MONITORING MOUNTAIN PLOVERS (*CHARADARIUS MONTANUS*) AND UPLAND VEGETATION, WITH SPECIAL ATTENTION TO THE EFFECTS OF FIRE.

FINAL REPORT

Prepared by:

Dr George P. Jones, Ecologist
Wyoming Natural Diversity Database
University of Wyoming
P.O. Box 3381
Laramie, Wyoming 82071-3381

For:

Ms. Cathryn Pesenti
Environmental Management Flight
90 CES / CEVN
300 Vesle Drive
F. E. Warren Air Force Base, Wyoming 82005

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ACKNOWLEDGEMENTS

Brandon Dalton and Laine Johnson of the Wyoming Natural Diversity Database located the sampling points and cheerfully collected the vegetation data. Plant specimens were identified by Joy Handley and Stuart Markow, using the facilities of the Rocky Mountain Herbarium. Cathy Cooper and Hollis Marriott entered and checked the data. Thanks are extended to all of them.

INTRODUCTION

In 2000, the 90th Civil Engineering Squadron, F.E. Warren Air Force Base, U.S. Air Force, contracted with the University of Wyoming's Natural Diversity Database (WYNDD) to conduct several projects on the Base, including one to collect vegetation data that managers could use to document changes in vegetation structure and plant species composition associated with burning of the grasslands in the northern part of the Base. Originally, we intended to collect vegetation data from sampling plots at locations where staff from the Center for Ecological Management of Military Lands (CEMML) had placed the sampling transects they used in their 1995 inventory of F. E. Warren. Some of those locations were then to have been burned in prescribed fires and some left unburned. In 2001, though, a wildfire burned a substantial part of the Base's northern end. Consequently, when the WYNDD field crew in 2002 placed the 12 sample plots described in this report, some of those plots were in areas burned approximately one year before, and some were in unburned areas.

In addition to the unplanned fire, a second complication faced by the WYNDD crew members in collecting the vegetation data was drought, which prevented all but a few of the plants in the grassland from blooming. The lack of flowers and fruits in turn prevented us from identifying many of the plants, and may also have prevented us from distinguishing between species that resemble each other in the vegetative condition. Due to this latter problem, we may have failed to record the presence of some species in the sample plots, and estimates of canopy cover for some species may include other species as well.

Despite the 2001 wildfire and the drought, we believe that the data reported herein provide a reasonably complete description of the conditions to which effects of land management practices in the future can be compared.

METHODS

The starting point for each of the 12 CEMML transects in the grasslands had been marked with a piece of metal re-bar pounded into the ground. We were provided by CEMML with copies of their data sheets, showing distances and compass bearings from landmarks to those starting points. WYNDD staff used the information on the data sheets to navigate to the approximate location of each starting point, and then used a metal detector to look for the exact location. This was unsuccessful, so we established a new sampling point for our plot as close as possible to the CEMML point. The UTM coordinates of each WYNDD sampling point were recorded with a global positioning receiver (GeoExplorer II, Trimble Surveying and Mapping Products, Sunnyvale CA).

The modified-Whittaker nested plot design (Stohlgren *et al*. 1995) was adopted for the WYNDD vegetation sampling plots. Each sampling point served as the corner of a 20 m X 50 m macroplot, within which were located 13 sub-plots (Figure 1). The canopy cover of a plant was defined (following the approach of Daubenmire 1959) as the polygon described by a line drawn around the leaf tips of the undisturbed above-ground portion of the plant. Sampling began with the microplots: in each, the percentage of the microplot beneath the canopy of each species was estimated and then recorded as the mid-point of the appropriate cover range (Table 1). After canopy cover had been estimated in the 10 microplots, the two corner sub-plots were searched for species that had not been recorded in the microplots, and their presence was noted. The center sub-plot was next searched for species that had not been

recorded in the microplots or in the corner sub-plots, and finally, the area of the macroplot outside of the microplots and the corner and center sub-plots was searched for new species. The values for a species from the 10 microplots were then averaged to give an estimate of the species's cover for the entire macroplot. Species that occurred in the corner or center sub-plots or in the macroplot but had not been encountered in the microplots were assigned a cover value of 0.01.

The percentage of the ground surface in each microplot covered by each of ten categories of ground cover (Table 2) was estimated and an average value for each was calculated for the macroplot, as for the plant canopy cover values. Selected environmental variables were recorded, including type of surface material (residual, colluvial, alluvial, or aeolian), soil texture (based on one hand-texture of the top 10 cm of soil, made near the sample point marker), slope steepness, and slope aspect. The vegetation at the sampling point was briefly described.

RESULTS

Twelve sample plots were placed throughout the grasslands in the northern part of the Base (Figure 2). (UTM coordinates [NAD27, Zone 13] for all plots are in the accompanying spreadsheet, "2002 WYNDD Sample UTM.xls.") Fifty species of vascular plants were recorded in these plots. As is usually the case with native vegetation, most of the species were rare and few were common: nearly half of those species occurred in only one-quarter or fewer of the plots, and only one species was recorded in all 12 plots (Figure 3). (The "forb, unknown" shown in Table 3 as occurring in 12 plots includes several unidentified taxa and cannot be considered a single species.) Only five of the species were identified as introduced, but the taxa that could not be identified to species may include a few more introduced species (Table 3). Thirty-eight of the 50 species were forbs, 9 were graminoids (grasses or sedges), 2 were sub-shrubs, and 1 was a shrub.

In every sample plot, the bulk of the plant species recorded were natives (Table 4). In only two plots did known introduced plants contribute a substantial amount of canopy cover. Intermediate wheatgrass (*Thinopyrum intermedium*) accounted for approximately half of the canopy cover in plot 02WAFB09, and crested wheatgrass (*Agropyron cristatum*) was a major species in plot 02WAFB03 (Appendix 1). Both of these are planted grasses.

Although most of the plant species recorded in the plots were forbs, the grasses and sedges contributed most of the canopy cover. Needle and thread grass (*Hesperostipa comata*) contributed substantial canopy cover to more plots than did any other species. This native bunchgrass dominated three plots (02WAFB10, 02WAFB11, and 02WAFB12), co-dominated three additional plots (02WAFB04, 02WAFB06, and 02WAFB08) with thickspike wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*), and co-dominated another plot (02WAFB02) with blue grama (*Bouteloua gracilis*). Two plots (02WAFB05 and 02WAFB07) were dominated by the native, rhizomatous thickspike wheatgrass, and one plot (02WAFB01) was co-dominated by the mat-forming native threadleaf sedge (*Carex filifolia*) and the native bunchgrass, purple threeawn grass (*Aristida purpurea*).

Unfortunately, the drought of 2002 prevented a number of plants from being identified to species (Table 4 and Appendix 1). In addition, names could be assigned to some of the plants in the plots only with uncertainty. For example, rhizomatous wheatgrass was encountered in seven of the plots and was identified as thickspike wheatgrass (*Elymus*

lanceolatus ssp. *lanceolatus*) in all of them. But this identification is based on one specimen encountered in flower in only one plot, and the rhizomatous wheatgrass in some of the plots may have been western wheatgrass (*Elymus smithii*). The two species cannot be distinguished from one another in the vegetative condition. This same problem may exist with a number of the forbs.

DISCUSSION

The 12 vegetation plots sampled in 2002 indicate that the grasslands in the northern part of F.W. Warren Air Force Base are composed of the same species that make up the grasslands on medium-textured soils throughout much of eastern Wyoming. (See Knight 1994 for a discussion of Wyoming grasslands.) Planted, introduced bunchgrasses (crested wheatgrass and intermediate wheatgrass) contribute substantial cover in places, but the plot data suggest that even on the part of the Base that was plowed and seeded several decades ago, native species are important components of the vegetation. A disturbing feature of the vegetation is the presence of dalmatian toadflax (*Linaria dalmatica*) over much of the area. This noxious weed, common along Crow Creek farther south on the Base, was encountered in half of the vegetation plots (Table 3).

Although a substantial number of the plants encountered in the plots in 2002 could not be identified to species due to lack of flowers and fruits, the data reported herein still constitute a starting point for assessing how the grassland vegetation changes over time under various management regimes. The 2002 data can be most readily used for finding changes in dominance by the native grasses. Species richness and species diversity will be harder to show, because of the number of unknown taxa in the 2002 data. In addition, the drought may have prevented some plants from growing at all, and the 2002 data contain no record of such species.

LITERATURE CITED

Daubenmire, R.F. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33: 43-64.

Knight, D.H. 1994. Mountains and Plains. The Ecology of Wyoming Landscapes. Yale University Press. 338 pp.

Stohlgren, T.J., M.B. Faulkner, and L.D. Schell. 1995. A modified-Whittaker nested vegetation sampling method. Vegetatio 117: 113-121.

TABLES

Table 1. Canopy cover ranges and mid-points.

% cover	>1	1-5	5-15	15-25	25-35	35-45	45-55	55-65	65-75	75-85	85-95	95-99	>99
Mid-point (value recorded)	1	3	10	20	30	40	50	60	70	80	90	98	100

Table 2. Categories of ground cover recorded in the microplots

Category	Description
Soil	Particles < 0.19 in. (0.5 cm) across
Gravel	Particles 0.19 - 3 in (0.5 - 7.5 cm) across
Cobble	Rocks 3 - 10 in. (7.5 - 25 cm) across
Boulder	Rocks > 10 in. (25 cm) across
Bedrock	Unfragmented rock
Litter	Dead plant material < ¼ inch (6 mm) across, lying on ground surface
Wood	Dead plant material > ¼ inch (6 mm) across, lying on ground surface
Lichen	
Moss	
Dead, rooted plant	Dead plant material rooted in ground

Table 3. Frequency of occurrence of vascular plant species recorded in the 12 vegetation sampling plots.

Species Name	NRCS Code	Origin	Growth Form	# of plots
artemisia frigida, fringed sagewort	arfr4	Native	3. Subshrub	12
forb, unknown	forbunk	Unknown	6. Forb	12
sphaeralcea coccinea, scarlet globemallow	spco	Native	6. Forb	11
cirsium, thistle	cirsi	Native and Introduced	6. Forb	10
heterotheca, telegraphplant	heter8	Unknown	6. Forb	9
astragalus laxmannii, laxmann's milkvetch	asla27	Native	6. Forb	9
hymenopappus filifolius, fineleaf hymenopappus	hyfi	Native	6. Forb	9
helianthus pumilus, little sunflower	hepu3	Native	6. Forb	8
machaeranthera pinnatifida, lacy tansyaster	mapi	Native	6. Forb	8
mirabilis linearis, narrowleaf four o'clock	mili3	Native	6. Forb	8
hesperostipa comata, needle and thread	heco26	Native	5. Graminoid	8
bouteloua gracilis, blue grama	bogr2	Native	5. Graminoid	7
lygodesmia juncea, rush skeletonplant	lyju	Native	6. Forb	7
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	Native	5. Graminoid	7
linaria dalmatica, dalmatian toadflax	lida	Introduced	6. Forb	6
mertensia lanceolata, lanceleaf bluebells	mela3	Native	6. Forb	6
paronychia sessiliflora, creeping nailwort	pase	Native	6. Forb	6
yucca glauca, small soapweed	yugl	Native	3. Subshrub	5
lesquerella alpina, alpine bladderpod	leal	Native	6. Forb	5
euphorbia brachycera, horned spurge	eubr	Native	6. Forb	5
liatris punctata, dotted gayfeather	lipu	Native	6. Forb	5
cryptantha thyrsiflora, calcareous catseye	crth	Native	6. Forb	5

Species Name	NRCS Code	Origin	Growth Form	# of plots
gaura coccinea, scarlet beeblossom	gaco5	Native	6. Forb	4
pediocactus simpsonii, simpson hedgehog cactus	pesi	Native	6. Forb	4
astragalus spatulatus, tufted milkvetch	assp6	Native	6. Forb	4
descurainia sophia, herb sophia	deso2	Introduced	6. Forb	3
carex duriuscula, needleleaf sedge	cadu6	Native	5. Graminoid	3
eriogonum flavum, yellow eriogonum	erfl4	Native	6. Forb	3
solanum rostratum, buffalobur nightshade	soro	Native	6. Forb	3
grindelia squarrosa, curlycup gumweed	grsq	Native	6. Forb	3
koeleria macrantha, prairie junegrass	koma	Native	5. Graminoid	3
krascheninnikovia lanata, winterfat	krla2	Native	3. Subshrub	3
lupinus plattensis, nebraska lupine	lupl	Native	6. Forb	3
castilleja sessiliflora, downy paintedcup	case5	Native	6. Forb	2
agropyron cristatum, crested wheatgrass	agcr	Introduced	5. Graminoid	2
tragopogon dubius, yellow salsify	trdu	Introduced	6. Forb	2
arenaria hookeri, hooker's sandwort	arho4	Native	6. Forb	2
tetraneuris acaulis var. acaulis, stemless four-nerve daisy	teaca2	Native	6. Forb	2
cirsium arvense, canadian thistle	ciar4	Introduced	6. Forb	2
oxytropis multiceps, southwestern locoweed	oxmu	Native	6. Forb	2
ambrosia tomentosa, skeletonleaf bur ragweed	amto3	Native	6. Forb	1
aristida purpurea, purple threeawn	arpu9	Native	5. Graminoid	1
thinopyrum intermedium, intermediate wheatgrass	thin6	Introduced	5. Graminoid	1
machaeranthera canescens ssp. canescens, spiny goldenweed	macac3	Native	6. Forb	1

Species Name	NRCS Code	Origin	Growth Form	# of plots
eriogonum, eriogonum	eriog	Native	6. Forb	1
chenopodium hians, hians goosefoot	chhi	Native	6. Forb	1
musineon tenuifolium, slender wildparsley	mute3	Native	6. Forb	1
ipomopsis spicata, spiked gilia	ipsp	Native	6. Forb	1
elymus smithii, western wheatgrass	elsm3	Native	5. Graminoid	1
phlox muscoides, musk phlox	phmu4	Native	6. Forb	1
carex filifolia, threadleaf sedge	cafi	Native	5. Graminoid	1

Table 4. Numbers of native and introduced vascular plant species in each of 12 sampling plots.

BurnedPlots

		Number of Spp.	Native	Intro-duced	Native and Intro-duced	Unknown
Plot	02WAFB02	27	24		1	2
Plot	02WAFB03	18	14	2	1	1
Plot	02WAFB04	22	17	2	1	2
Plot	02WAFB05	19	14	2	1	2
Plot	02WAFB06	22	18	1	1	2
Plot	02WAFB07	21	17	1	1	2
Plot	02WAFB08	20	16	1	1	2

Unburned Plots

		Number of Spp.	Native	Intro-duced	Native and Intro-duced	Unknown
Plot	02WAFB01	25	21	1	1	2
Plot	02WAFB09	20	15	2	1	2
Plot	02WAFB10	9	7	1		1
Plot	02WAFB11	12	9	2		1
Plot	02WAFB12	14	10	1	1	2

FIGURES

Figure 1. Layout of a modified-Whittaker vegetation sampling plot.

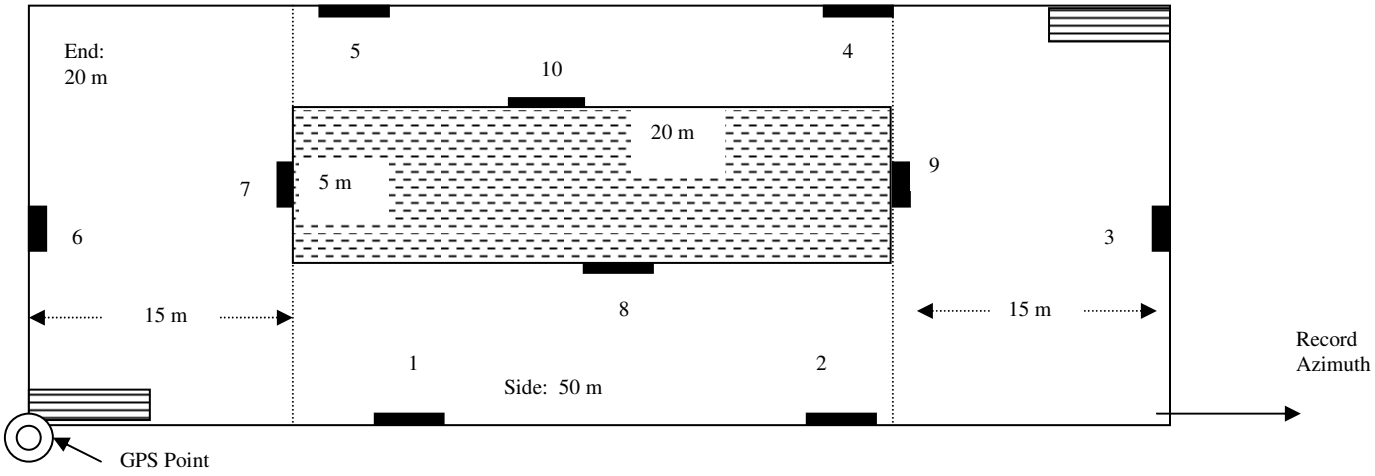


Figure 2. Locations of WYNDD sampling points on F.E. Warren Air Force Base.
Each sample point was placed as close as possible to the starting point of a CEMML transect.

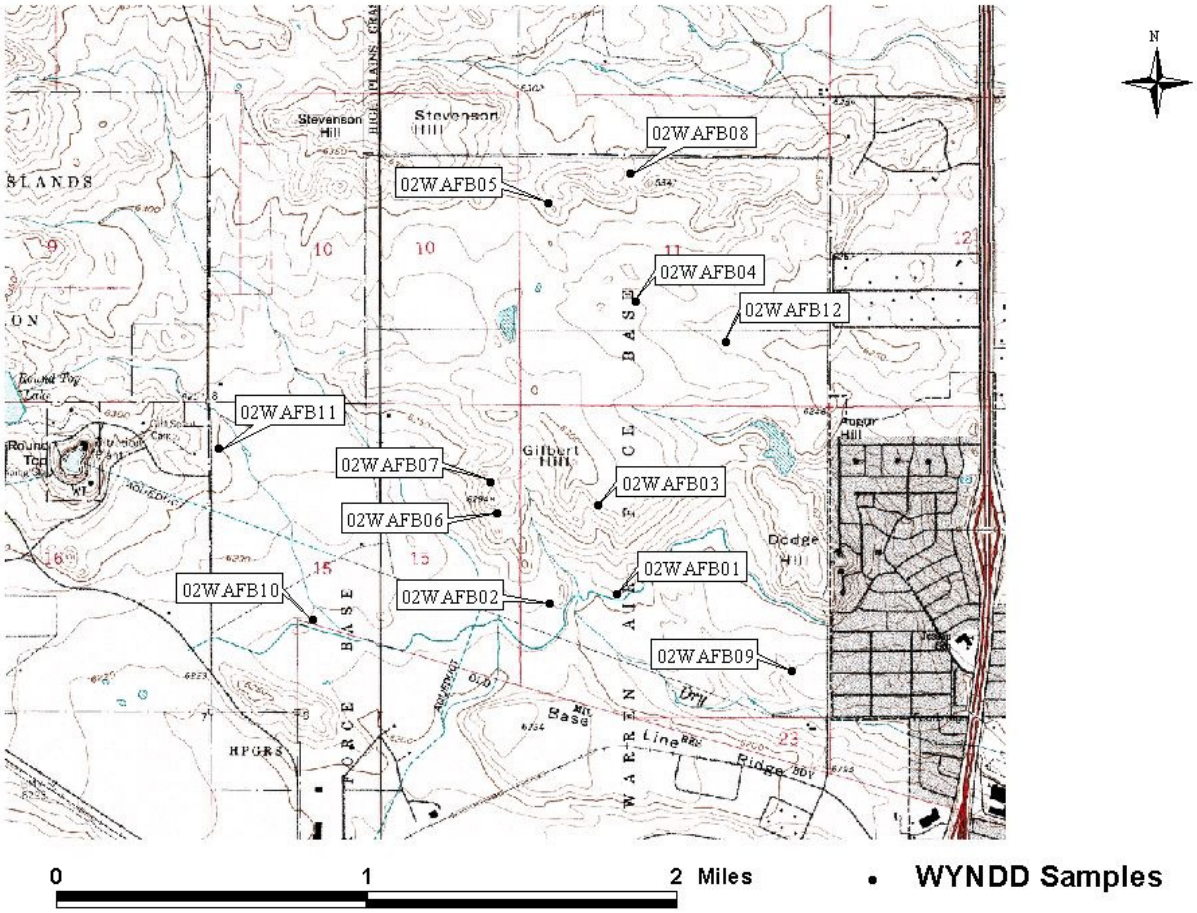
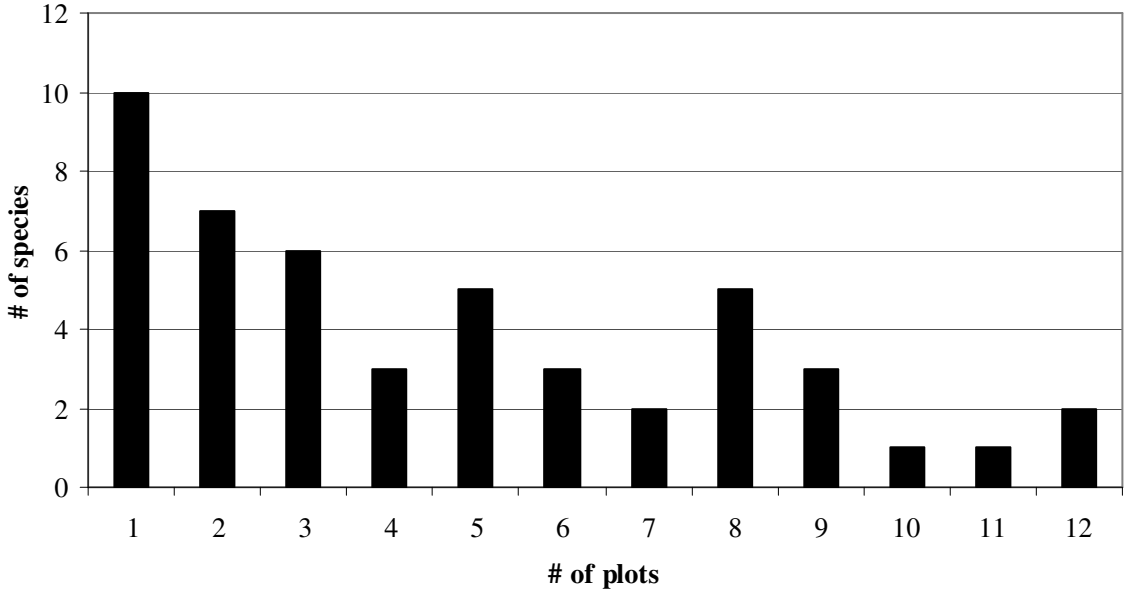


Figure 3. Frequency of Occurrence of 50 Vascular Plant Species in 12 Sample Plots.



APPENDIX 1. DATA FROM WYNDD SAMPLE PLOTS.

The data from the 2002 plots, shown in the following tables, are in the spreadsheet, "2002 WYNDD plot data.xls", provided with this report.

Plot 02WAFB01

Project: FEW grass

Sampling Date 6/26/2002 **Cover Type:** FEW Unburned grass

Location T 0 N, R 0 W Section 0 , 1/4

UTM 4558612 m N, 511714 m E (NAD27 13N)

Map name: Cheyenne North 1:

Environment Elevation 6227 feet Aspect (degrees): 180 Slope (degrees): 3

Topo position: Toeslope Soil Clay Loam

Soil features:

Surface deposit: Residual

Description

Photos:

Vegetation:
Predominantly grasses with some forbs. The plot is adjacent to a burned area.

Disturbance signs:
Possible training area and artillery range

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline conditions for assessing effects of fire on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish.

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:

Ground Cover Percentages

Soil	36	Gravel	2.4	Cobble	0	Boulder	0	Bedrock	0
Litter	14	Wood	1	DRP*	9.3	Lichen	1	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB01

Species	Code	Cover
Growth Form	*3. Subshrub*	
artemisia frigida, fringed sagewort	arfr4	0.3
yucca glauca, small soapweed	yugl	0.01
Growth Form	*5. Graminoid*	
aristida purpurea, purple threeawn	arpu9	8.5
carex filifolia, threadleaf sedge	cafi	7.6
Growth Form	*6. Forb*	
arenaria hookeri, hooker's sandwort	arho4	0.2
astragalus laxmannii, laxmann's milkvetch	asla27	0.1
astragalus spatulatus, tufted milkvetch	assp6	0.2
cirsium, thistle	cirsi	0.01
cryptantha thyrsiflora, calcareous catseye	crth	0.3
eriogonum, eriogonum	eriog	0.01
euphorbia brachycera, horned spurge	eubr	0.2
forb, unknown	forbunk	1
forb, unknown	forbunk	0.8
forb, unknown	forbunk	0.2
forb, unknown	forbunk	0.3
gaura coccinea, scarlet beeblossom	gaco5	0.3
helianthus pumilus, little sunflower	hepu3	0.4
heterotheca, telegraphplant	heter8	0.4
hymenopappus filifolius, fineleaf hymenopappus	hyfi	0.1
liatris punctata, dotted gayfeather	lipu	0.9
linaria dalmatica, dalmatian toadflax	lida	0.01
lupinus plattensis, nebraska lupine	lupl	1
machaeranthera pinnatifida, lacy tansyaster	mapi	0.2
oxytropis multiceps, southwestern locoweed	oxmu	0.01
paronychia sessiliflora, creeping nailwort	pase	0.5
pediocactus simpsonii, simpson hedgehog cactus	pesi	0.1
sphaeralcea coccinea, scarlet globemallow	spco	0.7
tetraneuris acaulis var. acaulis, stemless four-nerve daisy	teaca2	0.5

Plot 02WAFB02

Project: FEW grass

Sampling Date 6/27/2002 **Cover Type:** FEW Burned grass

Location T 0 N, R 0 W Section 0 , 1/4

UTM 4558563 m N, 511369 m E (NAD27 13N)

Map name: Cheyenne North 1:

Environment Elevation 6207 feet Aspect (degrees): 111 Slope (degrees): 3

Topo position: Toeslope Soil Clay Loam

Soil features: Exposed soil due to fire. Not very rocky.

Surface deposit: Residual

Description

Photos:

Vegetation:
The plants are very short due to the 2001 fire. Plants within the burned plot are greener and there is only a small amount of litter.

Disturbance signs:
Disturbance resulting from military use (training area). Plot burned by 2001 fire. Some patches outside of the plot did not burn.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline conditions for assessing the effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants were blooming.

Notes:

Ground Cover Percentages

Soil	33.6	Gravel	3.8	Cobble	0	Boulder	0	Bedrock	0
Litter	10	Wood	1	DRP*	2.2	Lichen	0.7	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB02

Species	Code	Cover
Growth Form	*3. Subshrub*	
artemisia frigida, fringed sagewort	arfr4	1.2
krascheninnikovia lanata, winterfat	krla2	0.01
yucca glauca, small soapweed	yugl	0.4
Growth Form	*5. Graminoid*	
bouteloua gracilis, blue grama	bogr2	20.7
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	1
hesperostipa comata, needle and thread	heco26	29.6
koeleria macrantha, prairie junegrass	koma	0.5
Growth Form	*6. Forb*	
arenaria hookeri, hooker's sandwort	arho4	3.7
astragalus spatulatus, tufted milkvetch	assp6	0.2
castilleja sessiliflora, downy paintedcup	case5	0.1
cirsium, thistle	cirsi	0.3
cryptantha thyrsiflora, calcareous catseye	crth	0.2
eriogonum flavum, yellow eriogonum	erfl4	1.1
forb, unknown	forbunk	0.8
forb, unknown	forbunk	0.9
forb, unknown	forbunk	1.6
forb, unknown	forbunk	2
forb, unknown	forbunk	0.1
forb, unknown	forbunk	0.2
gaura coccinea, scarlet beeblossom	gaco5	0.4
helianthus pumilus, little sunflower	hepu3	0.2
heterotheca, telegraphplant	heter8	0.3
hymenopappus filifolius, fineleaf hymenopappus	hyfi	0.2
ipomopsis spicata, spiked gilia	ipsp	0.01
liatris punctata, dotted gayfeather	lipu	0.2
machaeranthera pinnatifida, lacy tansyaster	mapi	0.1
oxytropis multiceps, southwestern locoweed	oxmu	0.3
paronychia sessiliflora, creeping nailwort	pase	1.1
phlox muscoides, musk phlox	phmu4	1.4
solanum rostratum, buffalobur nightshade	soro	0.01
sphaeralcea coccinea, scarlet globemallow	spco	0.3
tetraneuris acaulis var. acaulis, stemless four-nerve daisy	teaca2	1.1

Plot 02WAFB03

Project: FEW grass

Sampling Date 6/27/2002 **Cover Type:** FEW Burned grass

Location T 0 N, R 0 W Section 0 , 1/4

UTM 4559070 m N, 511617 m E (NAD27 13N)

Map name: Cheyenne North 1:

Environment Elevation 6206 feet Aspect (degrees): 90 Slope (degrees): 4

Topo position: Toeslope Soil Clay Loam

Soil features:

Surface deposit: Residual

Description

Photos:

Vegetation:
Vegetation predominantly grasses and dalmatian toadflax. Little dead material because of the 2001 fire. The grasses are uniform in height and the toadflax is generally the tallest plant.

Disturbance signs:
The area around plot was burned in the 2001 fire. The plot has some patches of unburned grasses. Power lines and associated road run through the plot. The area is used for military training, judging from the presence of gun shells and debris.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline for evaluating the effect of management burns on plant species richness.

Uncertainty on measurements:
Grasses were difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:

Ground Cover Percentages

Soil	48	Gravel	6.8	Cobble	0	Boulder	0	Bedrock	0
Litter	18	Wood	1.2	DRP*	5.1	Lichen	0	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB03

Species	Code	Cover
Growth Form	*3. Subshrub*	
artemisia frigida, fringed sagewort	arfr4	1.1
Growth Form	*5. Graminoid*	
agropyron cristatum, crested wheatgrass	agcr	10
bouteloua gracilis, blue grama	bogr2	18
koeleria macrantha, prairie junegrass	koma	13.2
Growth Form	*6. Forb*	
astragalus laxmannii, laxmann's milkvetch	asla27	0.01
cirsium, thistle	cirsi	0.01
cryptantha thyrsiflora, calcareous catseye	crth	0.01
euphorbia brachycera, horned spurge	eubr	1
forb, unknown	forbunk	0.8
forb, unknown	forbunk	0.01
helianthus pumilus, little sunflower	hepu3	0.1
hymenopappus filifolius, fineleaf hymenopappus	hyfi	0.6
lesquerella alpina, alpine bladderpod	leal	1.5
linaria dalmatica, dalmatian toadflax	lida	1
lygodesmia juncea, rush skeletonplant	lyju	0.2
machaeranthera pinnatifida, lacy tansyaster	mapi	0.2
mertensia lanceolata, lanceleaf bluebells	mela3	0.5
paronychia sessiliflora, creeping nailwort	pase	0.1
sphaeralcea coccinea, scarlet globemallow	spco	2.1

Plot 02WAFB04

Project: FEW grass

Sampling Date 7/9/2002 **Cover Type:** FEW Burned grass

Location T 14 N, R 67 W Section 11 , SW 1/4

UTM 4560121 m N, 511815 m E (NAD83 13N)

Map name: CHEYENNE NORTH 1:24,000

Environment Elevation 6220 feet Aspect (degrees): 119 Slope (degrees): 1

Topo position: Terrace Soil Clay Loam

Soil features: Soil very dry on the surface and "crunchy" when walked upon. Fine soil, not particularly gravelly.

Surface deposit: Residual

Description

Photos:
none

Vegetation:
Predominantly grasses with some forbs. Tall dalmatian toadflax scattered in highly disturbed areas.

Disturbance signs:
Burned by the 2001 fire. Small mammal burrows are present. Debris from military training scattered around the area.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline conditions for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:
Azimuth of long side of macroplot = 142 degrees from GPS corner

Ground Cover Percentages

Soil	20	Gravel	6.3	Cobble		Boulder	Bedrock
Litter	15	Wood	1.6	DRP*	4.4	Lichen	Moss

*DRP = Dead, Rooted

Plot 02WAFB04

Species	Code	Cover
Growth Form *3. Subshrub*		
artemisia frigida, fringed sagewort	arfr4	0.1
Growth Form *5. Graminoid*		
agropyron cristatum, crested wheatgrass	agcr	0.01
bouteloua gracilis, blue grama	bogr2	1.2
carex duriuscula, needleleaf sedge	cadu6	0.6
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	12.9
hesperostipa comata, needle and thread	heco26	12.6
Growth Form *6. Forb*		
astragalus laxmannii, laxmann's milkvetch	asla27	0.2
castilleja sessiliflora, downy paintedcup	case5	0.01
cirsium, thistle	cirsi	0.01
descurainia sophia, herb sophia	deso2	0.01
forb, unknown	forbunk	0.2
forb, unknown	forbunk	1
forb, unknown	forbunk	0.1
forb, unknown	forbunk	0.01
forb, unknown	forbunk	1.1
grindelia squarrosa, curlycup gumweed	grsq	0.1
helianthus pumilus, little sunflower	hepu3	0.01
heterotheca, telegraphplant	heter8	1.4
hymenopappus filifolius, fineleaf hymenopappus	hyfi	0.01
lesquerella alpina, alpine bladderpod	leal	0.3
lupinus plattensis, nebraska lupine	lupl	0.3
lygodesmia juncea, rush skeletonplant	lyju	0.1
mertensia lanceolata, lanceleaf bluebells	mela3	0.1
mirabilis linearis, narrowleaf four o'clock	mili3	0.5
pediocactus simpsonii, simpson hedgehog cactus	pesi	0.1
sphaeralcea coccinea, scarlet globemallow	spco	1.7

Plot 02WAFB05 **Project:** FEW grass

Sampling Date 7/9/2002 **Cover Type:** FEW Burned grass

Location T 14 N, R 67 W Section 11 , NW 1/4

UTM 4560632 m N, 511357 m E (NAD83 13N)

Map name: CHEYENNE NORTH 1:24,000

Environment Elevation 6246 feet Aspect (degrees): 274 Slope (degrees): 6

Topo position: Toeslope Soil Clay Loam

Soil features: Small rocks scattered in and on top of soil. Brought to surface from plowing.

Surface deposit: Residual

Description

Photos:
none

Vegetation:
Predominantly grasses. Pockets of toadflax in heavily disturbed areas. Low growing vegetation due to fire. Greener than unburned area adjacent to plot.

Disturbance signs:
Entire area was plowed at one time to remove ammunition. Small mammal burrows are present. Plot was burned in 2001 fire.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline conditions for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:
Azimuth of long side of macroplot = 272 degrees from GPS corner

Ground Cover Percentages

Soil	25	Gravel	3.7	Cobble		Boulder		Bedrock	
Litter	29	Wood	1.2	DRP*	6.1	Lichen	1	Moss	

*DRP = Dead, Rooted

Plot 02WAFB05

Species	Code	Cover
Growth Form *3. Subshrub*		
artemisia frigida, fringed sagewort	arfr4	0.4
Growth Form *5. Graminoid*		
carex duriuscula, needleleaf sedge	cadu6	0.6
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	18.8
koeleria macrantha, prairie junegrass	koma	1.2
Growth Form *6. Forb*		
astragalus laxmannii, laxmann's milkvetch	asla27	0.1
cirsium, thistle	cirsi	0.01
descurainia sophia, herb sophia	deso2	0.01
euphorbia brachycera, horned spurge	eubr	0.3
forb, unknown	forbunk	0.2
forb, unknown	forbunk	0.3
forb, unknown	forbunk	0.4
forb, unknown	forbunk	0.1
grindelia squarrosa, curlycup gumweed	grsq	0.01
heterotheca, telegraphplant	heter8	0.2
hymenopappus filifolius, fineleaf hymenopappus	hyfi	0.5
lesquerella alpina, alpine bladderpod	leal	0.2
linaria dalmatica, dalmatian toadflax	lida	0.3
lygodesmia juncea, rush skeletonplant	lyju	0.01
mertensia lanceolata, lanceleaf bluebells	mela3	0.2
mirabilis linearis, narrowleaf four o'clock	mili3	0.4
pediocactus simpsonii, simpson hedgehog cactus	pesi	0.1
sphaeralcea coccinea, scarlet globemallow	spco	1.3

Plot 02WAFB06 **Project:** FEW grass

Sampling Date 7/10/2002 **Cover Type:** FEW Burned grass

Location T 14 N, R 67 W Section 15 , NE 1/4

UTM 4559031 m N, 511094 m E (NAD83 13N)

Map name: CHEYENNE NORTH 1:24,000

Environment Elevation 6225 feet Aspect (degrees): 178 Slope (degrees): 5

Topo position: Footslope Soil Clay Loam

Soil features: Fair amount of gravel that has been brought to the surface from plowing

Surface deposit: Residual

Description

Photos:
None

Vegetation:
Predominantly grasses. Shorter vegetation and greener than adjacent non-burned area. Some scorched yucca and blooming prickly poppy.

Disturbance signs:
Burned in 2001 fire. Small mammal burrows are present. Military training. Area was plowed and seeded at least 20 years ago.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline condition for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:
Azimuth of long side of macroplot = 80 degrees from GPS corner

Ground Cover Percentages

Soil	21	Gravel	11.6	Cobble		Boulder	Bedrock
Litter	12.3	Wood	1	DRP*	3.1	Lichen	Moss

*DRP = Dead, Rooted

Plot 02WAFB06

Species	Code	Cover
Growth Form *3. Subshrub*		
artemisia frigida, fringed sagewort	arfr4	0.7
yucca glauca, small soapweed	yugl	2
Growth Form *5. Graminoid*		
bouteloua gracilis, blue grama	bogr2	0.5
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	17
hesperostipa comata, needle and thread	heco26	22.3
Growth Form *6. Forb*		
astragalus laxmannii, laxmann's milkvetch	asla27	0.1
astragalus spatulatus, tufted milkvetch	assp6	0.3
cirsium, thistle	cirsi	0.4
descurainia sophia, herb sophia	deso2	0.01
euphorbia brachycera, horned spurge	eubr	0.6
forb, unknown	forbunk	0.1
forb, unknown	forbunk	0.3
forb, unknown	forbunk	0.4
forb, unknown	forbunk	0.7
helianthus pumilus, little sunflower	hepu3	0.6
heterotheca, telegraphplant	heter8	0.2
hymenopappus filifolius, fineleaf hymenopappus	hyfi	0.01
liatris punctata, dotted gayfeather	lipu	0.6
lygodesmia juncea, rush skeletonplant	lyju	0.1
machaeranthera canescens ssp. canescens, spiny goldenweed	macac3	0.1
machaeranthera pinnatifida, lacy tansyaster	mapi	0.1
mirabilis linearis, narrowleaf four o'clock	mili3	0.3
paronychia sessiliflora, creeping nailwort	pase	0.1
solanum rostratum, buffalobur nightshade	soro	
sphaeralcea coccinea, scarlet globemallow	spco	0.2

Plot 02WAFB07 **Project:** FEW grass

Sampling Date 7/10/2002 **Cover Type:** FEW Burned grass

Location T 14 N, R 67 W Section 15 , NE 1/4

UTM 4559191 m N, 511056 m E (NAD83 13N)

Map name: CHEYENNE NORTH 1:24,000

Environment Elevation 6220 feet Aspect (degrees): 112 Slope (degrees): 8

Topo position: Backslope Soil Clay Loam

Soil features: Gravel brought to surface from plowing

Surface deposit: Residual

Description

Photos:
None

Vegetation:
Predominantly grasses. Shorter vegetation and greener than adjacent non-burned area. Tallest plants are buffalo bur that are blooming.

Disturbance signs:
Power lines run above plot. 2001 fire burned the plot. Small mammal burrows present. Sheep grazing in area. Area was plowed at least 20 years ago to remove ammunition.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline condition for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:
Azimuth of long side of macroplot = 62 degrees from GPS corner

Ground Cover Percentages

Soil	24.3	Gravel	7.5	Cobble		Boulder	Bedrock
Litter	19	Wood	1.4	DRP*	2.9	Lichen	Moss

*DRP = Dead, Rooted

Plot 02WAFB07

Species	Code	Cover
Growth Form *3. Subshrub*		
artemisia frigida, fringed sagewort	arfr4	0.6
Growth Form *5. Graminoid*		
bouteloua gracilis, blue grama	bogr2	7.4
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	19.3
hesperostipa comata, needle and thread	heco26	8
Growth Form *6. Forb*		
astragalus laxmannii, laxmann's milkvetch	asla27	0.3
astragalus spatulatus, tufted milkvetch	assp6	0.2
cirsium, thistle	cirsi	0.1
forb, unknown	forbunk	0.4
forb, unknown	forbunk	0.5
forb, unknown	forbunk	0.1
forb, unknown	forbunk	0.01
forb, unknown	forbunk	0.2
gaura coccinea, scarlet beeblossom	gaco5	1
helianthus pumilus, little sunflower	hepu3	1.2
heterotheca, telegraphplant	heter8	0.1
hymenopappus filifolius, fineleaf hymenopappus	hyfi	0.01
liatris punctata, dotted gayfeather	lipu	0.3
lygodesmia juncea, rush skeletonplant	lyju	0.1
machaeranthera pinnatifida, lacy tansyaster	mapi	0.01
mirabilis linearis, narrowleaf four o'clock	mili3	0.1
musineon tenuifolium, slender wildparsley	mute3	0.1
paronychia sessiliflora, creeping nailwort	pase	0.3
solanum rostratum, buffalobur nightshade	soro	0.01
sphaeralcea coccinea, scarlet globemallow	spco	0.5
tragopogon dubius, yellow salsify	trdu	0.2

Plot 02WAFB08 **Project:** FEW grass

Sampling Date 7/11/2002 **Cover Type:** FEW Burned grass

Location T 14 N, R 67 W Section 11 , NW 1/4

UTM 4560782 m N, 511782 m E (NAD27 13N)

Map name: Cheyenne North 1:

Environment Elevation 6270 feet Aspect (degrees): 31 Slope (degrees): 8

Topo position: Backslope Soil Clay Loam

Soil features: gravelly soil around ground squirrel burrows

Surface deposit: Residual

Description

Photos:

Vegetation:
The dominant plant in this plot is skeleton plant which occupies about 1/3 of the plot. Grasses also common but are low growing due to the 2001 fire. There are also pockets of dalmatian toadflax in the plot.

Disturbance signs:
Small mammal burrows and vehicle tracks present. Plot burned in 2001 fire.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline condition for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:
Azimuth at corner of plot = 349 degrees

Ground Cover Percentages

Soil	12.6	Gravel	6.1	Cobble	0	Boulder	0	Bedrock	0
Litter	19	Wood	1.2	DRP*	4.9	Lichen	0	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB08

Species	Code	Cover
Growth Form *3. Subshrub*		
artemisia frigida, fringed sagewort	arfr4	0.3
Growth Form *5. Graminoid*		
bouteloua gracilis, blue grama	bogr2	23
carex duriuscula, needleleaf sedge	cadu6	2.2
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	15
hesperostipa comata, needle and thread	heco26	14.2
Growth Form *6. Forb*		
astragalus laxmannii, laxmann's milkvetch	asla27	0.2
cirsium, thistle	cirsi	0.01
eriogonum flavum, yellow eriogonum	erfl4	0.01
euphorbia brachycera, horned spurge	eubr	0.4
forb, unknown	forbunk	0.3
forb, unknown	forbunk	0.01
forb, unknown	forbunk	0.2
helianthus pumilus, little sunflower	hepu3	0.01
heterotheca, telegraphplant	heter8	0.01
hymenopappus filifolius, fineleaf hymenopappus	hyfi	1.3
lesquerella alpina, alpine bladderpod	leal	0.1
linaria dalmatica, dalmatian toadflax	lida	0.4
machaeranthera pinnatifida, lacy tansyaster	mapi	0.1
mertensia lanceolata, lanceleaf bluebells	mela3	0.2
mirabilis linearis, narrowleaf four o'clock	mili3	0.1
pediocactus simpsonii, simpson hedgehog cactus	pesi	0.01
sphaeralcea coccinea, scarlet globemallow	spco	1.6

Plot 02WAFB09

Project: FEW grass

Sampling Date 7/11/2002 **Cover Type:** FEW Unburned grass

Location T 14 N, R 67 W Section 14 , SE 1/4

UTM 455810 m N, 512620 m E (NAD 27 13N)

Map name: Cheyenne North 1:

Environment Elevation 6250 feet Aspect (degrees): 220 Slope (degrees): 5

Topo position: Shoulder Soil Clay Loam

Soil features: Some gravel on the surface. Surface is very dry due to drought conditions.

Surface deposit: Residual

Description

Photos:

Vegetation:
The plot is dominated by grasses which are also the tallest vegetation except for scattered thistles.

Disturbance signs:
The plot is between two dirt roads with vehicle tracks crossing the plot. Small mammal burrows are present.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline condition for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses are very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:
This plot is off the dirt road near the stables. No UTM's taken by mistake. The original CEMML transect was obliterated by expansion of a road.

Ground Cover Percentages

Soil	61	Gravel	5.8	Cobble	0	Boulder	0.3	Bedrock	0
Litter	27	Wood	1.2	DRP*	1.4	Lichen	1.2	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB09

Species	Code	Cover
Growth Form *3. Subshrub*		
artemisia frigida, fringed sagewort	arfr4	5.6
yucca glauca, small soapweed	yugl	0.1
Growth Form *5. Graminoid*		
bouteloua gracilis, blue grama	bogr2	0.3
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	32
thinopyrum intermedium	thin6	15.5
Growth Form *6. Forb*		
astragalus laxmannii, laxmann's milkvetch	asla27	3
cirsium, thistle	cirsi	0.01
cryptantha thyrsiflora, calcareous catseye	crth	0.8
eriogonum flavum, yellow eriogonum	erfl4	0.1
forb, unknown	forbunk	0.01
forb, unknown	forbunk	0.1
forb, unknown	forbunk	0.5
gaura coccinea, scarlet beeblossom	gaco5	0.2
helianthus pumilus, little sunflower	hepu3	0.01
heterotheca, telegraphplant	heter8	0.3
hymenopappus filifolius, fineleaf hymenopappus	hyfi	1.2
lupinus plattensis, nebraska lupine	lupl	0.01
lygodesmia juncea, rush skeletonplant	lyju	0.1
mirabilis linearis, narrowleaf four o'clock	mili3	0.3
paronychia sessiliflora, creeping nailwort	pase	0.3
sphaeralcea coccinea, scarlet globemallow	spco	0.9
tragopogon dubius, yellow salsify	trdu	0.01

Plot 02WAFB10

Project: FEW grass

Sampling Date 7/12/2002 **Cover Type:** FEW Unburned grass

Location T 0 N, R 0 W Section 0 , 1/4

UTM 4558480 m N, 510142 m E (NAD83 13N)

Map name: Roundtop Lake 1:

Environment Elevation 6273 feet Aspect (degrees): 204 Slope (degrees): 1

Topo position: Toeslope Soil Clay Loam

Soil features: very dry, moderate gravel, occasional cobble, has been plowed under during past several years

Surface deposit: Residual

Description

Photos:

Vegetation:
Needle and thread grass and thistle dominate the plot.

Disturbance signs:
The ground was tilled and seeded over 20 years ago. Evidence of heavy grazing by domestic sheep in adjacent areas. A two-track road borders the southern edge of the plot.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline condition for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:

Ground Cover Percentages

Soil	23.6	Gravel	3.6	Cobble	0	Boulder	0	Bedrock	0
Litter	27	Wood	1.2	DRP*	1	Lichen	0	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB10

Species	Code	Cover
Growth Form *3. Subshrub*		
artemisia frigida, fringed sagewort	arfr4	0.2
Growth Form *5. Graminoid*		
elymus lanceolatus ssp. lanceolatus, thickspike wheatgrass	ellal	2.9
hesperostipa comata, needle and thread	heco26	27.3
Growth Form *6. Forb*		
ambrosia tomentosa, skeletonleaf burr ragweed	amto3	0.01
chenopodium hians, hians goosefoot	chhi	0.01
cirsium arvense, canadian thistle	ciar4	18.7
forb, unknown	forbunk	0.4
liatris punctata, dotted gayfeather	lipu	0.1
mirabilis linearis, narrowleaf four o'clock	mili3	0.2

Plot 02WAFB11 **Project:** FEW grass

Sampling Date 8/14/2002 **Cover Type:** FEW Unburned grass

Location T 0 N, R 0 W Section 0 , 1/4

UTM 4559361 m N, 509652 m E (NAD83 13N)

Map name: Roundtop Lake 1:

Environment Elevation 6290 feet Aspect (degrees): 142 Slope (degrees): 1

Topo position: Terrace Soil Clay Loam

Soil features:

Surface deposit: Residual

Description

Photos:

Vegetation:
Canada thistle is the tallest plant within plot. Grasses are the dominant vegetation.

Disturbance signs:
Domestic sheep grazing, old ditch, badger burrows, and an abandoned road.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline condition for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish

Completeness of Species List:
May be missing late season bloomers. Extremely dry conditions. Very few plants are blooming.

Notes:
Azimuth at corner of plot = 133 degrees

Ground Cover Percentages

Soil	8.8	Gravel	0.1	Cobble	0	Boulder	0	Bedrock	0
Litter	30.3	Wood	0.5	DRP*	1.3	Lichen	0	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB11

Species	Code	Cover
Growth Form	*3. Subshrub*	
artemisia frigida, fringed sagewort	arfr4	2
krascheninnikovia lanata, winterfat	krla2	0.01
yucca glauca, small soapweed	yugl	0.2
Growth Form	*5. Graminoid*	
hesperostipa comata, needle and thread	heco26	71
Growth Form	*6. Forb*	
cirsium arvense, canadian thistle	ciar4	0.1
cryptantha thyrsiflora, calcareous catseye	crth	0.01
forb, unknown	forbunk	0.2
linaria dalmatica, dalmatian toadflax	lida	0.01
machaeranthera pinnatifida, lacy tansyaster	mapi	0.1
mertensia lanceolata, lanceleaf bluebells	mela3	0.01
mirabilis linearis, narrowleaf four o'clock	mili3	0.1
sphaeralcea coccinea, scarlet globemallow	spco	0.2

Plot 02WAFB12 **Project:** FEW grass

Sampling Date 8/14/2002 **Cover Type:** FEW Unburned grass

Location T 14 N, R 67 W Section 11 , SW 1/4

UTM 4559916 m N, 512281 m E (NAD83 13N)

Map name: Cheyenne North 1:

Environment Elevation 6260 feet Aspect (degrees): 144 Slope (degrees): 1

Topo position: Terrace Soil Clay Loam

Soil features:

Surface deposit: Residual

Description

Photos:

Vegetation:
Grasses are the most dominant vegetation. A few thistles are the tallest plants.

Disturbance signs:
Vehicle tracks cross through plot and there small mammal burrows are present.

Why was plot done?
Characterize unburned grassland habitat for mountain plovers and establish baseline condition for assessing effects of management burns on plant species richness.

Uncertainty on measurements:
Grasses were very difficult to distinguish. Difficult to distinguish between dormant plants due to drought and dead rooted plants.

Completeness of Species List:
May be missing late season bloomers due to drought condtions. Estimated grass cover including dead material. Assuming plants are still alive although there is little green tissue. Very few plants are blooming.

Notes:
Azimuth at corner of plot = 144 degrees

Ground Cover Percentages

Soil	7.2	Gravel	0.9	Cobble	0	Boulder	0	Bedrock	0
Litter	28	Wood	1	DRP*	0.8	Lichen	0.8	Moss	0

*DRP = Dead, Rooted

Plot 02WAFB12

Species	Code	Cover
Growth Form	*3. Subshrub*	
artemisia frigida, fringed sagewort	arfr4	0.3
krascheninnikovia lanata, winterfat	krla2	0.01
Growth Form	*5. Graminoid*	
hesperostipa comata, needle and thread	heco26	58
Growth Form	*6. Forb*	
astragalus laxmannii, laxmann's milkvetch	asla27	0.5
cirsium, thistle	cirsi	0.3
forb, unknown	forbunk	0.1
grindelia squarrosa, curlycup gumweed	grsq	0.1
heterotheca, telegraphplant	heter8	0.4
lesquerella alpina, alpine bladderpod	leal	0.01
linaria dalmatica, dalmatian toadflax	lida	0.3
linaria dalmatica, dalmatian toadflax	lida	0.6
lygodesmia juncea, rush skeletonplant	lyju	0.2
machaeranthera pinnatifida, lacy tansyaster	mapi	0.01
mertensia lanceolata, lanceleaf bluebells	mela3	0.01
sphaeralcea coccinea, scarlet globemallow	spco	0.1