THREE-YEAR BASELINE MONITORING STUDIES FOR *SILENE SPALDINGII* ON THE FLATHEAD INDIAN RESERVATION: YEAR 2017

Prepared for:

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1.0 INTRODUCTION

Spalding's catchfly (*Silene spaldingii*) is a regional endemic found in Montana, Washington, Oregon, Idaho, and barely extending into British Columbia, Canada. The Recovery Plan for *Silene spaldingii* (Spalding's Catchfly) (USFWS 2007; hereafter referred to as the Recovery Plan) requires that 27 populations, referred to as Key Conservation Areas (KCAs), each with at least 500 reproducing Spalding's catchfly individuals, occur rangewide in five physiographic provinces. Specifically, for the *Intermontane Valleys* physiographic province, which occurs only in Montana, the Recovery Plan states that four KCAs be identified (USFWS 2007). Further, Delisting Criterion #3 states that populations of Spalding's catchfly at KCAs must demonstrate stable or increasing population trends for at least 20 years using consistent range-wide long-term monitoring (USFWS 2007). The objective of this project is to make demonstrable progress towards the recovery plan goals for Spalding's catchfly by initiating the required monitoring at two potential KCAs on land owned by the Confederated Salish and Kootenai Tribes (CSKT). Funding from the U.S. Fish and Wildlife Service (USFWS) and cooperation from the CSKT is allowing the Montana Natural Heritage Program (MTNHP) Botanist to conduct the 3-year baseline for monitoring trend of Spalding's catchfly at the Sullivan Gulch and Crosson Valley/Sullivan Hill potential KCAs (**Figure 1**).

Within a given Spalding's catchfly population, individual plants exhibit dormancy for one or more growing seasons (Lesica and Crone 2004, USFWS 2012). This makes assessing population trends (stable, declining, or increasing) difficult. However, studies in Montana have shown that plants are rarely dormant for more than two growing seasons (USFWS 2012, Lesica and Crone 2007, and Lesica and Steele 1994). Therefore, the draft monitoring guidelines (USFWS 2012) requires that individuals within a defined transect are mapped for three consecutive years to account for about 95% of that population (USFWS 2012). Further, the 3-consecutive years of monitoring would then be repeated at 5- to 7-year intervals over the 20-year period to establish if the population is stable, declining, or increasing (USFWS 2012). This report documents the methods and results of Year 1 (2017) in the 3-year baseline monitoring studies at the Sullivan Gulch and Crosson Valley/Sullivan Hill areas.

2.0 METHODS

The Bitterroot River Population for Spalding's catchfly occurs almost exclusively within the Flathead Indian Reservation on land owned by the CSKT. It is composed of approximately 30 discrete areas referred to as Species Occurrences (SOs) that are mapped by the MTNHP (MTNHP 2018). Within the population two geographic areas are being proposed as KCAs which serve to focus conservation efforts: Sullivan Gulch area and Crosson Valley/Sullivan Hill area (**Figure 1**). A pilot study initiated in 2012 and conducted in 2015 at the Sullivan Gulch and Crosson Valley/Sullivan Hill areas with input from knowledgeable botanists determined that trend monitoring would require 10-12 transects per area (Lesica 2017). In the Sullivan Gulch

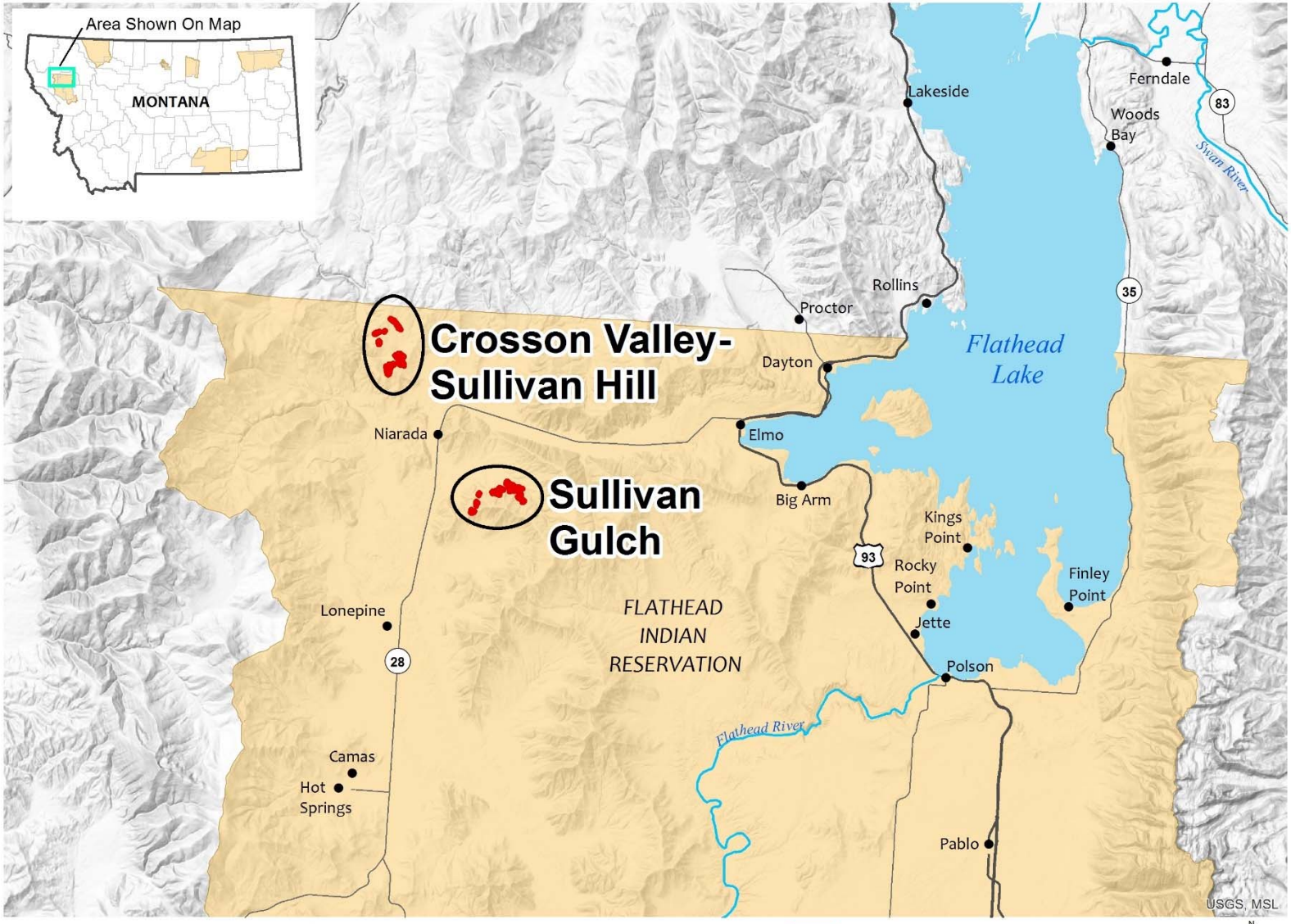

Figure 1. Spalding's Catchfly (*Silene spaldingii*)
Potential Key Conservation Areas on the Flathead Indian Reservation

Spalding Catchfly Species Occurrence (SO) Polygons
Reservations

area five transects used in the 2015 pilot study were retained while two transects were re-located because they lacked the two-plant minimum in 2015 and 2017, and an additional four transects were established. In the Crosson Valley/Sullivan Hill area two transects used in the 2015 pilot study were retained while one transect was re-located because of a fallen tree, and an additional eight transects were established. Thus, each potential KCA has 11 transects established in accordance with the USFWS (2012) monitoring guidelines for determining trends over the next 20-year period (**Figures 2** and **3** in **Appendix B**). Monitoring was conducted by Andrea Pipp (MTNHP Botanist) with assistance from Rusty Sydnor (CSKT Restoration Botanist) and Peter Lesica from July 14-24, 2017.

2.1 Transect Establishment

Within the Sullivan Gulch and Crosson Valley/Sullivan Hill SOs, transects were randomly located. Using ESRI Arc-GIS, a fishnet grid of points spaced at 10-meter intervals were laid over each SO. The latitude/longitude of each point was generated and brought into Microsoft (MS) Excel where data rows were selected using the random function. In the field, the randomly selected latitude/longitude was navigated to using a hand-held Global Positioning System (GPS) unit. Its location was marked with a pin flag, and area encircling the point was surveyed to find Spalding's catchfly plants. Pin flags were used to mark subsequent plants. The plant nearest to the random point was designated as the transect's start. From the 'start' the transect tape was stretched for 30 meters in the direction that captured the most number of plants. Thus, transects did not follow a particular cardinal or topographic direction. In the situation where a transect lacked the 2-plant minimum or included unsuitable habitat (for example, a road), the next randomly generated point was used and the process repeated (USFWS 2012). Once established, each 1-meter by 30-meter transect was marked at the ends with rebar and mapped by a GPS unit.

2.2 Monitoring

Each transect is divided into thirty, one-meter square plots to record Spalding's catchfly plant and habitat data. On the transect, the (x,y) coordinate of each Spalding's catchfly plant was mapped to the nearest centimeter. Field data recorded for each plant included the: a) life stage (dormant, rosette, single-stem, or multiple-stem), b) number of stems, c) number of grazed stems, d) number of flowers, e) presence/absence of insect herbivory on flowers, and f) comments. Each plant is assigned a unique identifier to track it over the 20-year period. Habitat data recorded in each square-meter included the percent cover of total vascular plants, total exotic plants, non-vascular species, plant litter, bare ground, rock, and wood. The percent cover of total vascular plants and of noxious weeds was based out of 100%. The combined cover of non-vascular species, plant litter, bare ground, rock, and wood totaled to 100% because these represent the ground surface area. The habitat data provides the context for which the Spalding's catchfly plants grow and will aid in explaining changes over the 20-year period. Changes to the habitat that exceed 20% of present will be quantified in Years 2 (2018) and 3 (2019). Across the 3-year baseline a comprehensive vascular plant species list is developed for each transect, as conditions permit. Each year, a qualitative assessment of the grazing condition is made for the transect. Each year the transects are photographed from each end (toward the other end) in the portrait and landscape positions. Additional photographs are taken of the plots, plants, and habitat, as deemed necessary. Changes in Spalding's catchfly numbers between or among years on a single transect will be analyzed using a paired-sample t-test (two-tailed) or analysis of variance, respectively.

A cursory survey to count the number of Spalding's catchfly will be conducted in as many SOs as is permitted by time. The visited SO is briefly walked through and plants are counted and habitat conditions assessed. Observation data is entered into the MTNHP's botany database, and information is available on Map Viewer and through data requests. Updated observation data and mapping is also shared with the Restoration Botanist on the CSKT.

3.0 RESULTS

Following a good winter of snowpack, Spalding's catchfly plants were numerous where surveyed, but summer growing conditions were very dry and some plants sprouted but did not flower. Most other forbs had senesced by the time monitoring began in late July, which made adding to the transect's species list difficult (**Tables 1** and **2** in **Appendix A**).

3.1 Sullivan Gulch

The Sullivan Gulch area currently consists of 12 SOs (**Figure 2** in **Appendix B**). Although it was not a requirement of this project a cursory survey for Spalding's catchfly plants was conducted at nine SOs. A total of 749 plants were observed in the Sullivan Gulch area in late July (**Table 1**).

Table 1. ***Number of Spalding's catchfly plants observed in the Sullivan Gulch Species Occurrences (SOs) in 2017.***

SO NUMBER	ON MONITORING TRANSECT	CURSORY SURVEY OF SO	TOTAL
41	10	251	261
42	19	82	101
43	15	105	120
51	not applicable	not visited	---
52	6	75	81
53	not applicable	50	50
54	not applicable	106	106
55	7	35	42
56	not applicable	not visited	---
64	3	not surveyed	3
65	15	9	24
66	11	1	12
		TOTAL	**749**

In the Sullivan Gulch area 11 transects were established within eight SOs (**Figure 2** in **Appendix B; Photos 1** to **22** in **Appendix C**). Habitat was consistent among the transects and consisted of mesic grassland dominated by rough fescue (*Festuca campestris*). Vascular plant cover ranged from 50% to 98% per square meter, with an average cover ranging from 71% to 86% per transect (**Table 2**). Exotic plant cover ranged from 0% to 5% per square meter, with an average cover ranging from 0% to less than 1% per transect (**Table 2**). Ground cover by non-vascular species

Table 2. ***Summary statistics on Spalding's catchfly plants, habitat, and noxious weeds collected on monitoring plots from July 14-24, 2017 in the Sullivan Gulch area.***

TRANSECT	TOTAL NUMBER ON TRANSECT FOR SPALDING'S CATCHFLY							AVERAGE PERCENT COVER ON TRANSECT						
	Plants	Flowering Plants	Non-Flowering Plants	Flowers	Plants with Flower Herbivory	Stems	Grazed Stems	Vascular Plants	Non-Vascular Species	Plant Litter	Bare Ground	Rock	Wood	Noxious Plant
SO #41														
SG-01	3	3	0	22	0	3	0	86	71	27	1	< 1	0	0
SG-02	7	6	1	77	0	10	0	73	55	41	4	< 1	0	< 1
SO #42														
SG-03	10	9	1	96	2	12	0	83	46	50	4	< 1	0	0
SG-04	9	8	1	91	0	9	1	83	60	38	2	< 1	0	0
SO #43														
SG-05	12	8	4	52	0	12	0	82	78	20	< 1	2	0	0
SG-06	3	2	1	10	0	3	1	77	72	26	< 1	1	0	0
SO #64														
SG-07	3	3	0	78	0	4	0	71	65	29	2	4	0	0
SO #65														
SG-08	15	9	6	73	1	19	1	84	19	80	1	< 1	0	0
SO #66														
SG-09	11	9	2	85	0	14	0	87	25	72	3	0	0	< 1
SO #52														
SG-10	6	6	0	281	0	12	0	87	13	83	< 1	4	0	< 1
SO #55														
SG-11	7	7	0	90	5	9	0	76	66	26	4	3	0	< 1
2017 Total	**86**	**70**	**16**	**955**	**8**	**107**	**3**	**81**	**52**	**45**	**2.0**	**1.4**	**0**	**0.08**

consists mostly of lichens and mosses, and is also called biological soil crust. Non-vascular cover ranged widely from 0.5% to 90% per square meter, with an average cover ranging from 13% to 78% per transect (**Table 2**). Plant litter varied widely from 8% to 99% per square meter, with an average cover ranging from 20% to 83% per transect (**Table 2**). Bare ground ranged from 0% to 30% per square meter, with an average cover ranging from less than 1% to 4% per transect (**Table 2**). Rock ranged from 0% to 40% per square meter, with an average cover ranging from less than 1% to 4% per transect (**Table 2**). Wood was not found on any transect (**Table 2**).

A total of 86 plants were found on the eleven transects with a range from 3 to 15 plants per transect (**Table 2**). Plants occurred as single- or multi-stemmed individuals and no rosettes were found. Flowering plants, which can be single- or multi-stemmed, accounted for 81% of the individuals observed (**Table 2**). The 70 flowering plants produced 955 flowers, ranging from 1 to 101 flowers per plant (**Table 2**). Only 8 (11%) flowering plants exhibited insect herbivory on their flowers or fruits (**Table 2**). Of the 107 stems counted 3 stems in 3 transects were browsed or grazed by either native ungulates or livestock (**Table 2**). Livestock grazing was observed and was most prevalent at elevations lower than the transects. Livestock grazing in or adjacent to the transects was qualitatively of low disturbance as evidenced by few grazed plants and old cow dung. Transect SG-02 showed the most sign of disturbance, and was at an elevation more easily accessible by livestock. In addition, vole tunnels and pocket gopher diggings were observed on many transects, but only one uprooted plant on Transect SG-6 was found.

3.2 Crosson Valley / Sullivan Hill

The Crosson Valley/Sullivan Hill area currently consists of 7 SOs, of which one was discovered during the 2017 field work (**Figure 3** in **Appendix B**). Although it was not a requirement of this project a cursory survey for Spalding's catchfly plants was conducted at all of the SOs. A total of 527 plants were observed in the Crosson Valley/Sullivan Hill area in late July (**Table 3**).

Table 3. ***Number of Spalding's catchfly plants observed in the Crosson Valley/Sullivan Hill Species Occurrences (SOs) in 2017.***

SO NUMBER	ON MONITORING TRANSECT	CURSORY SURVEY OF SO	TOTAL
9	21	182	203
10	18	79	97
11	2	24	26
12	5	11	16
13	21	59	80
14	12	27	39
74	not applicable	6	6
		TOTAL	**527**

In the Crosson Valley/Sullivan Hill area 11 transects were established within 6 SOs (**Figure 3** in **Appendix B**; **Photos 23** to **44** in **Appendix C**). Habitat was consistent among the transects and consisted of mesic grassland dominated by rough fescue. Vascular plant cover ranged from 5% to 90% per square meter, with an average cover ranging from 72% to 87% per transect (**Table 4**).

Table 4. ***Summary statistics on Spalding's catchfly plants, habitat, and noxious weeds collected on monitoring plots from July 14-24, 2017 in the Crosson Valley/Sullivan Hill area.***

TRANSECT	TOTAL NUMBER ON TRANSECT FOR SPALDING'S CATCHFLY							AVERAGE PERCENT COVER ON TRANSECT						
	Plants	Flowering Plants	Non-Flowering Plants	Flowers	Plants with Flower Herbivory	Stems	Grazed Stems	Vascular Plants	Non-Vascular Species	Plant Litter	Bare Ground	Rock	Wood	Noxious Plant
SO #9														
CV-01	15	15	0	94	2	16	3	87	15	85	1	< 1	0	< 1
CV-02	6	5	1	56	0	9	1	78	26	72	2	< 1	0	0
SO #14														
CV-03	7	3	4	44	0	8	2	79	9	82	9	< 1	0	0
CV-11	5	5	0	81	0	10	0	60	20	53	25	< 1	2	0
SO #10														
CV-04	8	7	1	118	3	14	0	75	5	55	39	1	< 1	3
CV-05	10	10	0	255	2	15	0	76	3	55	42	< 1	0	< 1
SO #11														
CV-06	2	2	0	28	0	2	0	75	21	71	8	< 1	0	3
SO #13														
CV-07	7	6	1	121	1	13	1	77	50	35	15	1	0	< 1
CV-08	7	7	0	62	0	12	0	72	54	38	7	1	0	0
CV-09	7	2	5	2	0	13	13	86	54	45	1	< 1	0	0
SO #12														
CV-10	5	5	0	52	1	7	0	75	32	59	9	< 1	< 1	1
2017 Total	**79**	**67**	**12**	**913**	**9**	**119**	**20**	**76**	**26**	**59**	**14**	**< 1**	**< 1**	**< 1**

This large range in vascular plant cover reflects the increase in livestock grazing disturbance observed on a select number of plots. Exotic plant cover ranged from 0% to 20% per square meter, with an average cover ranging from 0% to less than 3% per transect (**Table 4**). Non-vascular species cover ranged widely from 0% to 90% per square meter, with an average cover ranging from 3% to 54% per transect (**Table 4**). Plant litter varied widely from 0% to 100% per square meter, with an average cover ranging from 35% to 82% per transect (**Table 4**). Bare ground widely ranged from 0% to 91% per square meter, with an average cover ranging from less than 1% to 42% per transect (**Table 4**). Rock ranged from 0% to 20% per square meter, with an average cover of 1% or less per transect (**Table 4**). Wood ranged from 0% to 10% per square meter, with an average cover of 2% or less per transect (**Table 4**).

A total of 79 plants were found on the eleven transects with a range from 2 to 15 plants per transect (**Table 4**). Plants occurred as single- or multi-stemmed individuals and no rosettes were found. Flowering plants accounted for 85% of the individuals observed (**Table 4**). The 67 flowering plants produced 913 flowers, ranging from 1 to 56 flowers per plant (**Table 4**). Only 9 (13%) flowering plants showed insect herbivory on their flowers or fruits (**Table 4**). Of the 119 stems counted 20 stems on 5 transects were browsed or grazed by livestock; it is possible that some of these may have been browsed by native ungulates (**Table 4**). Livestock grazing disturbance in or adjacent to the transects was qualitatively observed as low or moderate. Transects with low disturbance had few grazed plants and old cow dung. Transects with moderate disturbance had more grazed plants, busted biological soil crust, and more bare soil. Transect CV-09 contains an active cattle trail and livestock were observed at all transects in SO 13. In addition, vole tunnels and pocket gopher diggings were observed on most transects, and three uprooted plants on Transects CV-03 and CV-09 were found.

4.0 DISCUSSION

The CSKT land hosts one of the largest populations of Spalding's catchfly in Montana (MTNHP 2010). The 3-year baseline monitoring will determine each transect's population size and be used to compare against future 3-year datasets over the minimum 20-year monitoring period. The comparison of 3-year datasets along intervals in the 20-year period will determine population trend (stable, declining, or increasing) at each transect and collectively (all 11 transects) at the Sullivan Gulch and at the Crosson Valley/Sullivan Hill proposed KCAs. In addition, the 3-year baseline will provide information on dormancy rates, flower productivity, qualitative damage from insect, small mammal, and ungulate (native and domestic) activities, and significant changes in habitat conditions at the transect level and extrapolated to the Sullivan Gulch and Crosson Valley/Sullivan Hill areas.

The Recovery Plan requires that KCAs have at least 500 reproducing Spalding's catchfly individuals growing in intact habitat. A cursory count of plants was made while conducting other monitoring tasks (accessing, setting-up, and monitoring). Since one's eye usually keys into the plant's inflorescence, almost all plants in the cursory counts were flowering. All together more than 700 plants were observed in the nine visited Sullivan Gulch SOs. It is assumed that the unvisited Sullivan Gulch SOs would also have had plants in 2017. Likewise a little over 525

plants were observed in the 7 SOs of Crosson Valley/Sullivan Hill. Based on 2017 and past survey work these areas both seem to support intact, viable populations.

Disturbance was assessed at each monitoring transect. Vole tunnels, pocket gopher diggings, and/or activity from other small mammals activity were observed at each transect in both areas. Specifically, voles seemed to be foraging on lupine (*Lupinus* spp.) and Spalding's catchfly plants within and outside transects. However, only four uprooted Spalding's catchfly plants were found on the 22 transects. Evidence of livestock use included visual sightings and the presence of hoof prints, grazed vegetation, cow patties, and trails. Livestock use at all monitored SOs does not appear to be year-round. At the Sullivan Gulch area livestock use was not directly observed in July 2017, but their sign was prevalent at elevations mostly below the transects and along the main access roads. The low grazing disturbance observed on all transects is likely because most transects are on a slope and not near to any water source. At the Crosson Valley/Sullivan Hill area livestock use in SOs 12 and 13 was observed, and sign was more prevalent in all SOs (when compared to the Sullivan Gulch area). Spalding's catchfly plants grazed by livestock were observed, particularly where growing in vicinity of a trail or access road. Localized, but significant ground disturbance (compaction and biological soil crust busting) caused by livestock was observed on portions of Transects CV-11 and CV-4. No evidence was observed that suggested harm at the population level of Spalding's catchfly. It is likely that some level of disturbance from grazing and low-intensity fires helps to maintain or improve conditions for Spalding's catchfly (Lesica 1999, MTNHP 2018). Surveys in 2011 and 2015 at the Niarada Hill area (SO 50) has found a very productive, large population in the context of an overgrazed grassland. It is thought that removing or reducing the canopy cover of bunchgrass litter may enhance germination and recruitment of Spalding's catchfly plants (Lesica 1999). It is likely that the timing and type of ground disturbance influence the effects on these plants. De-listing criteria in the Recovery Plan recommends conducting prescribed burning to mimic the historical fire regimes specific to the physiographic region (USFWS 2007). However, the plan cautions that burns should not include more than 30% of the individuals in a population or be done in areas that could exacerbate invasive exotic plants, and that additional plant monitoring should be enacted prior to and following the prescribed burn (USFWS 2007).

Invasive exotic plants have the ability to displace native plants. The occurrence of exotic plants on monitoring transects was assessed in 2017. De-listing criteria in the Recovery Plan requires that invasive exotics that have the potential to displace Spalding's catchfly plants be controlled or eradicated within 100 meters (328 feet) of all populations within KCAs (USFWS 2007). For the Intermontane Valleys physiographic province known invasive exotics include meadow hawkweed (*Hieracium pratense*), spotted knapweed (*Centaurea maculosa*), and sulfur cinquefoil (*Potentilla recta*) (USFWS 2007). Further, the Recovery Plan states that integrated pest management should be used within 25 meters (82 feet) of Spalding's catchfly for the following invasive exotics: Kentucky bluegrass (*Poa pratensis*), cheatgrass (*Bromus tectorum*), Canada thistle (*Cirsium arvense*), and St. Johnswort (*Hypericum perforatum*) (USFWS 2007). Other invasive exotics that are discovered should also be controlled or eliminated within 100 meters of Spalding's catchfly plants (USFWS 2007).

In 2017, exotic plants were found in the SO populations as well as some monitoring transects. In

the Sullivan Gulch transects, 15 of the 330 plots (or 5%) contained sulfur cinquefoil, cheatgrass, soft brome (*Bromus hordeacus*), and/or field bindweed (*Convolvulus arvensis*). These plants along with spotted knapweed were also found within many of the Sullivan Gulch SO populations and along the access roads. The Crosson Valley/Sullivan Hill area contains a higher prevalence of exotics and in the transects 71 of 330 (22%) plots contained sulphur cinquefoil, soft brome, cheatgrass, crested wheatgrass (*Agropyron cristatum*), spotted knapweed, and bulbous bluegrass (*Poa bulbosa*). These plants were also found outside the transects in portions of some of the Crosson Valley/Sullivan Hill SOs. In addition, sulfur cinquefoil, spotted knapweed, and field bindweed are Montana-listed noxious weeds and cheatgrass is regulated in Montana (MDA 2017). Within the SOs most of the exotic occurrences are stages of invasiveness that would be relatively easy to control given proper management techniques and timing.

5.0 REFERENCES

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Appendix A

Vascular Plant Checklists for Silene spaldingii *Monitoring Transects*

Table A-1. ***Vascular plants identified in 2015 and/or 2017 on Transects in the Sullivan Gulch area. Nomenclature within parenthesis indicates an uncertainty in identification.***

SPECIES	TRANSECTS									
	SG-01	SG-02	SG-03	SG-04	SG-05	SG-06	SG-07	SG-09	SG-10	SG-11
Achillea millifolium	X				X	X				
Agropyron spicatum				X		X				
Antennaria spp.	X				X	X				
Besseya rubra	X				X					
Brassicaceae						X				
Bromus tectorum				X						X
Bromus hordeaceus									X	X
Calochortus spp.	X			X		X				
Carex praticola			X	X						
Castilleja spp.			X							
Cerastrium spp.	X			X		X				
Chrysothamnus viscidiflorus				X	X					
Cirsium undulatum	X									
Convolvulus arvensis		X								
Danthonia spp.					X					
Dianthus armeria	X		X	X						
Drymocallis arguta			X		X					
Ericameria nauseosa	X		X							
Eriogonum spp.										
Eriogonum heracleoides	X		X	X	X	X				
Fabaceae										
Festuca campestris	X	X	X	X	X	X	X	X	X	X
Festuca idahoensis			X	X	X	X				
Gaillardia aristata										
Geranium viscosissinum			X							
Geum triflorum	X		X		X	X				
Heterotheca villosa										
Heuchera (*cylindrica*)	X				X	X				
Hieracium scouleri	X					X				
Koeleria macrantha	X		X			X				
Lithospermum ruderale			X	X	X	X				
Lomatium spp.					X	X				
Lomatium macrocarpum										
Lomatium triternatum						X				
Lupinus sericeus	X									
Melilotus officinalis										
Monarda fistulosa			X							
Orthocarpus spp.			X		X	X				
Penstemon spp.	X			X	X	X				
Pinus ponderosa			X							
Poa pratensis			X							
Potentilla gracilis	X		X	X						
Potentilla recta				X				X		X
Rosa acicularis										
Silene spaldingii	X	X	X	X	X	X	X	X	X	X
Solidago (*canadensis*)			X							
Stipa viridula			X	X						
Stipa spp.		X								
Tragopogon dubius										

Table A-2. ***Vascular plants identified in 2015 and/or 2017 that occur on Transects in the Crosson Valley / Sullivan Hill area. Nomenclature within parenthesis indicates an uncertainty in identification.***

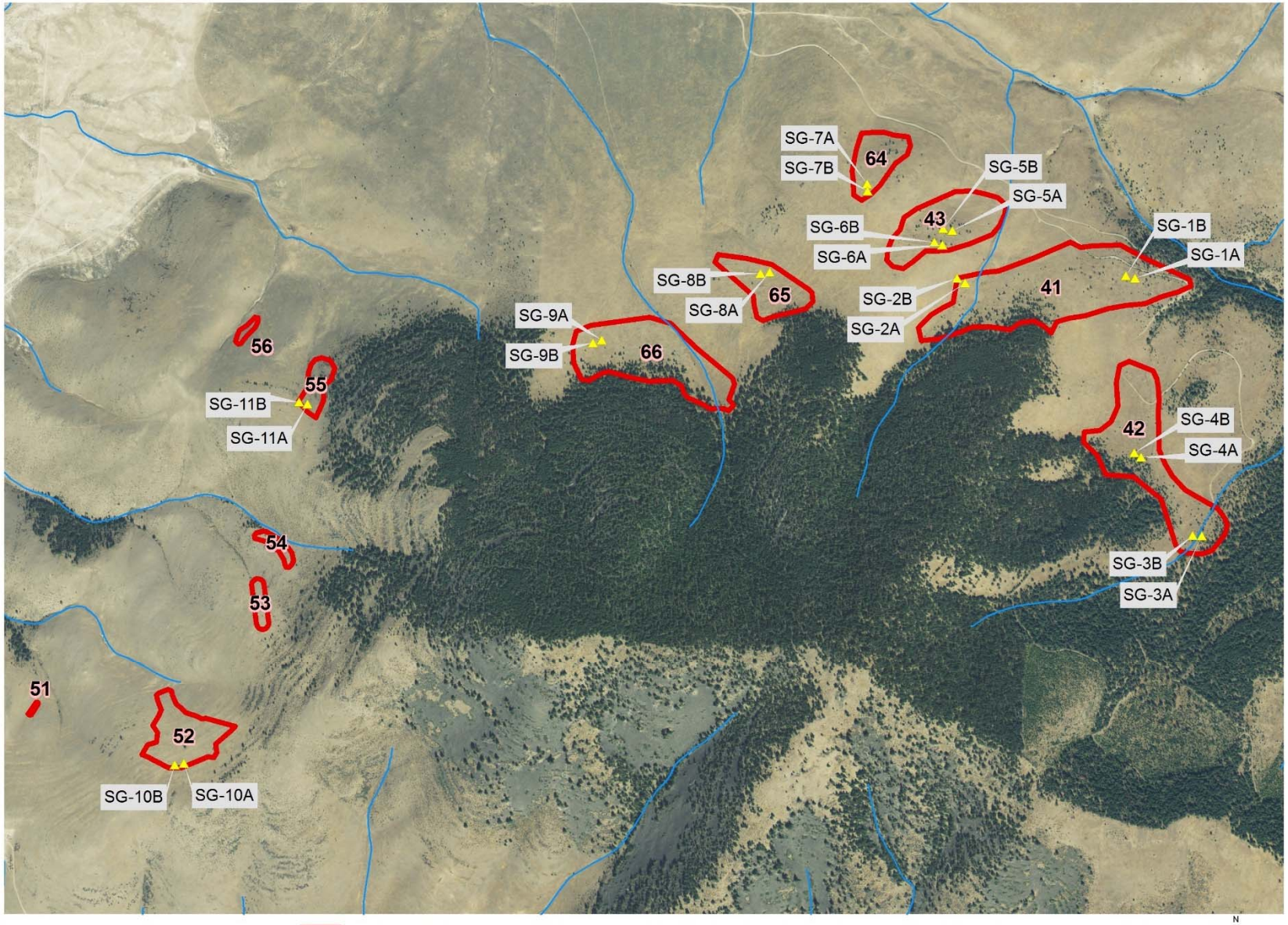
SPECIES	TRANSECTS										
	CV-01	CV-02	CV-03	CV-04	CV-05	CV-06	CV-07	CV-08	CV-09	CV-10	CV-11
Achillea millifolium		X	X							X	
Agropyron cristatum						X					
Agropyron spicatum											
Antennaria spp.			X								
Apiaceae Family										X	
Besseya rubra											
Brassicaceae Family		X								X	
Bromus hordeaceus				X		X					
Bromus tectorum						X					
Calochortus spp.											
Carex praticola		X	X								
Castilleja spp.											
Centaurea stoebe				X		X				X	
Cerastrium spp.											
Chrysothamnus viscidiflorus		X									
Cirsium undulatum											
Danthonia spp.											
Dianthus armeria											
Drymocallis arguta			X								
Ericameria nauseosa											
Eriogonum spp.		X									
Eriogonum heracleoides		X	X							X	
Fabaceae											
Festuca campestris	X	X	X		X	X	X	X	X	X	X
Festuca idahoensis		X	X								
Gaillardia aristata		X									
Geranium viscosissinum											
Geum triflorum											
Heterotheca villosa											
Heuchera (*cylindrica*)											
Hieracium scouleri											
Koeleria macrantha			X								
Lithospermum ruderale		X								X	
Lomatium spp.											
Lomatium macrocarpum			X								
Lomatium triternatum											
Lupinus sericeus	X	X	X					X	X		X
Melilotus officinalis											
Monarda fistulosa											
Orthocarpus spp.										X	
Penstemon spp.		X								X	
Pinus ponderosa										X	
Poa bulbosa						X					
Poa pratensis											

Table A-2 (continued). ***Vascular plants identified in 2015 and/or 2017 that occur on Transects in the Crosson Valley / Sullivan Hill area. Nomenclature within parenthesis indicates an uncertainty in identification.***

SPECIES	TRANSECTS										
	CV-01	CV-02	CV-03	CV-04	CV-05	CV-06	CV-07	CV-08	CV-09	CV-10	CV-11
Potentilla (*arguta*)										X	
Potentilla gracilis		X									
Potentilla recta	X				X	X	X			X	
Pseudotsuga menziesii					X						
Ribes spp.										X	
Rosa acicularis		X									
Silene spaldingii	X	X	X	X	X	X	X	X	X	X	X
Solidago (*canadensis*)											
Stipa viridula											
Tragopogon dubius		X									

Appendix B

Sullivan Gulch and Crosson Valley/Sullivan Hill Area Maps



Sullivan Gulch

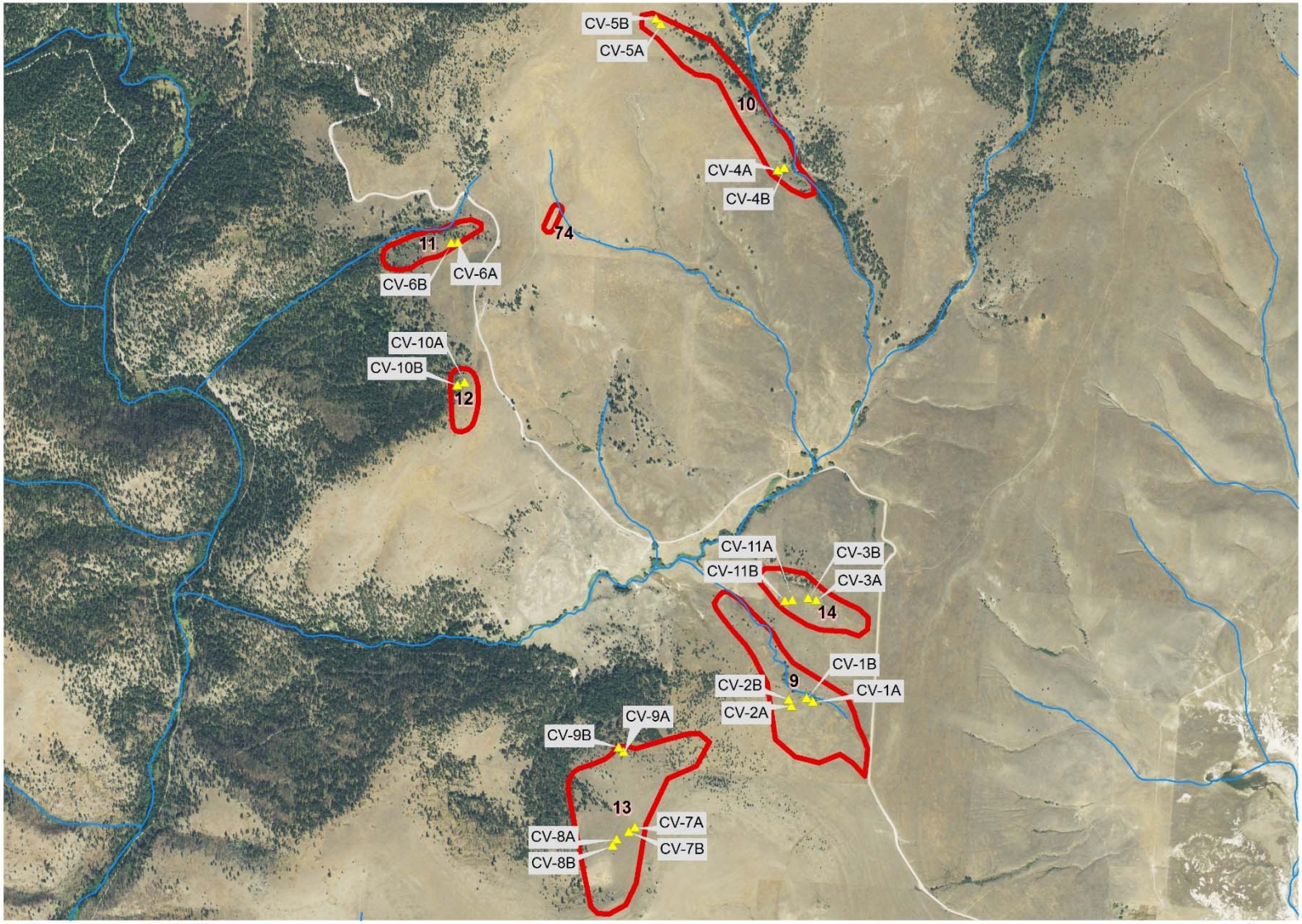
Spalding Catchfly Species Occurrence (SO) Polygons

Monitoring Transect Start and End Points

55 SO Polygon ID

0 500 1,000 2,000
Feet

N W E S



Crosson Valley-Sullivan Hill

Monitoring Transect Start and End Points

Spalding Catchfly Species Occurrence (SO) Polygons

11 SO Polygon ID

0 500 1,000 2,000 Feet

N W E S

Appendix C

Sullivan Gulch and Crosson Valley/Sullivan Hill Transect Photographs

SPALDING'S CATCHFLY BASELINE MONITORING, SULLIVAN GULCH – 2017 PHOTOGRAPHS

Photo 1: View is west from Stake A on Transect SG-1 (SO-41).

Photo 2: View is east from Stake B on Transect SG-1 (SO-41).

Photo 3: View is northwesterly from Stake A on SG-2 (SO-41).

Photo 4: View is northwesterly from Stake B on SG-2 (SO-41).

Photo 5: View is west northwest from Stake A on SG-3 (SO-42).

Photo 6: View is east northeast from Stake B on SG-3 (SO-42).

Photo 7: View is northwest from Stake A on Transect SG-4 (SO-42).

Photo 8: View is northeast from Stake B on Transect SG-4 (SO-42).

Photo 9: View is west from Stake A on Transect SG-5 (SO-43).

Photo 10: View is east from Stake B on SG-5 (SO-43).

Photo 11: View is west from Stake A on Transect SG-6 (SO-43).

Photo 12: View is east from Stake B on Transect SG-6 (SO-43).

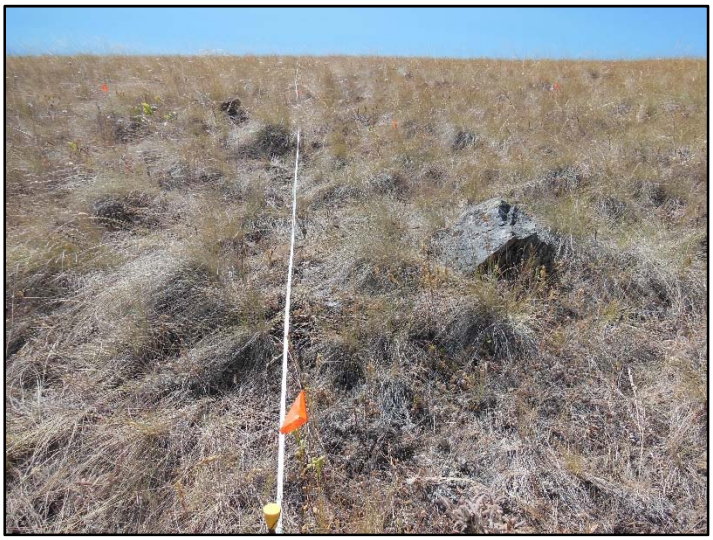


Photo 13: View is south southeast from Stake A on Transect SG-7 (SO-64).

Photo 14: View is north northwestt from Stake B on Transect SG-7 (SO-64).

Photo 15: View is west from Stake A on Transect SG-8 (SO-65).

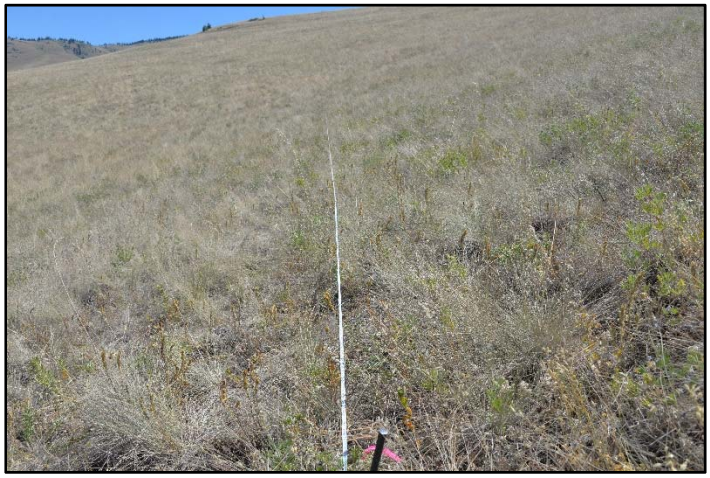


Photo 16: View is east from Stake B on Transect SG-8 (SO-65).

Photo 17: View is southwest from Stake A on Transect SG-9 (SO-66).

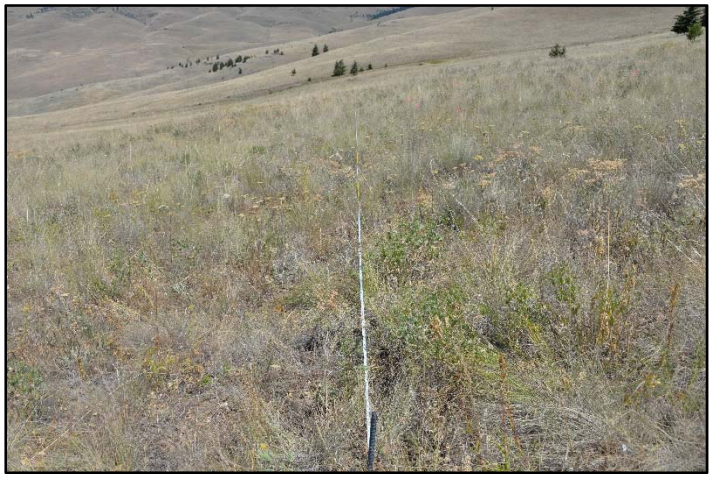


Photo 18: View is northeast from Stake B on Transect SG-9 (SO 66).

Photo 19: View is westerly from Stake A on Transect SG-10 (SO-52).

Photo 20: View is easterly from Stake B on Transect SG-10 (SO-52).

Photo 21: View is westerly from Stake A on Transect SG-11 (SO-55).

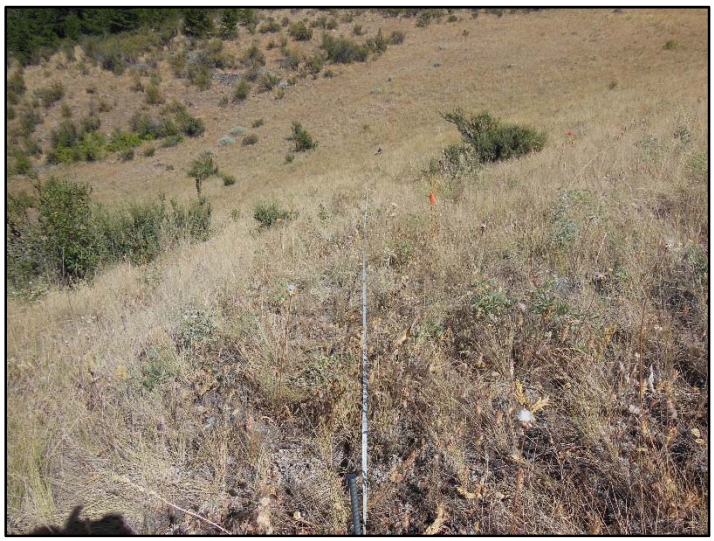


Photo 22: View is easterly from Stake B on Transect SG-11 (SO-55).

Photo 23: View is west from Stake A on Transect CV-1 (SO-9). **Photo 24:** View is easterly from Stake B on Transect CV-1 (SO-9).

Photo 25: View is northwest from Stake A on Transect CV-2 (SO-9).

Photo 26: View is southeast from Stake B on Transect CV-2 (SO-9).

Photo 27: View is west northwest from Stake A on Transect CV-3 (SO-14).

Photo 28: View is east southeast from Stake A on Transect CV-3 (SO-14).

Photo 29: View is east northeast from Stake A on Transect CV-4 (SO-10).

Photo 30: View is west southwest from Stake B on Transect CV-4 (SO-10).

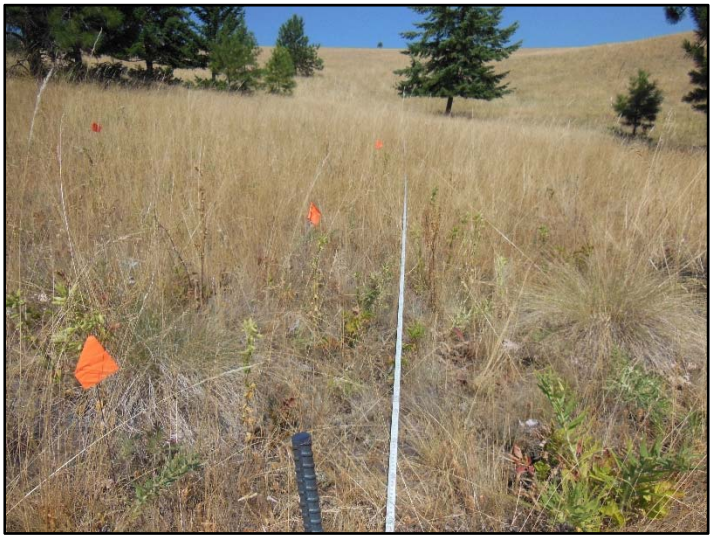


Photo 31: View is northwest from Stake A on Transect CV-5 (SO-10).

Photo 32: View is southeast from Stake B on Transect CV-5 (SO-10).

Photo 33: View is westerly from Stake A on Transect CV-6 (SO-11).

Photo 34: View is westerly from Stake B on Transect CV-6 (SO-11).

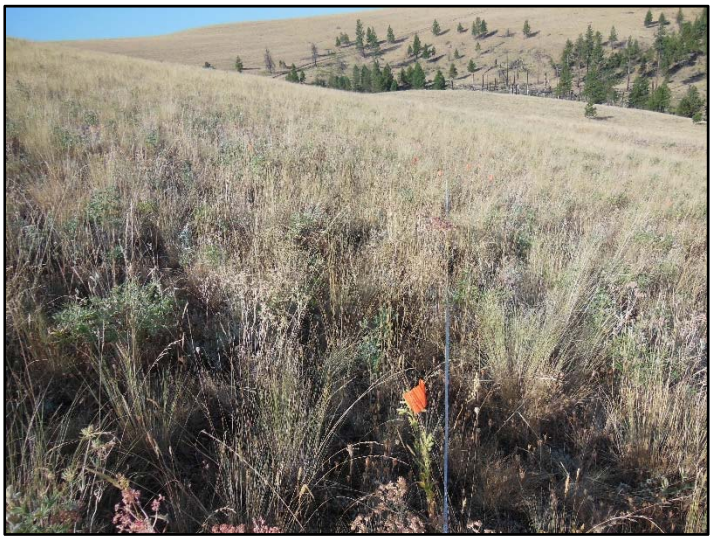


Photo 35: View is southwest from Stake A on Transect CV-7 (SO-13).

Photo 36: View is northeast from Stake B on Transect CV-7 (SO-13).

Photo 37: View is south southwest from Stake A on Transect CV-8 (SO-13).

Photo 38: View is north northeast from Stake B on Transect CV-8 (SO-13).

Photo 39: View is northwest from Stake A on Transect CV-9 (SO-13).

Photo 40: View is southeast from Stake B on Transect CV-9 (SO-13).

Photo 41: View is west southwest from Stake A on Transect CV-10 (SO-12).

Photo 42: View is east northeast from Stake B on Transect CV-10 (SO-12).

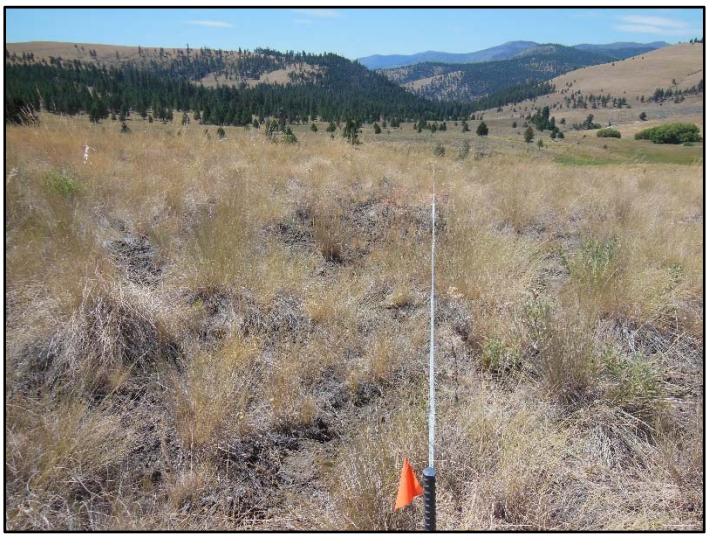


Photo 43: View is west southwest from Stake A on Transect CV-11 (SO-14).

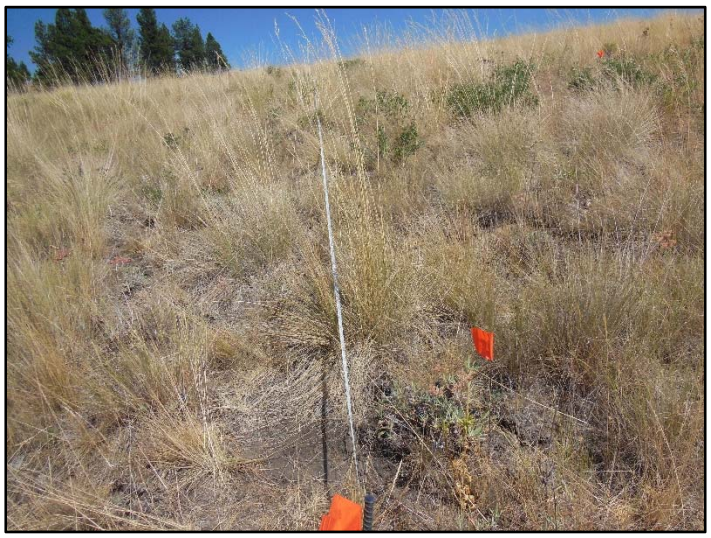


Photo 44: View is east northeast from Stake B on Transect CV-11 (SO-14).