area and the Wike Waterfowl Production Area. As found at Pickerel Lake State Recreation Area however, management practices that increase the forb diversity and abundance may attract skippers from adjacent sites. Therefore Dakota Skipper's may reestablish populations on formerly degraded habitat. It is unclear why the species is absent on sites with suitable appearing habitat like the Wattier Pasture while present on the Peckham Ranch, an adjacent prairie with similar vegetative quality. It is possible pesticide use or some other factor not clearly evident is limiting the species survival on some prairie remnants like the Wattier Pasture.

Ottoe Skipper (*Hesperia ottoe*)

Not observed during this study. Marrone (2002) lists the Ottoe Skipper as being very local and generally uncommon to rare throughout South Dakota. The only record for northeast South Dakota was a worn female found by Marrone on East Blue Dog Prairie (Day County) in 1991. The flight period of the Ottoe coincides with the Dakota Skipper, however the species size distinguishes it from the latter. The author thought the species might occur on the larger mixed-grass prairies found along the western slope of the prairie coteau in Day County, especially the Wattier and Peckham sites. The Ottoe Skipper still occurs in two west-central Minnesota counties adjacent to South Dakota so the species may still occur on prairie remnants in Deuel and Brookings Counties; however recent surveys have found these Minnesota populations to be declining.

Leonard's Skipper (*Hesperia leonardus pawnee*)

Marrone (2002) lists the Leonard's Skipper as generally uncommon in eastern South Dakota. During this study the species was only observed at sites located along the western slope of the prairie coteau in Day County. On 25 August 2006, a total of 39 individuals were counted on the Wattier Pasture at 13.4 observations per km. The species was also observed in 2007 at the nearby Peckham Ranch. Prior to this study the only reported records for the Leonard's Skipper were from Bitter Lake located in Day County in 1966 and 1971; and Sica Hollow State Park located in Marshall County in 1966 and 1972.

Uncas Skipper (*Hesperia uncas*)

Not observed during this study. Marrone (2002) lists the species as locally common in northeastern South Dakota preferring mixed-grass prairie sites. The only records for this area reported by Marrone (2002) are from Bitter Lake in Day County in 1984 and a record for Deuel County from 1987. Like the Ottoe Skipper, the author thought this species may occur along the western slope of the prairie coteau in Day County. Coffin and Pfannmuller (1988) show the eastern limits of this species range reaching into eastern South Dakota and west-central Minnesota.

Poweshiek Skipperling (*Oarisma Poweshiek*)

In recent years the disappearance of the Poweshiek Skipperling has been the most disturbing with even stable appearing populations becoming extinct. The species formerly occurred at all study sites; Hartford Beach State Park where last observed in 2002, Pickerel Lake State Recreation Area where last observed in 2004, Wike Waterfowl Production Area where last observed in 2006, and Scarlet Fawn Prairie. At Scarlet Fawn Prairie 25 adults Poweshieks were counted on 9 July 2008 at 11 observations per kilometer; however in 2009 no adults were observed. In 2009, Poweshiek skipperling's were also absent at three other fall hayed remnant prairies near Scarlet Fawn where last observed in 2006; Goodboy Prairie, Hayes Prairie, and Oak Island Prairie. Since the species is univoltine (one brood per year), the entire population of larvae are dying sometime after the end of the adult flight in early July. It was presumed by the author that the decline at several of these sites was due to a lack of disturbance (fire, haying, grazing) that had resulted in a decline in the diversity and abundance of native forbs and grasses. Clearly however, there are other factors or a combination thereof that is causing this species extirpation not only in South Dakota, but also in Iowa, Minnesota, and North Dakota. A working group of butterfly specialists from several resource agencies and academia are developing models to determine why this species has suddenly become so imperiled. Since the Poweshiek Skipperling only occurs in northeast South Dakota where these declines have been observed, this species may now be the most endangered prairie-dependent butterfly in the state.

Uhler's Arctic (*Oeneis uhleri varuni*)

Not observed during this study. The Uhler's Arctic was last observed in northeast South Dakota in Roberts County by the author on the Knapp Ranch in 2002. Several specimens were collected by the author and Gary Marrone on prairie remnants found at the east unit of Pickerel Lake State Recreation Area in the 1980s, the last observation was in 1988. This is another species whose spring adult emergence may have been missed due to the timing and number of surveys conducted. Coffin and Pfannmuller (1988) show the eastern limits of this species range reaching into eastern South Dakota and west-central Minnesota.

Regal Fritillary (*Speyeria idalia*)

Marrone (2002) lists the Regal Fritillary as common in northeast South Dakota. The Regal Fritillary was observed yearly at every survey site with the highest numbers recorded on the Wattier Pasture and Scarlet Fawn Prairie. On 10 July 2006, 119 Regal Fritillaries (41 observations per km) were recorded along the Wattier Pasture transect with an average count of 20.3 individuals per km during the four years of surveys. The largest populations of Regal Fritillaries were found on the larger prairie remnants that were actively managed by either rotational grazing (Wattier) or fall haying (Scarlet Fawn). On idle sites (Wike WPA, Pickerel Lake State Recreation Area, and

Hartford Beach State Park) that had poor vegetative diversity and/or abundance, small size, or in the case of Hartford Beach, isolated from other prairie remnants by several miles, an average of only 1.3 Regal Fritillaries per km was observed.

Other Species of Interest

While the studies main purpose was to determine the status of several prairie-dependent species of butterflies in northeast South Dakota, records of all species observed during Pollard counts was kept. In addition to documenting the absence and decline of prairie-dependent species the study also recorded a decline in the number of Monarchs observed, another species that utilizes tallgrass prairie plants for larval and adult food. A severe decline in the number of Monarchs counted between 2006 and 2009 was documented and shown in Figure 3.

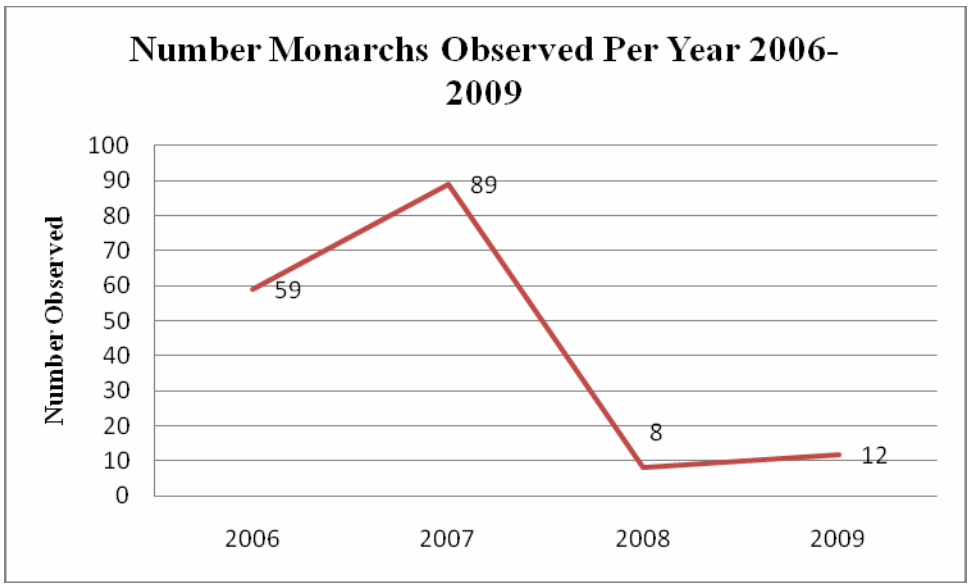


Figure 3.

Discussion

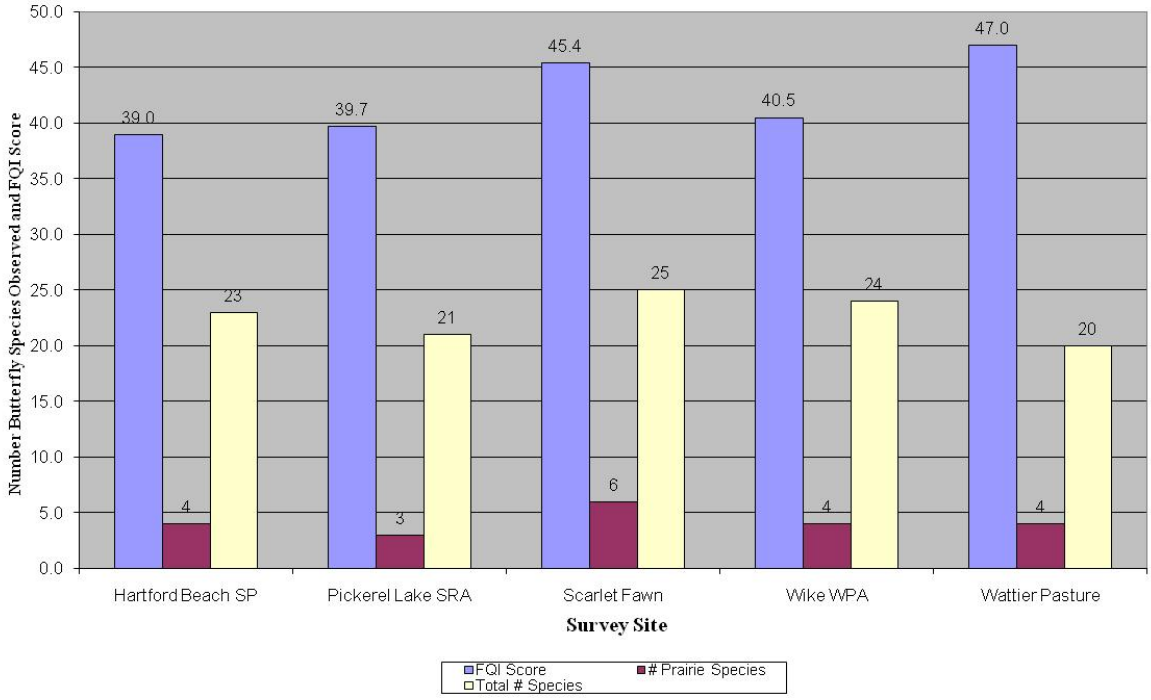
Sites managed by rotational grazing and fall haying did have a better diversity and abundance of native forbs and grasses than sites left idle, however the number of prairie-dependent butterflies did not necessarily increase with higher vegetative quality. For instance, the Wattier Pasture managed by rotational grazing had the highest Floristic Quality Index score (Figure 4), yet the number of prairie-dependent species was the same as two of the idle sites, Hartford Beach State Park and Wike Waterfowl Production Area. While fall haying may benefit a species like the Dakota Skipper, it can be detrimental to other prairie-dependent butterflies like the Arogos Skipper that have different larval requirements or species with different adult flight periods. At Scarlet Fawn Prairie at least half of the site should be left un-mowed each year to leave suitable habitat for the Arogos Skipper and late summer species like the Plains Skipper to utilize for food and shelter. The size of the prairie remnant and location in relation to other remnants is also important. The largest populations of Regal Fritillaries occurred on the Wattier Pasture and Scarlet Fawn Prairie, high quality prairies 200 acres or larger that are contiguous with other native tracts.

It is possible that Uhler's Arctic, Poweshiek Skipperling, and the Arogos, Ottoe, and Uncus Skippers no longer occur in northeast South Dakota. Some species like the Uncus and Ottoe Skippers may have been more common in the past than historic records indicate. However, it has been over twenty years since these two species have been

observed in northeast South Dakota, and the last records may have been from declining remnant populations that no longer exist. Surveys for prairie butterflies by the author have been ongoing since 1996 with dozens of sites surveyed all across the prairie coteau with no new records for these two species.

Data from this study shows a combination of remnant size, location, vegetative quality, and management has some impact on the number of species and population size of prairie-dependent butterflies. However, other less evident factors are apparently affecting the survival of prairie-dependent butterflies in northeast South Dakota.

Figure 4. FQI Scores and # Butterfly Species Observed Per Site



Recommendations

It is clear there are many unanswered questions as to why prairie-dependent butterflies are declining in northeast South Dakota. The loss of habitat by conversion to cropland and mining; and habitat degradation due to lack of management and invasive exotic plants have been well documented as reasons for declines. However, it is becoming clear that other factors, possibly disease, pesticides (Bt?), climate change, predation and parasites (Asian beetles?) or a combination of these factors are now causing prairie-dependent butterflies like the Poweshiek Skipperling to disappear at an accelerated pace. Clearly, protecting tallgrass prairie habitat from destruction and degradation should be the number one priority for maintaining the remaining populations of prairie-dependent butterflies. However, efforts should begin to determine the feasibility of captive rearing prairie-dependent butterflies and relocating existing populations to large well managed and protected sites to ensure long-term survival of these species. Further studies need to be implemented by academia to determine the less evident factors causing butterfly declines like climate change, pesticides etc.

Further surveys are probably now needed to determine if the Poweshiek Skipperling is still extant in northeast South Dakota, or if like Minnesota the species has been completely extirpated from the state.

Additional field personnel that can identify prairie-dependent species are also needed to conduct future surveys. Due to distance between sites and loss of survey days due to inclement weather it is difficult to visit enough sites

during the adult flight periods of these butterflies to collect sufficient data to determine a species status outside of a few sites. As the author found during this study, trying to conduct Pollard Counts at five sites was extremely difficult because of the aforementioned reasons. Walk-through surveys using GPS tracking to record routes and species locations may be just as effective and less time consuming that Pollard Counts. It is known that prairie-dependent butterflies like the Dakota Skipper are opportunistic and will move short distances as nectar sources increase or decrease, thus possibly moving off an established transect.

References

Coffin, Barbara and Lee Pfannmuller editors. 1988. Minnesota's Endangered Flora and Fauna. University of Minnesota Press, Minneapolis. 473 pp.

Marrone, Gary M. 2002. Field Guide to Butterflies of South Dakota. South Dakota Department of Game, Fish and Parks. 478pp.

Royer, Ronald Alan. 2003. Butterflies of North Dakota, An Atlas and Guide. Science Monograph Number Two, Minot State University. 192 pp.

Appendix 1.

		Obs/Survey								Obs/Hour								Obs/Km						
Site Name	**Date**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Hrs**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Km**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**
Hartford Beach SP	13-Jun-06		2						0.7		2.8						.9		2.2					
	26-Jun-06				2			1	0.9				2.2			1.1	.9				2.2			1.1
	3-Jul-06				2			1	0.5				4.0			2.0	.9				2.2			1.1
	19-Jun-07				22				0.7				31.4				.9				24.4			
	23-Jun-07	2			12			1	0.8	2.5			15.0			1.2	.9	2.2			13.3			1.1
	10-Jun-08		1						0.5		2.0						.9		1.1					
	23-Jun-08		1						0.6		1.7						.9		1.1					
	2-Jul-08				11				0.5				22.0				.9				12.2			
	6-Jul-08				10				0.6				16.7				.9				11.1			
	16-Jul-08				1			4	0.4				2.5			10.0	.9				1.1			4.4
	10-Jun-09		1						0.3		3.3						.9		1.1					
	18-Jun-09		1						0.5		2.0						.9		1.1					
	24-Jun-09				6			1	0.7				8.5			1.4	.9				6.7			1.1
	29-Jun-09				7				0.8				8.8				.9				7.8			
	1-Jul-09				14			1	0.6				23.3			1.7	.9				15.5			1.1
	10-Jul-09				2			1	0.5				4.0			2.0	.9				2.2			1.1
	31-Jul-09							1	0.3							3.3	.9							1.1
	Date	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Hrs**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Km**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**
Pickerel Lake SRA	22-Aug-06							1	0.6							1.7	0.9							1.1
	26-Aug-06			6				1	1.0			6.0				1.0	0.9			6.6				1.1
	24-Aug-07			2				1	0.8			2.5				1.2	0.9			2.2				1.1
	29-Aug-07							1	0.4							2.5	0.9							1.1
	8-Jul-08				1				0.8				1.2				0.9				1.1			
	13-Jul-08				3			2	0.9				3.3			2.2	0.9				3.3			2.2
	19-Jul-08				1			2	0.6				1.7			3.3	0.9				1.1			2.2
	11-Jul-09							4	0.8							5.0	0.9							4.0
	19-Jul-09							1	0.4							2.5	0.9							1.1

Aa = *Atrytone arogos*
Ah = *Atrytonopsis hianna*
Ha = *Hesperia assiniboia*
Hd = *Hesperia dacotae*
Hl = *Hesperia leonardus pawnee*
Op = *Oarisma poweshiek*
Si = *Speyeria idalia*

		Obs/Survey								Obs/Hour								Obs/Km						
Site Name	**Date**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Hrs**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Km**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**
Scarlet Fawn Prairie	1-Jul-06	1			7		52	6	1.8	0.5			3.9		28.9	3.3	2.0	0.5			3.5		26.0	3.0
	8-Jul-06				7		26	15	1.4				5.0		18.6	10.7	2.0				3.5		13.0	7.5
	20-Aug-06			2					1.2			1.7					2.0			1.0				
	8-Jun-07		2						1.1		1.8						2.0		1.0					
	22-Jun-07				20		14		1.3				15.4		10.8		2.0				10.0		7.0	
	30-Jun-07				16		9	15	1.0				16.0		9.0	15.0	2.0				8.0		4.5	7.5
	6-Jul-08				44		3	1	1.5				29.3		2.0	0.7	2.0				22.0		1.5	0.5
	9-Jul-08				48		25		1.4				34.3		17.8		2.0				24.0		12.5	
	4-Jul-09				7				1.0				7.0				2.0				3.5			
	9-Jul-09				16			6	1.0				16.0			6.0					8.0			3.0
	Date	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Hrs**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Km**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**
Wattier Pasture	6-Jun-06		3						2.9		1.0						2.9		1.0					
	28-Jun-06							34	2.8							12.1	2.9							11.7
	10-Jul-06							119	1.9							62.6	2.9							41.0
	25-Aug-06			2		39		5	3.4			0.6		11.5		1.5	2.9			0.7		13.4		1.7
	6-Jul-07							78	1.8							43.3	2.9							26.9
	Date	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Hrs**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**	**Km**	**Aa**	**Ah**	**Ha**	**Hd**	**Hl**	**Op**	**Si**
Wike WPA	29-Jun-06				6		11	1	2.3				2.6		4.8	0.4	2.9				2.0		3.8	0.3
	5-Jul-06						9	1	1.4						6.4	0.7	2.9						3.1	0.3
	23-Aug-06			25				5	2.7			9.2				1.8	2.9			8.6				1.7
	26-Jun-07				2			1	1.9				1.1			0.5	2.9				0.7			0.3
	30-Jun-07				2			1	1.3				1.5			0.8	2.9				0.7			0.3
	29-Aug-07							2	1.3							1.5	2.9							0.7

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