

A Butterfly Survey of the Southern Black Hills and Adjacent Areas with Emphasis on Species Monitored by the South Dakota Natural Heritage Program.



Report Submitted to:

**South Dakota Dept. of Game, Fish and Parks
Pierre, South Dakota**

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Cover photo -- Photo shows area bordering west side of Boland Ridge in Wind Cave National Park where the Regal Fritillary, Ottoe Skipper, and Arogos Skipper were found.

INTRODUCTION

In June 2006 the author was contracted by South Dakota Dept. of Game, Fish and Parks to conduct a butterfly survey in the southern half of the Black Hills and adjacent areas during the flight season in 2006. The primary purpose of the survey was to determine the presence or absence of three species recently listed on the new Sensitive Species List and monitored by South Dakota Game, Fish and Parks Natural Heritage Program; the Regal Fritillary (*Speyeria idalia*), Ottoe Skipper (*Hesperia ottoe*), and Atlantis Fritillary (*Speyeria atlantis pahasapa*). Emphasis was also placed on locating populations of the Arogos Skipper (*Atrytone arogos iowa*), another species currently monitored by the South Dakota Natural Heritage Program. The secondary intent of the survey was to collect information to be used to develop a monitoring plan for each species using a technique called "Pollard Walks" as described by Pollard and Yates (1993) and Thomas (1983). This study also provides recommendations to resource personnel so land management practices can be developed that will promote and/or enhance the existence of native butterfly species.

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, of which 118, 94, and 127 are documented for the Black Hills counties of Custer, Fall River, and Pennington, respectively (Marrone 2002).

METHODS

Three sampling periods (late June - early July, mid July, and late August) were selected to coincide with the flight periods of the four target species. 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 larval host plants was recorded. Additional data was also collected on temperature, time of day, habitat type(s), and weather conditions.

The census method known as a "checklist count", as noted by Royer *et al.* (1998), was used because of its effectiveness in confirming the presence of as many butterfly species as possible in a relative short period of time and effort. This casual or random technique for observing butterflies allows the surveyor to select likely concentration sites such as nectar sources, larval host sites, and potential habitat for specific species and avoid large areas with high densities of non-native plant species.

Common and scientific names of butterflies used in this report follow the book, *Field Guide to South Dakota Butterflies* by this author. A list of butterflies found during the survey is included in Appendix A. Common names of plants were taken from the publication (Larson and Johnson, 1999).

STUDY AREA

The area covered during this survey consisted of the southern Black Hills and adjacent areas (south of forty-four degrees latitude), which includes portions of Custer, Fall River, and Pennington counties in South Dakota. Survey sites were restricted to public lands, including U.S. Forest Service (USFS), South Dakota Dept. of Game, Fish and Parks (SDGFP), and Wind Cave National Park (WCNP). A large tract of private land known as the Whitney Preserve southwest of Hot Springs managed by The Nature Conservancy was also included in the survey. Major habitat types include Montane Forest (found in the higher elevations), Foothills Forests, and Open Ponderosa Pine Woodland and Savanna (both located along the edge of the Black Hills).

Upon consulting with SDGFP, WCNP, and USFS natural resource personnel and reviewing past collection records, eleven sites were chosen to search for the Regal Fritillary, Ottoe Skipper and Arogos Skipper. Sites examined for the Atlantis Fritillary were selected by checking topography maps for potential habitat such as small streams (particularly areas marked as springs) or with assistance with USFS and GFP personnel. A total of twenty sites were searched with success in finding one or more of these target species (Figures 1-4). Location and description of each site is presented in Table 1. Each site was searched for 15 minutes to 2 hours by walking through favorable habitat for butterflies. Length of time spent was determined by success of finding butterflies and size of the site.

RESULTS AND DISCUSSION

A list of butterflies and the numbers observed at each site during each visit are presented in Tables 2-4. A total of fifty-four butterfly species were encountered during the survey (Table 5). Voucher specimens were collected for selected species and have been deposited in the author's personal collection and the insect collection at Wind Cave National Park. All four of the target species were found – the Regal Fritillary, Atlantis Fritillary, Ottoe Skipper, and Arogos Skipper. A brief synopsis of the four target species is included in Appendix B. Past butterfly records for the southern Black Hills and observations made during this survey for the four species are listed in Appendix C-F.

COMMENTS ON TARGET SPECIES:

Regal Fritillary -- This large distinctive butterfly is common in northeast South Dakota in tall-grass prairie sites near marshes and undisturbed mixed-grass prairie along the Missouri River. It is generally restricted to areas where sufficient native prairie exists. Females wander extensively in late summer in search for oviposition sites. Populations seem to fluctuate from year to year and may account for the few records in the Black Hills area in favorable years. Most sightings for this species in extreme western South Dakota are of single specimens. Only three individuals of the Regal Fritillary (2 females and 1 male), all near Borland Ridge at site #4 in Wind Cave National Park, were observed. Past records along with these sighting indicate that a small population may have become established there. Due to their low numbers, attempts to monitor the Regal Fritillary using such techniques such as "Pollard Walks" at specific sites in the Black Hills area would probably be fruitless.

Atlantis Fritillary -- Subspecies *pahasapa*, type locality Deerfield Lake, Pennington County, is a recently described subspecies of the Atlantis Fritillary known only from the Black Hills. The butterfly prefers wet meadows and boggy areas near springs and headwaters of small streams. Twelve new sites were located for the species during this survey, including a southernmost record – site #12 in WCNP. Future monitoring efforts should consider using "Pollard Walk" surveys at sites 5a, 9, 11, 20, and 21.

Ottoe Skipper -- The Ottoe Skipper is one of many butterflies that are restricted to relatively undisturbed, mixed-grass to tall-grass prairie habitats and depend on scattered remnants for their survival. Distribution is very local and generally uncommon to rare throughout South Dakota and its entire range. This skipper is usually found in small numbers (the author has never seen more than a half dozen at one time at any given site) not far from big bluestem, the favored host plant for the larvae. Three new sites (#3, 13, and 14), all within WCNP, were found for the Ottoe Skipper during this survey. Because the species occurs in very small numbers at most known sites, conducting a "Pollard Walk" survey would probably be impractical.

Arogos Skipper -- This skipper is found locally throughout South Dakota and also requires relatively undisturbed prairies and grasslands. In western South Dakota, populations of this butterfly are generally found near patches of big bluestem on south facing slopes of rolling hills. The Arogos Skipper was found at six sites during this survey. The species can be occasionally common in some areas, as found at sites #4, 5a, and 16. Future monitoring efforts for this species using "Pollard Walks" could easily be established at sites 5a and 16.

A noteworthy find was the capture of two Uncas Skippers (one male and one female) at site #4 in Wind Cave National Park. Populations of this prairie butterfly seem to be on the decline due to loss of habitat; therefore it is recommended that the South Dakota Natural Heritage Program also monitor this species.

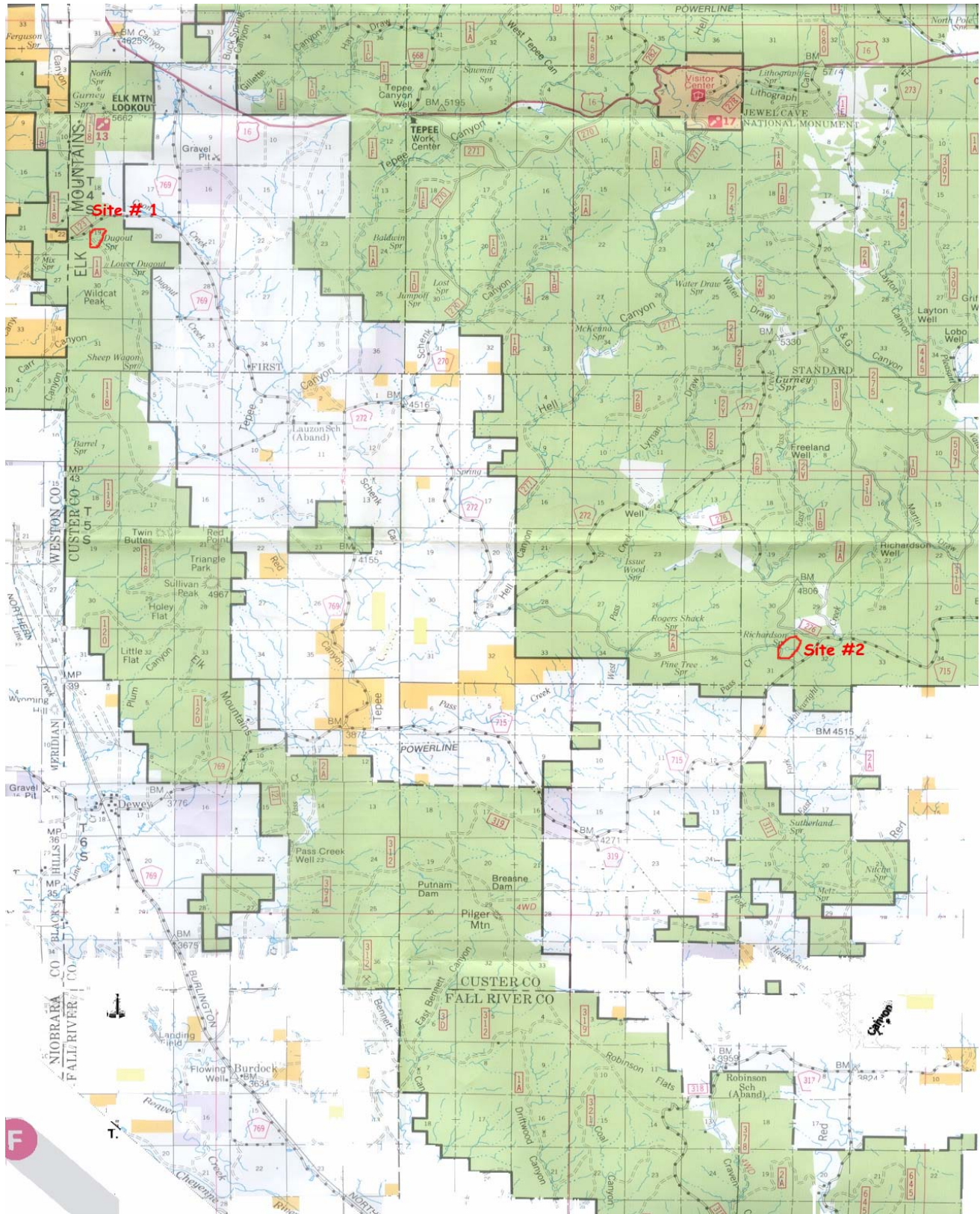


Figure 1. Location of survey sites number 1 and 2.

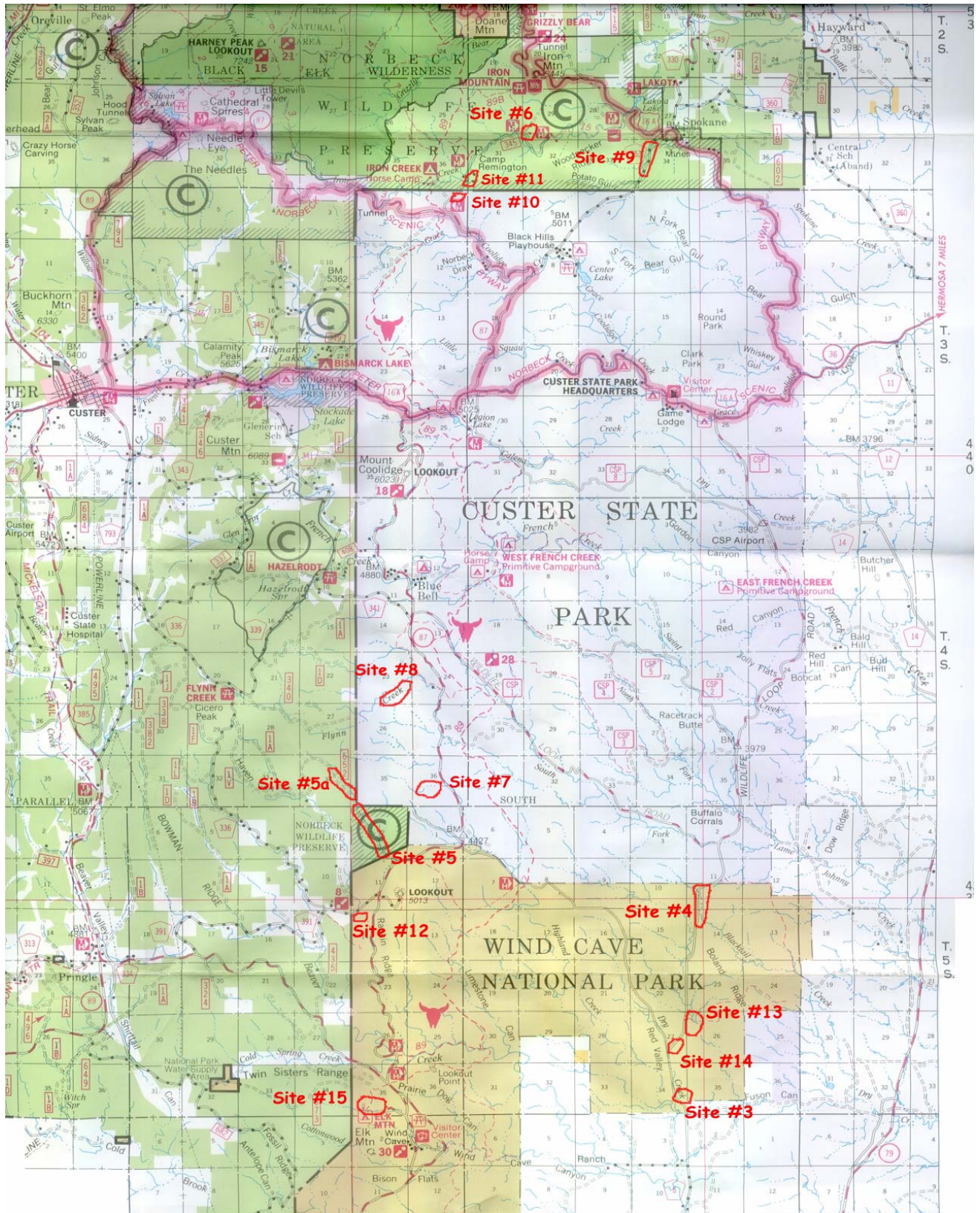


Figure 2. Location of survey sites number 3, 4, 5, 5a, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15.

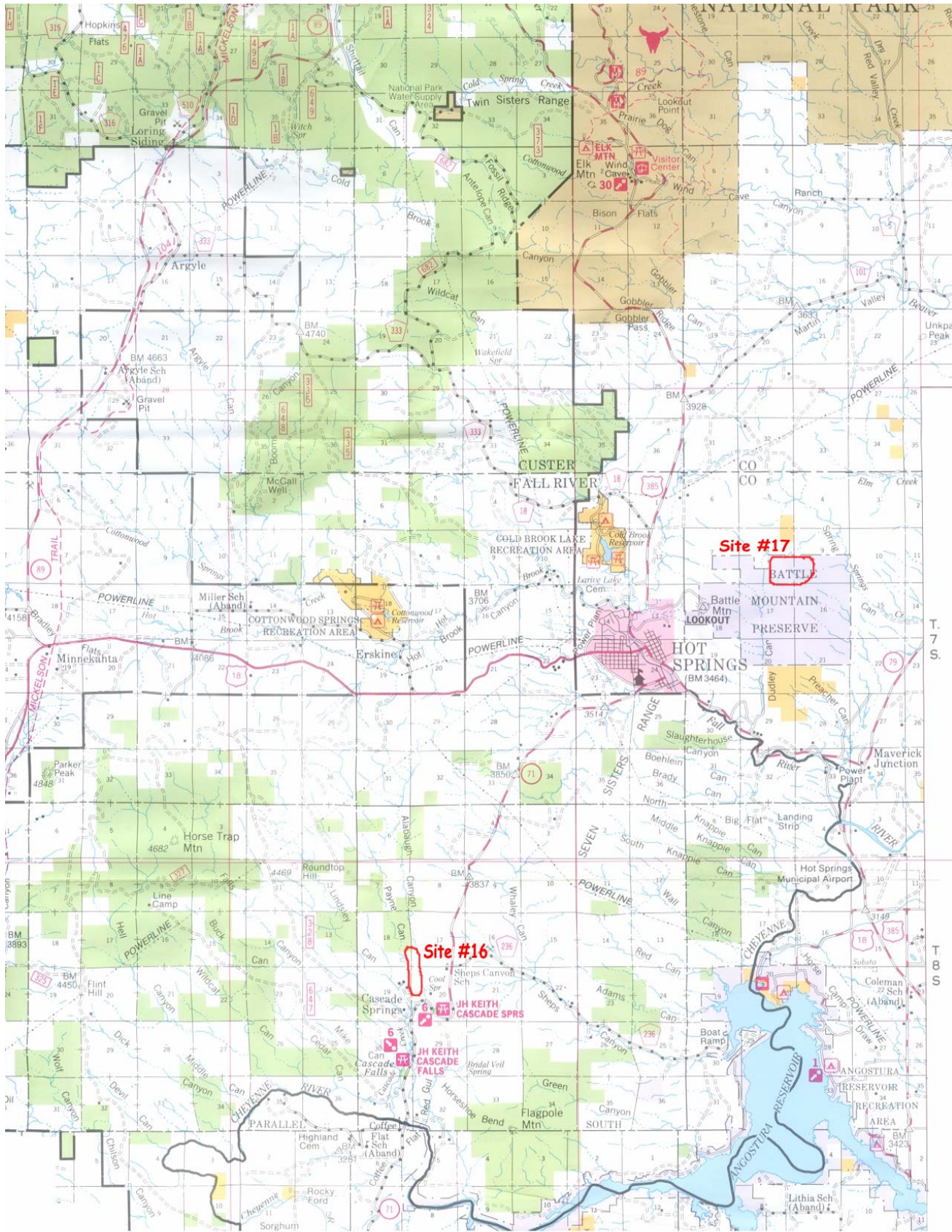


Figure 3. Location of survey sites number 16 and 17.

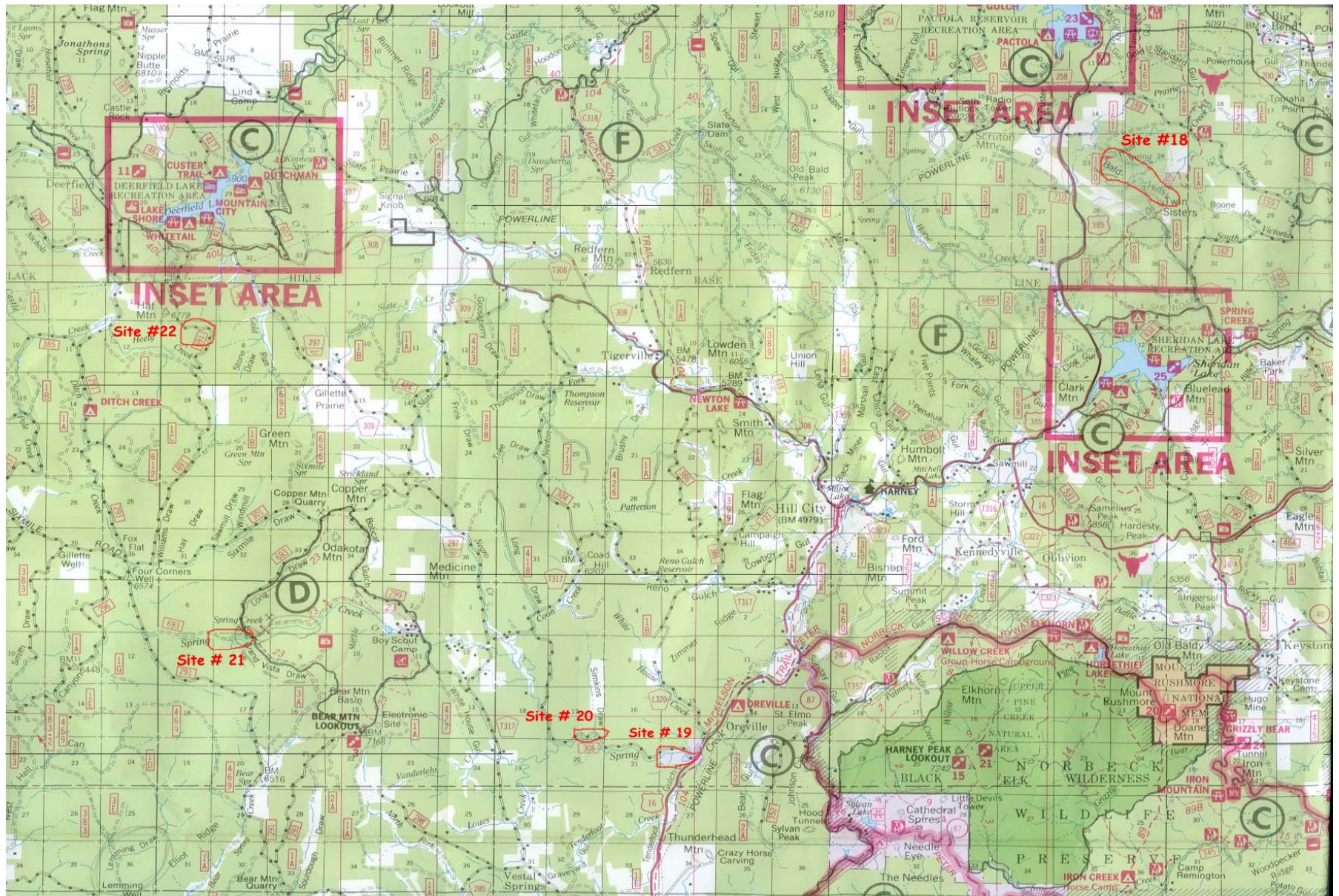


Figure 4. Location of survey sites number 18, 19, 20, 21, and 22.

Table 1. Location and description of butterfly sites visited during this survey.

SITE NUMBER	COUNTY	NAME, LOCATION, OWNERSHIP	DESCRIPTION	COMMENTS
1	Custer	Dugout Spring N43°41.301', W104°02.665' Federally owned and managed by USFS	Spring and manmade livestock pond (dugout) at headwaters of Dugout Creek. Riparian area contains juniper, green ash, willow, cottonwood, and ponderosa pine. Few nectar sources for butterflies were observed.	Smooth brome grass invasion along uplands. No big bluestem observed. Area not suitable for Atlantis Fritillary. Area heavily grazed by livestock, except in enclosure.
2	Custer	Richardson Spring T41N,R2E,Sec. 31, NE ¼ Federally owned and managed by USFS	Spring area within small livestock enclosure. Cattail, Canada thistle, sweetclover, and scentless chamomile common. No big bluestem present.	Larger area downstream from spring should be protected from livestock trampling. Habitat not suitable for the four targeted butterfly species.
3	Custer	Purple Coneflower Hill N43°34.014, W103°22.953' Federally owned and managed by WCNP	Small hill near southeast entrance of Wind Cave NP with short and mixed-grass prairie. Purple coneflower very abundant. Little bluestem, side-oats grama, and few small patches of big bluestem present.	Area moderately grazed by bison. Forbs include dotted gayfeather, gumweed, common sunflower, goldenrod, and ragwort. Ottoe Skipper and Arogos Skipper present.
4	Custer	Boland Ridge area N43°37.329, W103°22.591' Federally owned and managed by WCNP.	Large area of rolling hills with short and mid-grass prairies. Native grasses include sideoats grama, little bluestem; big bluestem abundant along and just below ridgetop. Forbs and shrubs include wild bergamot, western snowberry, skunkbrush, vervain, coneflowers, leadplant, slimflower scurfpea, yucca, gumweed, dotted gayfeather, and fewflower buckwheat.	Some smooth brome grass and Kentucky bluegrass invasion. Area moderately grazed by bison. Arogos Skipper, Ottoe Skipper, and Regal Fritillary found at this site.

Table 1. (continued).

SITE NUMBER	COUNTY	NAME, LOCATION, OWNERSHIP	DESCRIPTION	COMMENTS
5	Custer	Norbeck Wildlife Preserve northwest of Wind Cave NP T5S,R5E,Sec. 2 Federally owned and managed by USFS	Mixed-grass prairie in ponderosa pine forest. Area includes scattered patches of big bluestem, little bluestem, and sideoats grama; purple coneflower abundant.	Area needs controlled burn or managed livestock grazing to remove thatch and limit encroachment of ponderosa pine. A large population of the Argos Skipper found here.
5a	Custer	Beaver Ponds northwest of Norbeck Wildlife Preserve N43°39.553, W103°30.266 Federally owned and managed by USFS	Spring-fed drainage in ponderosa pine forest. Area contains aspen, birch, willow, serviceberry, cattail, thistles, black-eyed Susan, and red clover	Exclude livestock grazing from area. Atlantis Fritillary abundant on June 30.
6	Custer	Norbeck Wildlife Preserve 1 mile SE of Lakota Lake T2S,R6E,S29,SW ¼ Federally owned and managed by USFS	Spring with willow, birch, and aspen. Forbs common to area include wild bergamot and black-eyed Susan.	Excellent high quality area with limited or no livestock grazing. Atlantis Fritillary present.
7	Custer	Baker Draw N43°39.339, W103°28.586' State owned and managed by CSP	Headwaters of stream with some willow, birch, and aspen. Forbs include black-eyed Susan, red clover, vervain, wild bergamot and wild strawberry. Sedges and reeds also present.	Invasion of Canada thistle and timothy a serious problem to native habitat. Atlantis Fritillary common.

Table 1. (continued).

SITE NUMBER	COUNTY	NAME, LOCATION, OWNERSHIP	DESCRIPTION	COMMENTS
8	Custer	Flynn Creek N43°40.968, W103°29.354' State owned and managed by CSP	Small stream in pine forest with black-eyed Susan, false dandelion, horsemint, yarrow, and harebell. Reeds and sedges present in stream bottom.	Threats to native area include invasion of smooth brome grass, Kentucky bluegrass, and Canada thistle. Atlantis Fritillary uncommon .
9	Custer	Spokane Creek 1 mile SE of Lakota Lake T2S,R6E,S34 Federally owned and managed by USFS	Small stream with narrow wet meadows. Black-eyed Susan abundant.	Excellent area. Atlantis Fritillary present; consider "Pollard Walk" survey here for this species.
10	Custer	South of entrance to Camp Remington area T3S,R5E,S1,NE ¼ State owned and managed by GFP	Stream with aspen, pine, and spruce. Forbs include black-eyed Susan, horsemint, raspberry, and red clover.	Excellent area for "Pollard Walk" survey of Atlantis Fritillary.
11	Custer	Camp Remington area T2S,R5E,S36, SE ¼ Federally owned and managed by USFS	Stream with spruce, aspen, and pine. Forbs included black-eyed Susan, and red clover. Also present were forget-me-nots along stream bed.	Some smooth brome grass present. Potential area for "Pollard Walk" survey for Atlantis Fritillary.
12	Custer	West entrance to Wind Cave NP T5S,R5E,S35, NW ¼ Federally owned and managed by WCNP	Small spring-fed intermittent stream with willow, pine and few aspen. Forbs common to area include wild bergamot, black-eyed Susan, and common milkweed.	Canada thistle a threat to native vegetation. Atlantis Fritillary uncommon.
13	Custer	Red Hills south of spring N43°35.351, W103°22.871' Federally owned and managed by WCNP	Mid to short-grass prairie with small patches of big bluestem, little bluestem, and buffalo grass. Also present were fewflower buckwheat, thistles, and purple coneflower.	Area moderately grazed by bison. Ottoe Skipper found on barren hills in short-grass prairie habitat.

Table 1. (continued).

SITE NUMBER	COUNTY	NAME, LOCATION, OWNERSHIP	DESCRIPTION	COMMENTS
14	Custer	Red Valley near jct. of WCNP roads 5 & 6 N43°35.096, W103°23.061' Federally owned and managed by WCNP	Rolling red soil hills of short to mixed-grass prairie with little bluestem and sideoats grama. Forbs include fewflower buckwheat, wavy-leaf thistle, golden aster, and broom snakeweed.	Habitat in good to excellent condition; however overgrazing by bison may be a problem. One male Ottoe Skipper found at stand of sideoats grama.
15	Custer	Elk Mountain Campground area T5S,R5E,Sec. 35 Federally owned and managed by WCNP	Rolling hills of mixed-grass prairie with abundant leadplant, purple coneflower and scattered patches of big bluestem. Area fenced and protected from grazing by bison.	Area needs prescribed burn to remove thatch and prevent encroachment of ponderosa pine. Arogos Skipper common near patches of big bluestem.
16	Fall River	Whitney Preserve N43°23.166, W103°36.800 Privately owned and managed by The Nature Conservancy	Excellent native prairie with scattered ponderosa pine. Grasses in area include many patches of big bluestem, little bluestem, and needlegrass. Forbs observed were wavy-leaf thistle, purple coneflower, and abundant leadplant. Some yucca present.	Area not grazed by livestock for 13 years. Some encroachment of smooth brome grass and Kentucky bluegrass. Ponderosa has been removed in some of this area to enhance prairie habitat. Arogos Skipper abundant.
17	Fall River	Battle Mountain GPA N43°27.273, W103°26.536 State owned and managed by SDGFP	Mixed-grass prairie intermixed with ponderosa pine. Small patches of little and big bluestem present. Forbs include leadplant, purple coneflower, and thistles.	Smooth brome grass, Kentucky bluegrass, and ponderosa pine encroachment a major threat. Arogos Skipper uncommon.
18	Pennington	Bald Hills N44°01.613, W103°28.884' Federally owned and managed by USFS	Large open area of rolling, mixed-grass prairie hills with adjacent pine forest. Area contains needlegrass and scattered patches of big bluestem. Forbs observed were purple coneflower, harebell, leadplant, western wallflower, and thistles.	Excellent area; lightly to moderately grazed by livestock. None of the targeted butterfly species found; however this area should be surveyed again in future.

Table 1. (continued).

SITE NUMBER	COUNTY	NAME, LOCATION, OWNERSHIP	DESCRIPTION	COMMENTS
19	Pennington	Spring Creek GPA N43°51.901, W103°37.772' State owned and managed by GFP	Spring-fed stream with wet meadows containing spruce, birch, and willow. Forbs include red clover, black-eyed Susan, goldenrod, thistle, golden aster, fleabane, wild bergamot, and yellow clover.	Invasive noxious weeds include Canada thistle and common mullein. Herbicide spraying activity present. Atlantis Fritillary present; consider "Pollard Walk" survey here.
20	Pennington	Spring Creek N43°51.963, W103°39.500' Federally owned and managed by USFS	Spring-fed stream with willow, spruce, and birch. Forbs include red clover, black-eyed Susan, fleabane, yellow clover, wild bergamot, ox-eye daisy, Drummond thistle, cow parsnip, and water hemlock.	Smooth brome grass along roadside. Potential site for "Pollard Walk" survey of Atlantis Fritillary.
21	Pennington	Spring Creek Headwaters N43°53.759, W103°47.368' Federally owned and managed by USFS	Headwaters of spring with associated vegetation. Forbs include wild bergamot, yarrow, black-eyed Susan, wild geranium, and red clover.	Threats include invasion of smooth brome grass, timothy, Kentucky bluegrass, and Canada thistle. Area being over-grazed by livestock. Atlantis Fritillary common; consider "Pollard Walk" survey here.
22	Pennington	Heely Creek N43°58.641' W103°48.678' Federally owned and managed by USFS	Rolling hills of montane prairie grassland with golden aster, wild bergamot, red clover, blanket flower, and goldenrod.	Threats include invasion of Kentucky bluegrass, smooth brome grass, and timothy. One specimen of Atlantis Fritillary was observed along creek.

Table 2. List of butterflies found on twelve sites in the southern Black Hills and adjacent areas during June 27-July 4, 2006.

COMMON NAME	SURVEY SITE NUMBER												TOTAL	COMMENTS
	1	2	3	4	5	5a	7	8	15	16	17	18		
Canadian Tiger Swallowtail						1							1	worn
Two-tailed Swallowtail				4	3	6				6	6	1	26	
Western White					2				2			10+	14+	
Cabbage White	3												3	
Clouded Sulphur	20+	6	6	6	6	10+		6	4	6	2	10+	82+	
Gray Copper						1							1	
Juniper Hairstreak	1	4											5	
Gray Hairstreak						1							1	
Melissa Blue				2									2	
Variegated Fritillary									1				1	
Manitoba Fritillary	10+	2	6	20+	10+	20+		6	8	10+	10+	4	106+	mostly in good condition
Edwards' Fritillary	1	2		2	5	5				1	2		18	mostly in good condition
Atlantis Fritillary						15+	6	3					24+	fresh condition; 1 pair in copula
Kohler's Fritillary						2	15+						17+	fresh condition
Gorgone Checkerspot	1												1	
Silvery Checkerspot						1							1	worn
Northern Crescent						3							3	
Pale Crescent									1				1	worn; WCNP record
Green Comma										6			6	
Mourning Cloak	1	1				6		1					9	
Painted Lady	1												1	
Weidemeyer's Admiral	6					4			1		1		12	
Prairie Ringlet												2	2	
Common Wood-Nymph				10+		6	2	2				6	26+	
Monarch							2						2	
Silver-spotted Skipper	6												6	
Afranius Duskywing				2									2	
Common Checkered Skipper	1								1				2	
Ottoo Skipper			1										1	worn condition
Pahaska Skipper	2		1										3	worn condition
Crossline Skipper				6	40+	4			5	30+		3	88+	
Arogos Skipper			2	50+	40+				4	20+	1		117+	fresh & very abundant at site #4
Hobomok Skipper	1												1	
Taxiles Skipper						2							2	
Kiowa Skipper	6	2				20+	1						29+	common

Strecker's Giant Skipper										2		1	3	fresh	
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Table 3. List of butterflies found on seventeen survey sites in the southern Black Hills and adjacent areas during July 17-24, 2006.

COMMON NAME	SURVEY SITE NUMBER																	TOTAL	COMMENTS
	3	4	6	7	9	10	11	12	13	14	16	17	18	19	20	21	22		
Old World Swallowtail			1		1									1				2	nectaring on bergamot
Anise Swallowtail			1		1													2	nectaring on bergamot
Two-tailed Swallowtail		1	2								1							3	worn condition
Western White																	1	1	
Clouded Sulphur	2	2					2		2	1	3	3	3	5	10	5	10	48	
Orange Sulphur													1					1	
Christina Sulphur															4	6	4	14	
Gray Hairstreak									1									1	
Reakirt's Blue												1						1	nectaring on leadplant
Melissa Blue	1		1						1	1	1	1	4	1			3	14	
Greenish Blue																	1	1	
Variegated Fritillary									1		2		1				2	6	
Manitoba Fritillary		1	6	4	7		6	4					2			2		32	
Regal Fritillary		2																2	one male, one female
Edwards' Fritillary		2								1								3	fresh condition
Atlantis Fritillary			4	3	6	4	6	1						8	10	10	1	53	worn condition
Northwestern Fritillary			4				2							1	2	10		19	
Mormon Fritillary																	30	30	
Kohler's Fritillary				6										5				11	
Pearl Crescent			2				2										2	6	
Northern Crescent															1			1	
Green Comma																1		1	
Hoary Comma															1			1	
Mourning Cloak															2	1		3	
Red Admiral															1			1	
Weidemeyer's Admiral							1									1		2	
Prairie Ringlet														3	10	10		23	
Common Wood-Nymph		2	6	15			6	15					6	3	10	3	10	76	
Dark Wood-Nymph																10	15	25	
Monarch								1					2					3	

Table 3. (continued).

COMMON NAME	SURVEY SITE NUMBER																	TOTAL	COMMENTS
	3	4	6	7	9	10	11	12	13	14	16	17	18	19	20	21	22		
Uncas Skipper		2																2	nectaring on thistle
Ottoe Skipper									1	1								2	good condition
Long Dash																1		1	
Taxiles Skipper			2															2	
Kiowa Skipper								2							2	1		5	

Table 4. List of butterflies found on four sites in the southern Black Hills and adjacent areas during August 22-24, 2006.

COMMON NAME	SURVEY SITE NUMBER				TOTAL	COMMENTS
	3	4	15	16	38	
Clouded Sulphur	1	4		6	11	
Gray Hairstreak				3	3	
Melissa Blue	4	2	2		8	good condition
Lupine Blue		6			6	good condition
Variegated Fritillary		1			1	
Manitoba Fritillary			1	10+	11+	
Edwards' Fritillary	3	10		5	18	worn condition
Common Checkered Skipper		2			2	
Western Branded Skipper				10+	10+	
Leonards' Skipper	6	15+	2	10+	33+	fresh condition

Table 5. Number of butterflies found on twenty-three sites in the southern Black Hills and adjacent areas during June 27-July 4, July 17-24, and August 22-24, 2006.

COMMON NAME	SITE NUMBER																						TOTAL	
	1	2	3	4	5	5a	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Old World Swallowtail							1			1										1				3
Anise Swallowtail							1			1														2
Canadian Tiger Swallowtail						1																		1
Two-tailed Swallowtail				5	3	6	2										7	6	1					30
Western White					2											2			10+				1	15+
Cabbage White	3																							3
Clouded Sulphur	20+	6	9	12	6	10+			6			2		2	1	4	15	5	13+	5	10+	5	10+	141+
Orange Sulphur																			1					1
Christina Sulphur																					4	6	4	14
Gray Copper						1																		1
Juniper Hairstreak	1	4																						5
Gray Hairstreak						1								1			3							5
Reakirt’s Blue																		1						1
Melissa Blue			5	6										1	1	4	1	1	4	1			3	27
Greenish Blue																						1		1
Lupine Blue				6																				6
Variegated Fritillary				1										1		1	2		1				2	8
Manitoba Fritillary	10+	2	6	21	10+	20+	6	4	6	7		6	4			9	20+	10+	6			2		149+
Regal Fritillary				2																				2
Edwards’ Fritillary	1	2	3	14	5	5									1		6	2						39
Atlantis Fritillary						15+	4	9	3	6	4	6	1							8	10+	10+	1	77
Northwestern Fritillary							4					2								1	2	10+		19+
Mormon Fritillary																							30+	30+
Kohler’s Fritillary						2		21												5				28
Gorgone Checkerspot	1																							1
Silvery Checkerspot						1																		1
Pearl Crescent							2					2											2	6
Northern Crescent						3															1			4
Pale Crescent																1								1

Table 5. (continued).

COMMON NAME	SITE NUMBER																						TOTAL	
	1	2	3	4	5	5a	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22
Green Comma																	6					1		7
Hoary Comma																					1			1
Mourning Cloak	1	1				6			1												2	1		12
Red Admiral																					1			1
Painted Lady	1																							1
Weidemeyer's Admiral	6					4						1				1		1				1		14
Prairie Ringlet																			2	3	10+	10+		25+
Common Wood-Nymph				16		6	6	17+	2			6	15+						12	3	10+	3	10+	106+
Dark Wood-Nymph																						10+	15+	25+
Monarch								2					1						2					5
Silver-spotted Skipper	6																							6
Afranius Duskywing				2																				2
Common Checkered Skipper	1			2												1								4
Uncas Skipper				2																				2
Western Branded Skipper																	10+							10+
Ottoe Skipper			1											1	1									3
Leonard's Skipper			6	15+												2	10+							33+
Pahaska Skipper	2		1																					3
Crossline Skipper				6	40+	4										5	30+		3					88+
Long Dash																						1		1
Arogos Skipper			2	50+	40+											4	20	1						117+
Hobomok Skipper	1																							1
Taxiles Skipper						2	2																	4
Kiowa Skipper	1	2				20+		1					2								2	1		29+
Strecker's Giant Skipper																	2		1					3
Total species per site	14	6	8	15	7	17	9	6	6	4	1	7	5	5	4	11	13	8	12	8	11	12	12	

MANAGEMENT ISSUES AND RECOMMENDATIONS TO RESOURCE MANAGERS

1. **Management for ecosystem biodiversity would greatly benefit all native butterfly species.** Native habitats important to butterflies should be protected and/or enhanced, especially at water sources such as springs and headwaters of streams. Moffat and McPhillips (1993) discuss several management methods, including controlled burns, mowing, and grazing, specific for prairie endemic butterfly species that would be applicable to the southern Black Hills region.
2. Invasion of non-native grasses, particularly smooth brome grass, timothy, and Kentucky bluegrass, into native habitats should be prevented. Prescribed burns in infected areas may help control these three plant species.
3. Most butterfly species, including the four target species listed, inhabit sunny areas such as meadows and open prairies. Large open areas, especially around headwaters of springs and beaver ponds, should be created to provide habitat for flowering forbs and larval host plants used by butterflies, especially the “species of concern.” These areas should also be protected from livestock trampling with the construction of fenced exclosures.
4. Areas disturbed by new road construction, timber harvest, wild fires, etc. should be restored with grasses, wild flowers, and shrubs native to the area.
5. Periodically (at least once in every 4 years) monitor butterfly abundance and diversity at selected sites. “Pollard Walk” surveys can provide a systematic approach to monitoring the distribution and abundance of native butterflies as described by Pollard and Yates (1993) and Thomas (1993). Transect routes for this type of survey could be conducted for the Atlantis Fritillary at sites number 5a, 7, 9, 11, 19, 20, and 21.
6. Comments and recommendations specific to selected survey sites include the following:

(A). Site #3 (Purple Coneflower Hill) – This area of rolling hills with short and mixed-grass prairies has an abundance of purple coneflower, a favored nectar source of the Ottoe Skipper and other prairie butterflies.



Photo 1. Photo taken from the base of “Purple Coneflower Hill” that shows location of the Ottoe Skipper sighting.

(B). Site #4 (Boland Ridge) – This large area of the Red Valley geologic formation within Wind Cave National Park is mostly short and mixed-grass prairies interspersed with open pine forest.



Photo 2. Photo shows portion of Boland Ridge area with its red soils and sparse vegetation containing short-grass prairie plants, including sideoats grama, buffalograss, blue grama, and fewflower buckwheat. Inset shows an Uncas Skipper nectaring on wavy-leaf thistle. Uncas Skipper larvae feed on blue grama.

(C). Site #5a (Beaver Ponds northwest of Norbeck Wildlife Preserve) – Seventeen butterfly species were observed on this diverse site. The area should be protected from livestock grazing and open areas along stream bottom maintained by removal of ponderosa pine.



Photo 2. Photo shows the largest of several beaver ponds at site #5a. The spring-fed area above this pond could be a potential site for a “Pollard Walk” survey of the Atlantis Fritillary.

(D). Site #6 (Norbeck Wildlife Preserve one mile southeast of Lakota Lake) – This pristine area, protected from livestock grazing, is an excellent example of quality habitat for the Atlantis Fritillary. Abundant nectar sources and larval hostplants are available for butterflies.



Photo 3. Photo shows typical habitat for the Atlantis Fritillary – a small spring-fed stream bordered with willow, spruce, aspen, and an abundance of flowering forbs including black-eyed Susan, wild bergamot, and red clover.

(E). Site #15 (Elk mountain campground) – The large fenced enclosure surrounding the campground has developed into an exceptional prairie habitat for the Arogos Skipper. The abundant purple coneflowers provide a nectar source for many of the prairie butterflies.



Photo 4. Photo taken within enclosure of Elk Mountain Campground at Wind Cave National Park showing the abundance of undisturbed big bluestem, the larval hostplant of the Arogos Skipper. Lower inset is of a female Arogos Skipper nectaring on purple coneflower.

(F). Site #16 (The Nature Conservancy Whitney Preserve) – Large tracts of open areas protected from encroachment of ponderosa pine and excessive livestock grazing provide excellent habitat for prairie dependant butterfly species. The Arogos Skipper, which utilizes big bluestem as a larval hostplant, was abundant at this site.



Photo 5. Photo shows a portion of the large area where ponderosa pine removal has enhanced the growth of native prairie forbs and grasses, especially the big bluestem seen in the foreground.

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Appendix A. List of common and scientific names of fifty-four butterfly species found during the survey of the southern Black Hills and adjacent areas.

COMMON NAME	SCIENTIFIC NAME
Old World Swallowtail	<i>Papilio machaon bairdii</i>
Anise Swallowtail	<i>Papilio zelicaon nitra</i>
Canadian Tiger Swallowtail	<i>Papilio canadensis</i>
Two-tailed Swallowtail	<i>Papilio multicaudatus</i>
Western White	<i>Pontia occidentalis</i>
Cabbage White	<i>Pieris rapae</i>
Clouded Sulphur	<i>Colias philodice</i>
Orange Sulphur	<i>Colias eurytheme</i>
Christina Sulphur	<i>Colias christina krauthii</i>
Gray Copper	<i>Lycaena dione</i>
Juniper Hairstreak	<i>Callophrys gryneus siva</i>
Gray Hairstreak	<i>Strymon melinus franki</i>
Reakirts' Blue	<i>Hemiargus isola</i>
Melissa Blue	<i>Lycaeides melissa</i>
Greenish Blue	<i>Plebejus saepiolus amica</i>
Lupine Blue	<i>Icaricia lupini</i>
Variegated Fritillary	<i>Euptoieta claudia</i>
Manitoba Fritillary	<i>Speyeria aphrodite manitoba</i>
Regal Fritillary	<i>Speyeria idalia</i>
Edwards' Fritillary	<i>Speyeria edwardsii</i>
Atlantis Fritillary	<i>Speyeria atlantis pahasapa</i>
Northwestern Fritillary	<i>Speyeria hesperis lurana</i>
Mormon Fritillary	<i>Speyeria mormonia</i>
Kohler's Fritillary	<i>Boloria selene sabulocollis</i>
Gorgone Checkerspot	<i>Chlosyne gorgone carlota</i>
Silvery Checkerspot	<i>Chlosyne nycteis</i>
Pearl Crescent	<i>Phyciodes tharos</i>
Northern Crescent	<i>Phyciodes cocyta</i>
Pale Crescent	<i>Phyciodes pallida barnesi</i>
Green Comma	<i>Polygonia faunus hylas</i>
Hoary Comma	<i>Polygonia gracilis zephyrus</i>
Mourning Cloak	<i>Nymphalis antiopa</i>
Red Admiral	<i>Vanessa atalanta rubria</i>
Painted Lady	<i>Vanessa cardui</i>
Weidemeyer's Admiral	<i>Limenitis weidemeyerii oberfoelli</i>
Prairie Ringlet	<i>Coenonympha tullia benjamini</i>
Common Wood-Nymph	<i>Cercyonis pegala nephele</i>
Dark Wood-Nymph	<i>Cercyonis oetus charon</i>

Appendix A. (continued).

COMMON NAME	SCIENTIFIC NAME
Monarch	<i>Danaus plexippus</i>
Silver-spotted Skipper	<i>Epargyreus clarus</i>
Afranius Duskywing	<i>Erynnis afranius</i>
Common Checkered Skipper	<i>Pyrgus communis</i>
Uncas Skipper	<i>Hesperia uncas</i>
Western Branded Skipper	<i>Hesperia colorado idaho</i>
Ottoe Skipper	<i>Hesperia ottoe</i>
Leonard's Skipper	<i>Hesperia leonardus pawnee</i>
Pahaska Skipper	<i>Hesperia pahaska</i>
Crossline Skipper	<i>Polites origenes rhena</i>
Long Dash	<i>Polites mystic dacotah</i>
Arogos Skipper	<i>Atrytone arogos iowa</i>
Hobomok Skipper	<i>Poanes hobomok</i>
Taxiles Skipper	<i>Poanes taxiles</i>
Kiowah Skipper	<i>Euphyes vestris kiowah</i>
Strecker's Giant Skipper	<i>Megathymus streckeri leussleri</i>

Appendix B. A brief synopsis of each target species is included:

Regal Fritillary

Speyeria idalia

Description: Wingspan: 2.9-3.8 inches. Females are larger and darker than males. The upperside of the forewing is reddish orange with black and white spots. Hindwings are velvety black with two rows of spots; both rows of spots are cream-colored in the female, outer row rust-orange in the male. The underside of the hindwing is brown with large silver spots.

Similar Species: Only large fritillary in South Dakota with black hindwings.

Distribution and Habitat: Historical range extended from New England to North Carolina and westward to eastern Colorado, Wyoming, and southeastern Montana. No longer occurs in much of New England and rapidly declining over much of its range except the prairie states. The species is common in northeastern South Dakota in tall-grass prairie sites near marshes, undisturbed mixed-grass prairie areas along Missouri River breaks, and the Fort Pierre National Grassland. Generally restricted to areas of the state where sufficient native grasslands exist.

Early Stages: The caterpillar is yellowish brown with black markings and yellowish bands; black dorsal spines have silvery white bases.

Larval Host Plants: Various species of violets, including prairie violet and Nuttall's violet.

Adult Energy Sources: Nectar from a wide variety of flowers, including purple coneflower, gayfeather, hoary vervain, thistles, wild bergamot, alfalfa, and milkweeds. Whorled milkweed, near Oahe Dam in Stanley County, was noted to be a favored nectar source in 1983.

Flight Period: One brood, with flight dates ranging from June 12 to September 16. Males appear in mid-June and fly until August; female flight period is early July to mid-September. After hatching, the unfed caterpillar overwinters on the ground beneath leaves.

General Comments: Population size seems to fluctuate from year to year. Large tracts of native prairie with abundant wildflowers, such as Samuel Ordway Prairie managed by The Nature Conservancy near Leola, S.D., are needed to protect this species from further decline. The South Dakota Natural Heritage Program is currently monitoring this species.

Special References: Kelly, L., and D.M. Debinski. 1998. Relationship of host plant density to size and abundance of the Regal Fritillary *Speyeria idalia* Drury (Nymphalidae). J. Lepid. Soc. 52(3):262-276.

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Appendix B. (continued).

Atlantis Fritillary

Speyeria atlantis pahasapa

Description: Wingspan: 2.0-2.8 inches. Subspecies *pahasapa*, type locality Deerfield Reservoir, Pennington County, is a recently described subspecies of the Atlantis Fritillary known from only the Black Hills. The upperside is orange-brown and darker at the base. The male has black scales on the veins. Undersides of the hindwing are dark chocolate-brown with silver spots. The triangular silver marginal spots are capped inwardly with dark brown scales that protrude into a narrow buff-colored submarginal band.

Similar Species: Northwestern Fritillary has undersides of the hindwing reddish brown and spots unsilvered or occasionally partially silvered.

Distribution and Habitat: The Atlantis Fritillary occurs from eastern Alaska to Nova Scotia, south to central California, Arizona, and New Mexico; southern Manitoba to the Black Hills and Colorado; and Great Lakes region and Appalachians to Virginia. Subspecies *pahasapa* is thus far restricted to the Black Hills in Custer, Lawrence, Meade, and Pennington counties in South Dakota and Crook County, Wyoming. Prefers wet meadows and moist canyons such as those found near Dalton Lake and Timon Campground, Lawrence County, and Iron Creek near Lakota Lake, Custer County.

Early Stages: The caterpillar is brownish black with light stripes and orange spines.

Larval Host Plants: Violets, including northern bog violet, meadow violet, and Canada violet.

Adult Energy Sources: Nectar from a variety of flowers, including coneflowers, alfalfa, wild bergamot, ox-eye daisy, black-eyed Susan, and wild spiraea.

Flight Period: One brood, mostly July; dates extend from June 27 to August 9. Overwinters as unfed caterpillar.

General Comments: Males patrol in open area and along streams in search of females.

Special References: Marrone, G.M. 2005. A Butterfly Survey of the Northern Hills and Adjacent Areas with Emphasis on Species Monitored by the South Dakota Natural Heritage Program. Unpublished report to South Dakota Dept. of Game, Fish and Parks, Pierre, SD.

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Appendix B. (continued).

Ottoe Skipper

Hesperia ottoe

Description: Wingspan: 1.20-1.55 inches. Uppersides are bright orange. Males have narrow diffuse dark borders and a black stigma in the forewing that contains gray-brown scales. The female has wider more diffuse dark borders and several yellowish white spots in the forewing. The underside of the hindwing is pale orange with no markings in the male and occasionally a faint row of spots in the female.

Similar Species: Pawnee Skipper flies in August-September, and the male has yellow scales in the stigma. Dakota Skipper is smaller with darker undersides.

Distribution and Habitat: Very local and generally uncommon to rare throughout South Dakota and its entire range. Found in scattered, relatively undisturbed, mixed-grass to tall-grass prairie sites such as the area below Fort Randall Dam, Charles Mix County, and the Crystal Springs Preserve, managed by The Nature Conservancy, near Clear Lake, Deuel County.

Early Stages: The caterpillar is greenish brown; head dark brown.

Larval Host Plants: Native prairie grasses, including little bluestem, big bluestem, and sideoats grama.

Adult Energy Sources: Nectar from many flowers, but especially those of coneflowers, gayfeathers, asters, milkweeds, alfalfa, leadplant, black-eyed Susan, and sunflowers.

Flight Period: One brood from late June to August with peak flight in mid-July; dates extend from June 23 to August 4. Overwinters as a partially grown caterpillar in a leaf shelter.

General Comments: Males perch on tall flowers such as purple coneflowers and thistles to watch for females. The South Dakota Natural Heritage Program monitors the Ottoe Skipper. Native prairie sites with abundant nectar sources need protection in order for this species to survive.

Appendix B. (continued).

Arogos Skipper

Atrytone arogos iowa

Description: Wingspan: 1.10-1.25 inches. Uppersides are yellow-orange with wide dark borders. The female has broader dark wing margins that diffuse into, and nearly cover over, the orange in the hindwing. Males lack a stigma. The underside of the hindwing is golden yellow with pale veins.

Similar Species: Delaware Skipper is brighter orange and has a more distinct border and dark veins.

Distribution and Habitat: Local and occasionally common throughout South Dakota but may be absent from northwestern corner. Found in relatively undisturbed prairies and grasslands such as Mirror Lake Game Production Area, Lawrence County, and South Scalp Creek Recreation Area, near Fort Randall Dam, Gregory County.

Early Stages: The caterpillar is light green with a dark green dorsal stripe; head gray with orange streaks.

Larval Host Plants: Big bluestem and little bluestem. Caterpillars feed on leaves and live in nests constructed of two leaves sewn together with silk.

Adult Energy Sources: Purple coneflower, prairie coneflower, blackeyed Susan, and thistles.

Flight Period: One brood with peak flight in July; dates extend from June 25 to July 26. Overwinters as a partially grown caterpillar in a leaf cocoon about three feet above the ground.

General Comments: Males perch near host plants in mid-afternoon to watch for females. The South Dakota Natural Heritage Program is currently monitoring this species.

Special References: Royer, R.A., and G.M. Marrone. 1992. Conservation status of the Arogos Skipper (*Atrytone arogos*) in North and South Dakota. A report to the U.S. Dept. of the Interior, U.S. Fish and Wildlife Service, Denver, CO.

Appendix C. Records for the Ottoe Skipper found in the Black Hills and adjacent areas. Present survey records in bold print.

STATE	COUNTY	LOCATION	DATE	SEX	COLLECTOR	MEMO
SD	Custer	Wind Cave NP	07/23/06	M	G.M. Marrone	N43°35.096, W103°23.061', collected one male
SD	Custer	Wind Cave NP	07/18/06	M	G.M. Marrone	N43°35.351, W103°22.871', collected one male
SD	Custer	Wind Cave NP	06/29/06	M	G.M. Marrone	N43°34.014, W103°22.953', collected one male
SD	Custer	no data available	1991		P.J. Savage	record from R.E. Stanford
SD	Lawrence	no data available	----		----	record from R.E. Stanford
SD	Pennington	no data available	----		----	record from R.E. Stanford
SD	Lawrence	Beilage GPA*; also known as State Farm Headquarters	07/07/05	M	G.M. Marrone	*T6N,R2E,S25,N1/2; south slope below rocky ridge; collected one male near big bluestem
SD	Lawrence	Beilage GPA*; also known as State Farm Headquarters	07/20/05	F	G.M. Marrone	*T6N,R2E,S25,N1/2; south slope below rocky ridge; collected one fresh female near big bluestem
SD	Lawrence	Mirror Lake GPA*	07/22/05	M	G.M. Marrone	*N44.56229,W104.03510; elev. 3599; very worn

Appendix D. Records for the Regal Fritillary found in the Black Hills and adjacent areas. Present survey record in bold print.

STATE	COUNTY	LOCATION	DATE	SEX	COLLECTOR	MEMO
SD	Custer	Wind Cave NP N43°37.329', W103°22.591'	07/23/06		G.M. Marrone	obs. one male & one female nectaring on wild bergamot
SD	Custer	Custer State Park	09/--/46		A.H. Moeck	late August, 6 females, 2 males
SD	Custer	Wind Cave NP	07/18/97		Dan Roddy	obs. 3 in meadow east of Sanctuary Trail
SD	Custer	Wind Cave NP	07/21/97		Amy Czarnowski	obs. 2 south of Bison Flats prairie dog town
SD	Custer	Wind Cave NP	09/06/00		G.M. Marrone	along park road #6
SD	Custer	Wind Cave NP	09/08/97		Amy Czarnowski	obs. one in meadow at T5S,R5E,S10
SD	Custer	T2S,R10E,S35	08/18/96		Michael Melius	observed one at his residence
SD	Custer	Wind Cave NP	08/07/97		Dan Roddy	obs. 2 feeding on horsemint near trailhead at T5S,R5E,S11
SD	Custer	Wind Cave NP	--/--/96		M. Sanford	saw occasionally throughout NP, nectaring on milkweed
SD	Lawrence	Spearfish Canyon	07/24/66		P.J. Conway	obs. at canyon summit
SD	Lawrence	T6N,R2E,S11,NW	07/13/96		M. Sanford	I-90 exit #12 at base of Lookout Mtn.
SD	Lawrence	T3N,R4E,S15,NW	09/10/96		M. Sanford	nectaring on Aster ssp. in small forest meadow
SD	Lawrence	T3N,R4E,S26,NE	08/20/96		M. Sanford	nectaring on Canada thistle in small meadow
SD	Meade	Fort Meade Rec. Area	07/12/98		G.M. Marrone	obs. one male
SD	Meade	Fort Meade Rec. Area	07/06/85		G.M. Marrone	obs. one
SD	Meade	T6N,R4E,S31,SW	07/24/96		M. Sanford	obs. 3 nectaring on thistle off Whitewood Rd.
SD	Meade	Ft. Meade Rec. Area T5N,R5E,S24,NW&SW	07/15/96		M. Sanford	obs. five nectaring on purple coneflower
SD	Pennington	south of Rapid City near waterslide	07/31/96		Paul Johnson	

Appendix E. Records for the Atlantis Fritillary found in the Black Hills and adjacent areas. Present survey records in bold print.

STATE	COUNTY	LOCATION	DATE	SEX	COLLECTOR	MEMO
SD	Custer	Wind Cave NP west entrance	07/17/06		G.M. Marrone	Observed one male; T5S,R5E,Sec. 35,NW ¼
SD	Custer	Camp Remington	07/17/06		G.M. Marrone	observed 6; T2S,R5E,Sec. 36,SE ¼
SD	Custer	Camp Remington	07/17/06		G.M. Marrone	observed 4; T3S,R5E,Sec. 1, NE ¼
SD	Custer	Spokane Creek	07/17/06		G.M. Marrone	observed 6; T2S,R6E,Sec. 34
SD	Custer	Flynn Creek	07/03/06		G.M. Marrone	observed 3; N43°40.968, W103°29.354'
SD	Custer	Baker Draw in Custer State Park	07/17/06		G.M. Marrone	observed 3; N43°39.339, W103°28.586'
SD	Custer	Baker Draw in Custer State Park	07/03/06		G.M. Marrone	observed 6; N43°39.339, W103°28.586'
SD	Custer	Boland Ridge in Wind Cave NP	07/17/06		G.M. Marrone	observed 4; T2S,R6E,Sec. 29,SW ¼
SD	Custer	Beaver ponds NW of Norbeck Wildlife Preserve	06/30/06		G.M. Marrone	observed 15+ fresh individuals; one pair in copula, N43°39.553' , W103°30.226
SD	Custer	Iron Creek near Lakota Lk.	07/08/89	M/F	G.M. Marrone	
SD	Custer	Custer State Park	06/29/77		Ricky Patterson	det. by J.A. Scott
SD	Custer	5W, Custer	08/09/86		R.A. Royer	
SD	Custer	Pringle	07/04/85		D.L. Eiler	very common
SD	Custer	Iron Cr. trail near Lakota Lk.	08/15/04	F	G.M. Marrone	melantic aberrant
SD	Lawrence	Tinton	06/27/79	M	G.M. Marrone	
SD	Lawrence	Spearfish Creek/Iron Creek	07/13/86	M	G.M. Marrone	
SD	Lawrence	roads in T4N,R1E,S4 & 33	07/08/92		C.D. Ferris	elev. 6100-6400'
SD	Lawrence	2SW, Dumont	07/14/84	M	G.M. Marrone	
SD	Lawrence	Dalton Lake	07/15/00		G.M. Marrone	obs. 4 specimens nectaring on blk-eyed Susan
SD	Lawrence	Boxelder Creek trailhead near Nemo	07/15/00		G.M. Marrone	collected 6, observed 10

Appendix E. (continued).

STATE	COUNTY	LOCATION	DATE	SEX	COLLECTOR	MEMO
SD	Lawrence	Timon Campground	07/25/91		J. Oberfoell	
SD	Lawrence	Dalton Lake*	07/03/05		G.M. Marrone	*N44,14.178 W103,27.982; observed one
SD	Lawrence	Boxelder Creek Trailhead*	07/03/05		G.M. Marrone	*N44,11.870 W103,32.547; observed one
SD	Lawrence	Strawberry Picnic Area*	07/19/05		G.M. Marrone	*N44,18.672 W103,41.651; elev. 5506; observed 10 in fresh emerged condition
SD	Lawrence	near Mt. Roosevelt	07/19/05		G.M. Marrone	*N44,23.091 W103,45.082; elev. 4991; observed 10+, both sexes, one pair in copula
SD	Lawrence	near Mt. Roosevelt*	07/24/05		G.M. Marrone	*N44,23.091 W103,45.082; elve. 4991; observed 4, both sexes
SD	Lawrence	nr Tinton at Potato Spring*	07/22/05		G.M. Marrone	*N44.38065, W104.01739, elev. 5591; obs. 6
SD	Lawrence	1.5 mi. south of Dumont at jct. 104/USFS 206, ½ mi. west on 206	07/24/05		G.M. Marrone	*N44.20901,W103.77853, elev. 5965; obs. 30+, mostly males
SD	Lawrence	Little Spearfish Trail near Timon Cpgd*	07/04/05		G.M. Marrone	*N44,19.716,W103,59.379; observed two
SD	Lawrence	Yellow Creek*	07/20/05		G.M. Marrone	*N44.33007,W103.75568; obs. 3
SD	Lawrence	1.5 mi. south of Galena*	07/20/05		G.M. Marrone	*N44,18.939, W103,38.711; obs. one female
SD	Meade	Bethlehem Cave Spring*	07/21/05		G.M. Marrone	*N44,17.347, W103,28.964, elev. 4138; obs. one worn female; county record
SD	Pennington	Ditch Creek Campground	07/27/91		J. Oberfoell	
SD	Pennington	Spring Creek GPA	07/21/06		G.M. Marrone	observed 8; N43°51.901, W103°37.772'
SD	Pennington	Spring Creek	07/21/06		G.M. Marrone	observed 10+; N43°51.963, W103°39.500'
SD	Pennington	Headwaters of Spring Creek	07/22/06		G.M. Marrone	observed 10+; N43°53.759, W103°47.368'
SD	Pennington	Heely Creek	07/21/06		G.M. Marrone	observed one ; N43°58.641, W103°48.678'
SD	Pennington	Deerfield Lake	07/04/85	M	G.M. Marrone	
SD	Pennington	T47N,R1E	07/17/92		C.D. Ferris	
SD	Pennington	Mt. Rushmore NM	08/17/04		G.M. Marrone	beaver pond at T2S,R5E,S13,SE ¼; coll. one
SD	Pennington	Mt. Rushmore NM	07/19/04		G.M. Marrone	beaver pond at T2S,R5E,S13,SE ¼; coll. 2 males
WY	Crook	Botanical Trail south of	07/22/05		G.M. Marrone	*N44.47834,W104.11346, elev. 3968; obs.2; county

		Ranch "A"*				record
WY	Crook	½ mi. east of Green Hill on FS RD-801*	07/22/05		G.M. Marrone	*N44,24.920, W104,04.504; obs. 4

Appendix F. Records for the Arogos Skipper found in the Black Hills and adjacent areas. Present survey records in bold print.

STATE	COUNTY	LOCATION	DATE	SEX	COLLECTOR	MEMO
SD	Custer	Wind Cave NP, Elk Mt. Campground	06/25/06		G.M. Marrone	observed 4, T5S,R5E,Sec. 35
SD	Custer	Wind Cave NP	06/29/06		G.M. Marrone	observed 50+, N43°35.601', W103°21.813'
SD	Custer	Norbeck Wildlife Preserve	06/30/06		G.M. Marrone	observed 40+, T5S,R5E,Sec. 2
SD	Custer	Wind Cave NP	06/29/06		G.M. Marrone	observed 2, N43°34.014', W103°22.953'
SD	Custer	East of Argyle	07/10/66		J.S. Nordin	elev. 4400
SD	Fall River	Battle Mountain GPA	06/28/06		G.M. Marrone	observed 1, N43°27.273, W103°26.536'
SD	Fall River	TNC Whitney Preserve	06/28/06		G.M. Marrone	observed 20+, N43°23.166', W103°36.800'
SD	Fall River	Cold Brook Campground	07/10/66		J.S. Nordin	locally common in southern Black Hills
SD	Fall River	Robinson Flats	07/14/79		R.E. Stanford.	
SD	Lawrence	Crow Peak	06/25/88		G.M. Marrone	
SD	Lawrence	Mirror Lake	07/12/98		G.M. Marrone	obs. 12 near big bluestem, both sexes fresh
SD	Lawrence	Mirror Lake	07/13/86	F	G.M. Marrone	
SD	Lawrence	Mirror Lake*	07/02/05	M	G.M. Marrone	*T7N,R1E,S17,S1/2; coll. one fresh male
SD	Lawrence	Mirror Lake*	07/22/05		G.M. Marrone	*N44.56229,W104.03510, elev.3599; obs. 10+, all near big bluestem, both sexes; one nectaring on blue lettuce and one on woolly vervain; one obs. killed by crab spider
SD	Lawrence	Beilage GPA*; also known as State Farm Headquarters	07/07/05		G.M. Marrone	*T6N,R2E,S25,N1/2; obs. 15+, both sexes, fresh condition
SD	Lawrence	Beilage GPA*; also known as State Farm Headquarters	07/20/05		G.M. Marrone	*T6N,R2E,S25,N1/2; obs. 10+, both sexes
SD	Meade	Ft. Meade Rec. Area	07/08/96		Matt Sanford	purple coneflower abundant; coll. 3 specimens
SD	Meade	Bear Butte State Park*	07/18/05		G.M. Marrone	*west slope of butte, N44,28.655, W103,26.459; obs. one slightly worn female