

SIGNIFICANT NATURAL HERITAGE RESOURCES  
OF THE HALL RANCH, HEIL RANCH,  
AND THE TREVARTON OPEN SPACE  
AND THEIR CONSERVATION

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COLORADO NATURAL HERITAGE PROGRAM  
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## EXECUTIVE SUMMARY

In 1995, The Colorado Natural Heritage Program (CNHP) was contracted by Boulder County Parks and Open Space (BCPOS) to assess the biodiversity values of the Hall and Heil Ranches and the Trevarton Open Space. The goal of the project was to accumulate biological data from the area, incorporate appropriate portions into the CNHP's Biological Conservation Database, and with appropriate field verification, identify significant natural heritage resources. We were also asked to make recommendations on actions that would be necessary to protect these resources and develop maps of major plant communities and exotic plant species concentrations.

The Natural Heritage Inventory was conducted in four steps:

1. Existing information pertaining to significant elements of biological diversity at the Hall and Heil Ranches, Trevarton Open Space and adjacent areas was accumulated.
2. Ground surveys were performed to map plant communities and concentrations of exotic species, identify new elements, update existing records, and rank occurrences of elements in terms of quality, condition, viability, and defensibility, and to identify conservation planning boundaries for each element.
3. Natural Heritage Biodiversity Ranks (B-ranks) were assigned to determine significance of each conservation site.
4. Data were assessed relative to the conservation priorities of the International Network of Natural Heritage Programs the results of which are presented in this report.

The Hall and Heil Ranches and the Trevarton Open Space were determined to contain significant natural heritage resources (those species or communities determined by CNHP to be rare, threatened or endangered or of high significance). Four sites within the study area were denoted as "natural heritage conservation sites." The Natural Heritage Program developed preliminary conservation planning boundaries for these sites. In developing these boundaries, a number of factors were considered including: habitat for rare species or significant communities, protection of water quality, buffers from potentially detrimental land uses, and the maintenance of ecological processes necessary for the perpetuation of the significant elements in the area.

The delineation of a conservation planning boundary in this report does not confer any regulatory protection. These boundaries are intended to be used to support wise planning and decision-making for the conservation of these significant areas. The Colorado Natural Heritage Program encourages Boulder County Parks and Open Space to take actions that will protect these significant sites. The Colorado Natural Heritage Program offers its assistance in working with Boulder County Parks and Open Space to ensure protection of these areas.

The report includes several recommendations for the Hall and Heil Ranches and Trevarton Open Space.

**Where appropriate, consider special area designations or special management plans for the conservation sites identified in this study.**

**Incorporate the information included in this report in the review of activities in or near areas identified as significant.**

**Increase public awareness of the benefits of protecting areas determined to be significant to the nation's natural diversity.**

**Promote cooperation with boundary neighbors (private individuals, the State Land Board, U. S. Forest Service) to insure the maintenance of selected sites and ecosystem integrity.**

**Properly manage significant elements of natural diversity.**

**Actively manage roads and trails through and to conservation sites to control invasive alien plant.**

**Continue to identify significant natural resources through inventories and other tools.**

**Investigate the fire ecology and grazing relationship within all plant communities on the Hall and Heil Ranches and Trevarton Open Space.**

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# INTRODUCTION

In 1995, The Colorado Natural Heritage Program (CNHP) was contracted by Boulder County Parks and Open Space to assess the biodiversity values of the Hall and Heil Ranches and Trevarton Open Space. The goal of the project was to accumulate new biological data and examine existing data from the area, incorporate appropriate portions into the CNHP's Biological Conservation Database, and with appropriate field verification, identify significant natural heritage resources. Natural heritage resources are defined as rare, threatened, endangered, or sensitive species and significant natural communities that are monitored by CNHP. In short, we were to identify those sites supporting unique or exemplary natural communities, rare plants and rare animals, and other significant natural features. It is within the purpose of this effort to identify the conservation sites which will protect these most sensitive elements of natural diversity. We were also to develop a map of the major plant communities and areas with concentrations of exotic species.

## Overview of the Study Area

Today much of the natural vegetation of the Front Range has been replaced by croplands, cattle pastures, and human developments. Extensive urbanization has dramatically changed the character of the vegetation. The Hall and Heil Ranches and the Trevarton Open Space were found to have significant natural heritage resources. However, signs of disturbance and potential threats abound and the integrity of the area is considered threatened.

The Hall and Heil Ranches were both acquired during the 1940's. The Hall Ranch was originally divided up as five homesteads, and the Heil remained as one entity. Cultivation of the land occurred on both ranches and silo structures on the properties still attest to this fact. Since the 1940's, the ranches have been utilized for the grazing of livestock. The Heil Ranch in particular has several quarry sites which were mined for the Lyons Red Sandstone that was key in the building of many structures in both Lyons and Boulder. The Hall Ranch has numerous quarries especially on the slopes just west of Lyons.

The Hall and Heil Ranches and Trevarton Open Space sites are located in north-central Boulder County, Colorado. The relatively recent and extensive use of the area has greatly impacted the flora and fauna. Extirpations have been largely restricted to large mammals. Grizzly bears and gray wolves once roamed throughout the state and black-footed ferret were not uncommon (Armstrong 1972). All are no longer resident within the state. Fortunately, most species have not suffered so extensively, but many have been reduced in numbers -- some significantly. Many plant species not native to this area have become established and in some cases dominant, especially in areas that historically have been or currently are to some degree disturbed by human activity (including livestock grazing, alteration of natural processes such as fire or flooding, gravel mining, agricultural activity, road building or other development).

Climate. The climate of the area is strongly influenced by the mountains and is continental in character. Sudden and extreme changes in atmospheric conditions may occur from hour to hour and day to day at any season of the year. Winters are generally cool and dry and summers warm. Average annual precipitation at the Boulder station (5420 feet elevation) is 18 inches (Doesken et al. 1984). January is the coldest month with average lows of 20 degrees F, and average highs of 45 degree F. July is the warmest month with average highs of 88 degrees F, and average lows of 59 degrees F (Owenby and Ezell 1992).

Geology. The geology of the area is quite complex. The most common substrate is sandstone of various ages, but siltstone, shale, claystone, and some limestone and Quaternary colluvium and alluvium are prominent along the eastern part of the study area. Pegmatite and the Silver Plume granite are more common to the west (Braddock et al. 1988).

Figure 1. Landscape view of the study area looking west from near Indian Lookout Mountain



## Colorado's Natural Heritage Program

To place this report in context it is useful to understand the history and functions of the Colorado Natural Heritage Program (CNHP). CNHP has been extant in Colorado for 16 years. CNHP was relocated from the Division of Parks and Outdoor Recreation into the University of Colorado Museum in the spring of 1992, and more recently to the College of Natural Resources at Colorado State University. With an increased staff, the Program is revitalized and updating comprehensive information on the rare, threatened, and endangered species and significant natural communities in Colorado. The multi-disciplinary team of scientists and information managers gather information and incorporate it into continually updated databases. CNHP is part of an international network of conservation data centers that use the Biological and Conservation Databases (developed by The Nature Conservancy). In addition, CNHP has effective relationships with the Colorado Natural Areas Program, Colorado Department of Natural Resources, the Colorado Division of Wildlife, and the numerous federal agencies. Concentrating on site-specific data for each element of natural diversity, the accurate status of each element becomes known. The data presented here illustrate sites that are important to the conservation of Colorado's, and indeed the nation's natural biological diversity. By using the element ranks and the quality of each occurrence, priorities can be established for the protection of the most sensitive or imperilled sites. It is by having an updated locational database and priority-setting system that CNHP can provide its most effective, proactive land-planning tools.

Information is gathered by CNHP on species, natural communities, and ecosystems. Each of these significant natural features (species and communities or plant associations) is an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative rarity or imperilment on a five-point scale (1 = extremely rare/imperilled; 5 = abundant/secure; **Table 1**).

The primary criterion for ranking elements is the number of occurrences, i.e. the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, population trends, and threats. However, the emphasis remains on the number of occurrences, such that ranks are an index of known biological rarity. These ranks are assigned both in terms of the element's rarity within Colorado (its State or S-rank) and the element's rarity over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the rarity of the element. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species are listed as Endangered or Threatened. **Natural Heritage rarity/imperilment ranks should not be interpreted as legal designations.**

Table 1. Definition of Natural Heritage state rarity/imperilment ranks. Global rarity ranks are similar, but refer to a species' rarity throughout its range. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. Note that GA and G#N are not used and GX means extinct. These ranks should not be interpreted as legal designations.

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- S1 Critically imperiled or extremely rare: usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
- S2 Imperiled or very rare; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.
- S3 Vulnerable or rare; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
- S4 Common; usually > 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
- S5 Very common; demonstrably secure under present conditions.
- SA Accidental in the state.
- SH Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.
- S#B Same rank as the numbered S-series, but refers to the breeding season rarity of migrants.
- S#N Same rank as the numbered S-series, but refers to the non-breeding season rarity of migrants; where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
- SU Status uncertain, often because of low search effort or cryptic nature of the element.
- S? The rank is somewhat questionable, often because of lack of information.
- SX Apparently extirpated from the state.

The spot on the landscape that supports a particular population or location of a species or a specific stand of a given community type is an **element occurrence**. The Colorado Natural Heritage Program has mapped over 6,000 element occurrences in Colorado. Information on the locations and quality of these element occurrences is also entered into the computerized Biological and Conservation Databases (BCD). This computer system, developed by The Nature

Conservancy, is utilized by the international network of natural heritage programs and conservation data centers (Stein et al. 1995). All centers utilize the same methodology, allowing a unique, direct comparison of information throughout the area covered.

In addition to ranking each element in terms of rarity or imperilment, natural heritage staff scientists rank each element occurrence so that protection efforts can be aimed not only at the rarest elements, but at the best examples of each. Element occurrences are ranked in terms of the **quality** (size, vigor, etc.) of the population or community, the **condition** or naturalness of the habitat, the long-term **viability** of the population or community, and the **defensibility** (ease or difficulty of protecting) of the occurrence. Given the intimate relationship between a natural community and its environment, community occurrences are largely ranked in terms of their quality and condition.

One of the strongest ways that the Colorado Natural Heritage Program uses these element and element occurrence ranks is to assess the overall significance of a site, which may include one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity** (or B-) **rank**:

- B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.
- B2 Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.
- B3 High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.
- B4 Moderate Significance: good example of a community type, excellent or good occurrence of state-rare species.
- B5 General Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

All of the sites presented in this report support important components of the total biological diversity for Colorado. These sites, if protected, will represent protection for genetic, species, community, and landscape diversity.

**Protection urgency ranks** and **management urgency ranks** are two mechanisms used to prioritize conservation actions related to potential conservation areas. These two ranks summarize the urgency of the need for action and apply a timeline to focus action planning. Urgency ranks are based on current knowledge, but are not always known for a particular area. When this information is not available, every effort is made to obtain it as soon as possible.

**Protection Urgency Ranks.** The urgency for protection rating reflects the need to take legal, political, or other administrative measures to alleviate threats that are related to land

ownership or designation. The following codes are used to indicate the rating which best describes the urgency to protect the area:

- P1 - Immediately threatened by severely destructive forces, within 1 year of rank date; **protect now or never!**
- P2 - Threat expected within 5 years.
- P3 - Definable threat but not in the next 5 years.
- P4 - No threat known for foreseeable future.
- P5 - Land protection complete or adequate reasons exist not to protect the site; do not act on this site.

Protection action involves increasing the current level of legal protection accorded one or more tracts at a potential conservation area. It may also include activities such as educational or public relations campaigns or collaborative planning efforts with public or private entities to minimize adverse impacts to element occurrences at a site. It does not include management actions, i.e. any action requiring stewardship intervention.

Threats that may require a protection action include:

- 1) Anthropogenic forces that threaten the existence of one or more element occurrences at a site, e.g. (a) development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; and (b) timber, range, recreational, or hydrological management that is incompatible with an element occurrence's existence;
- 2) The inability to undertake a management action in the absence of a protection action, e.g. obtaining a management agreement; and
- 3) In extraordinary circumstances, a prospective change in ownership or management that will make future actions more difficult.

**Management Urgency Rating.** The urgency for management rating focuses on land management or land stewardship action required to maintain element occurrences at the potential conservation area. The following codes are used to indicate the action needed to be taken at the area:

- M1 - (a) Management action required immediately or element occurrences could be lost or irretrievably degraded within one year.  
(b) Ongoing annual management action must continue or element occurrences could be lost or irretrievably degraded within one year.

- M2 - (a) New management action will be needed within 5 years to prevent the loss of element occurrences.  
(b) Ongoing, recurring management action must continue within 5 years to prevent loss of element occurrences.
- M3 - (a) New management action will be needed within 5 years to maintain current quality of element occurrences.  
(b) Ongoing, recurring management action must continue within 5 years to maintain the current quality of element occurrences.
- M4 - Although not currently threatened, management may be needed in the future to maintain the current quality of element occurrences.
- M5 - No serious management needs known or anticipated at the site.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area.

## **What is Biological Diversity?**

Biological diversity has recently become an important management issue for many natural resource professionals. Biological diversity at its most basic level includes the full range of species on Earth, from species such as bacteria, viruses, and protists, through multicellular kingdoms of plants, animals and fungi. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within single populations. On a wider scale, biological diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. All levels are necessary for the continued survival of species and natural communities, and all are important for the well-being of humans (Temple 1991).

The biological diversity of an area can be described at four levels:

1. Genetic Diversity -- the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species is variable between populations of a species within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region.
2. Species Diversity -- the total number and abundance of plant and animal species in an area.

3. Community Diversity -- the variety of natural communities or ecosystems within that area. These communities may be diagnostic or even endemic to an area. It is within these ecosystems that all life dwells.

4. Landscape Diversity -- the type, condition, pattern, and connectedness of natural communities or ecosystems within a landscape. Fragmentation of forested landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

### **Relating this Report to Managing Biological Diversity at the Landscape Level**

The management of Biological Diversity must consider more than species specific management criteria and consider the elements of human-use in the area. The conservation sites typically identified in this type of study may be considered as core areas for the protection of the full range of biological diversity. Some of these areas are best considered as candidates for special area designations, others as sites within a landscape that should be managed to include the maintenance of the site's integrity.

A basic premise in the landscape management approach starts with the delineation of core protected areas that can be represented by special designations. Where possible, these should be connected through corridors and appropriately buffered. Buffer areas should include the ecological processes supporting the diversity of the core area. Such is the basis of the development of preliminary conservation planning boundaries.

## METHODS

The Natural Heritage staff conducted a natural heritage inventory in four stages:

1. Gather existing information. Information was accumulated from a variety of sources and through published and unpublished information. This included the gathering of maps, reviewing the BCD and manual Natural Heritage data, and consulting experts including local naturalists and knowledgeable BCPOS staff members.
2. Perform field surveys and determine preliminary conservation boundaries. Ground surveys were conducted to map plant communities and concentrations of exotic species, and to locate and rank occurrences of elements in terms of quality, condition, viability, and defensibility. This was done in order to put into perspective the state and range wide significance of the element occurrence. Preliminary conservation boundaries were identified for each natural heritage conservation site.
3. Assign Biodiversity Ranks (B-ranks). Each conservation site was assigned a B-rank based on the rarity or imperilment, occurrence rank, and management and protection urgency of each element as it relates to the protection of biological diversity.
4. Compile the results and prepare a final report. As work was completed, Natural Heritage staff scientists reviewed the information gathered. Based on a review of all natural heritage resources present, the staff prioritized the elements in terms of their significance and the threats facing them, developed and mapped preliminary conservation planning boundaries, and drafted site profiles for each conservation site including protection and management recommendations.

Table 2. Rare species and significant natural communities known from Boulder County.

	SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FEDERAL SENSITIVE
** Animals: Vertebrate							
*** Amphibians	BUFO BOREAS POP 1	BOREAL TOAD (SOUTHERN ROCKY MOUNTAIN POPULATION)	G5T2Q	S1	C1	E	FS
*** Birds	ARDEA HERODIAS	GREAT BLUE HERON	G5	S3B,SZN			
	FALCO PEREGRINUS ANATUM	AMERICAN PEREGRINE FALCON	G3	S2B,SZN	LE	T	
*** Fish	ETHEOSTOMA EXILE	IOWA DARTER	G5	S2		SC	
	ETHEOSTOMA NIGRUM	JOHNNY DARTER	G5	S3			
	FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S2	C2	SC	FS
	HYBOGNATHUS HANKINSONI	BRASSY MINNOW	G5	S3			
	HYBOGNATHUS PLACITUS	PLAINS MINNOW	G5	SH	C2	SC	
	NOTROPIS CORNUTUS	COMMON SHINER	G5	S2		SC	
	NOTURUS FLAVUS	STONECAT	G5	S1		SC	
	ONCORHYNCHUS CLARKI STOMIAS	GREENBACK CUTTHROAT TROUT	G5T2	S2	LT	T	
*** Mammals	GULO GULO	WOLVERINE	G4	S1	C2	E	FS
	PLECOTUS TOWNSENDII	TOWNSEND'S BIG-EARED BAT	G4	S3	C2		FS
	SOREX MERRIAMII	MERRIAM'S SHREW	G5	S3			
	ZAPUS HUDSONIUS PREBLEI	PREBLE'S MEADOW JUMPING MOUSE	G5T2	S1S2	C2	SC	FS
*** Reptiles	TROPIDOCOLONIA LINEATUM	LINED SNAKE	G5	S3			FS
*** Natural Communities	ANDROPOGON	XERIC TALLGRASS PRAIRIES	G2	S2			
	GERARDII-SCHIZACHYRIUM						
	SCOPARIUM						
	ANDROPOGON	WET PRAIRIES	G1	S1?			
	GERARDII-SORGHASTRUM NUTANS						
	BETULA OCCIDENTALIS/MESIC FORB	FOOTHILLS RIPARIAN SHRUBLAND	G2G3	S2			
	CAREX DIANDRA QUAKING FEN	QUAKING FEN	G?	S?			
	CERCOCARPUS MONTANUS-RHUS	MIXED FOOTHILL SHRUBLANDS	GU	SU			
	TRILOBATA/ANDROPOGON GERARDII						
	CERCOCARPUS MONTANUS/STIPA	MIXED FOOTHILL SHRUBLANDS	G2	S2			
	COMATA						
	CERCOCARPUS MONTANUS/STIPA		GU	SU			
	NEOMEXICANA						
	CERCOCARPUS MONTANUS/STIPA		GU	SU			
	SCRIBNERI						
	DANTHONIA PARRYI	MONTANE GRASSLANDS	G2?	S2?			
	DISTICHLIS SPICATA VAR STRICTA	GREAT PLAINS SALT MEADOWS	G4	S3			
	JUNIPERUS	FOOTHILLS PINYON-JUNIPER	G2	S2			
	SCOPULORUM/CERCOCARPUS	WOODLANDS/SCARP WOODLANDS					
	MONTANUS						
	PHIPPSIA ALGIDA	ALPINE WETLANDS	GU	SU			

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FEDERAL SENSITIVE
PICEA ENGELMANNII/CALAMAGROSTIS CANADENSIS		G3	SU			
PINUS PONDEROSA/CERCOCARPUS MONTANUS/ANDROPOGON GERARDII	FOOTHILLS PONDEROSA PINE SCRUB WOODLANDS	G2	S2?			
PINUS PONDEROSA/LEUCOPOA KINGII	FOOTHILLS PONDEROSA PINE SAVANNAS	G2	S2			
POPULUS ANGUSTIFOLIA/ALNUS INCANA		G?	S?			
PURSHIA TRIDENTATA/MUHLENBERGIA MONTANA	MIXED FOOTHILL SHRUBLANDS	G2	S2			
SALIX GEYERIANA-SALIX MONTICOLA/CALAMAGROSTIS CANADENSIS	MONTANE WILLOW CARRS	G3	S3			
STIPA COMATA - EAST	GREAT PLAINS MIXED GRASS PRAIRIES	G2	S2			
STIPA NEOMEXICANA	GREAT PLAINS MIXED GRASS PRAIRIES	G2	S2			

\*\* Animals: Invertebrate

\*\*\* Insects

AESHNA EREMITA	LAKE DARNER	G5	S1?			
AESHNA VERTICALIS	GREEN-STRIPED DARNER	G5	S?			
APHAENOGASTER HUACHUCANA	AN ANT	G2?	S?			
ARCHILESTES GRANDIS	GREAT SPREADWING	G5	S3			
ARGIA SEDULA	BLUE-RINGED DANCER	G5	S2			
ATRYTONE AROGOS	AROGOS SKIPPER	G3G4	S2			
CALOPTERYX AEQUABILIS	RIVER JEWELWING	G5	SH			
CORDULIA SHURTLEFFI	AMERICAN EMERALD	G5	S1?			
EREBIA THEANO	THEANO ALPINE	G4	S3			
ERYNNIS MARTIALIS	MOTTLED DUSKY WING	G4	S2S3			
FORMICA LAEVICEPS	AN ANT	G3	S2			
HESPERIA OTTOE	OTTOE SKIPPER	G3?	S2			
INCISALIA MOSSI	MOSS'S ELFIN	G4T3	S2S3			
OENEIS JUTTA REDUCTA	ROCKY MOUNTAIN ARCTIC JUTTA	G5TU	S1			
PARATRYTONE SNOWI	SNOW'S SKIPPER	G4	S3			
PYRGUS RURALIS	TWO-BANDED SKIPPER	G4	S3			
SPEYERIA IDALIA	REGAL FRITILLARY	G3	S1	C2		FS
STIGMATOMMA PALLIPES	AN ANT	G5	S1			
SYMPHEIDOLE ELECEBRA	AN ANT	G1?	S1			

\*\*\* Mollusks

ACROLOXUS COLORADENSIS	ROCKY MOUNTAIN CAPSHELL	G?	S2	C2	SC	FS
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL	G5	S2			
PHYSA UTAHENSIS	BANDED PHYSA	G?	S1	C2		
PROMENETUS EXACUOUS	SHARP SPRITE	G?	S2			
PROMENETUS UMBILICATELLUS	UMBILICATE SPRITE	G?	S3			

\*\*\* Plants

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FEDERAL SENSITIVE
ACORUS CALAMUS	SWEET FLAG	G5	S1			
ALETES HUMILIS	LARIMER ALETES	G2G3	S2S3	C2		FS
AMORPHA NANA	DWARF WILD INDIGO	G5	S2S3			
APIOS AMERICANA	AMERICAN GROUNDNUT	G5	S2			
AQUILEGIA SAXIMONTANA	ROCKY MOUNTAIN COLUMBINE	G3	S3	3C		
ARISTIDA BASIRAMEA	FORKTIP THREE-AWN	G5	S1			
ASPLENIUM ADIANTUM-NIGRUM	BLACK SPLEENWORT	G5	S1			
BOTRYCHIUM ECHO	REFLECTED MOONWORT	G2	S2			FS
BOTRYCHIUM HESPERIUM	WESTERN MOONWORT	G3	S2			
BOTRYCHIUM LANCEOLATUM VAR LANCEOLATUM	LANCE-LEAVED MOONWORT	G5T4	S2			
BOTRYCHIUM LINEARE		G1	S1	C2		FS
BOTRYCHIUM MINGANENSE	MINGAN MOONWORT	G4	S2			
BOTRYCHIUM PALLIDUM	PALE MOONWORT	G2	S2	C2		FS
CAREX DIANDRA		G5	S1			
CAREX SAXIMONTANA	ROCKY MOUNTAIN SEDGE	G5	S1			
CAREX SYCHNOCEPHALA	MANY-HEADED SEDGE	G4	S1?			
CAREX TORREYI	TORREY SEDGE	G4	S1			
CHIONOPHILA JAMESII *	ROCKY MOUNTAIN SNOWLOVER	G4?	S3S4			
CRATAEGUS CHRYSOCARPA	YELLOW HAWTHORN	G5	S1S2			
CREPIS NANA	DWARF HAWKSBEARD	G5	S2			
CYPRIPEDIUM FASCICULATUM	PURPLE LADY'S-SLIPPER	G4	S3	C2		FS
DRABA FLADNIZENSIS	ARCTIC DRABA	G4	S2S3			
DRABA PORSILDII	PORSILD DRABA	G3	S1			
ERIGERON MELANOCEPHALUS	BLACK-HEAD FLEABANE	G3	S3			
ERIGERON PINNATISECTUS	PINNATE FLEABANE	G3	S3			
EUSTOMA RUSSELLIANUM	SHOWY PRAIRIE GENTIAN	G5	S3			
GAURA NEOMEXICANA SSP COLORADENSIS	COLORADO BUTTERFLY WEED	G4T2	S1	C1		FS
JUNCUS VASEYI	VASEY BULRUSH	G3G5	S1			
LIATRIS LIGULISTYLIS	GAY-FEATHER	G5?	S1S2			
LIGUSTICUM TENUIFOLIUM	SLENDER-LEAF LIGUSTICUM	G5	S1?			
LILIUM PHILADELPHICUM	WOOD LILY	G5	S3			
LISTERA CONVALLARIOIDES	BROAD-LEAVED TWAYBLADE	G5	S2			
LYCOPODIUM ANNOTINUM VAR PUNGENS	STIFF CLUBMOSS	G?Q	SU			
MALAXIS BRACHYPODA	WHITE ADDER'S-MOUTH	G4	S1	C2		FS
PAPAVER LAPPONICUM SSP OCCIDENTALE	ALPINE POPPY	G3Q	S2			
PHIPPSIA ALGIDA	SNOW GRASS	G5	S2			
PHYSARIA BELLII	BELL'S TWINPOD	G2	S2	C2		
POTENTILLA EFFUSA VAR RUPINCOLA	ROCKY MOUNTAIN CINQUEFOIL	G?T1	S2	C2		FS
PYROLA PICTA	PICTURELEAF WINTERGREEN	G4G5	S2			
RANUNCULUS KARELINII	TUNDRA BUTTERCUP	G4	S2			
ROTALE RAMOSIOR	TOOTH CUP	G5	S1?			
SAXIFRAGA CESPITOSA SSP MONTICOLA	TUNDRA SAXIFRAGE	G5T5	S1			
SPIRANTHES DILUVIALIS	UTE LADIES' TRESSES	G2	S2	LT		
VIOLA PEDATIFIDA	PRAIRIE VIOLET	G5	S2			

Federal Status = U. S. Fish & Wildlife Service Status

State Status = Division of Wildlife Status

FS = Forest Service Sensitive Species

\* Occurrences for bird species are only those with probable or confirmed breeding status, or significant concentration areas (wintering or migrating).

Table 3. Rare species and significant natural communities known from the Hall and Heil Ranches, and Trevarton Open Space, Boulder County.

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	FEDERAL SENSITIVE
*** Natural Communities						
ANDROPOGON GERARDII-SCHIZACHYRIUM SCOPARIUM	XERIC TALLGRASS PRAIRIES	G2	S2			
BETULA OCCIDENTALIS	FOOTHILLS RIPARIAN SHRUBLAND	G3	SU			
CERCOCARPUS MONTANUS/STIPA COMATA	MIXED FOOTHILL SHRUBLANDS	G2	S2			
CERCOCARPUS MONTANUS/STIPA NEOMEXICANA		GU	SU			
CERCOCARPUS MONTANUS/STIPA SCRIBNERI		GU	SU			
JUNIPERUS	FOOTHILLS PINYON-JUNIPER WOODLANDS/SCARP WOODLANDS	G2	S2			
SCOPULORUM/CERCOCARPUS MONTANUS						
PINUS PONDEROSA/CERCOCARPUS MONTANUS/ANDROPOGON GERARDII	FOOTHILLS PONDEROSA PINE SCRUB WOODLANDS	G2	S2?			
PINUS PONDEROSA/LEUCOPOA KINGII	FOOTHILLS PONDEROSA PINE SAVANNAS	G2	S2			
STIPA COMATA - EAST	GREAT PLAINS MIXED GRASS PRAIRIES	G2	S2			
STIPA NEOMEXICANA	GREAT PLAINS MIXED GRASS PRAIRIES	G2	S2			
** Animals: Invertebrate						
*** Insects						
ATRYTONE AROGOS	AROGOS SKIPPER	G3G4	S2			
HESPERIA OTTOE	OTTOE SKIPPER	G3?	S2			
PARATRYTONE SNOWI	SNOW'S SKIPPER	G4	S3			

### Vegetation Surveys:

The areas were surveyed during the months of July, August, and September. Orthophotos (1:400 or 1:500) were analyzed before ground truthing in an effort to determine the resolution at which plant communities could be mapped. In general, shrublands and grasslands were more homogeneous than the forests and woodlands, and were usually mapped to a finer classification scale. Dominant and other important species were noted for each community. The classification was done to a plant association level where possible. If we were unable to classify to the plant association level the vegetation was classified to the Series or Alliance level. Mapping was done on the orthophotos and on 1:24,000 USGS topographic maps. Mapping delineations are based on field observations and aerial photo interpretation. In most cases boundaries were not precisely verified and several descriptions may have been done within one mapped type (representing several plant associations in a Series). These boundaries should be interpreted as approximations of the extent of the plant communities and weed concentrations. Descriptions of the most common and significant plant associations are included in the appendices. The brief descriptions are from a combination of published literature on relatively undisturbed stands and field observations from the study area.

Even though most of the occurrences found at the Hall and Heil Ranch were degraded, several are globally rare or imperiled and therefore are of concern for their biodiversity significance.

Management recommendations are provided where information is available. Many of the plant communities that occur in the study area are described in the literature from National Forests at slightly higher elevations. At the Hall and Heil Ranches these are at the lower elevation limits for that type. For this reason the communities at the study area have a somewhat different floristic component when compared to those documented from higher elevation Forest Service lands.

Due to the difficulty and slowness of hiking large distances on the rugged, often rocky, and trailless slopes, the exact boundaries of many plant associations are uncertain. For example, there are several plant associations dominated by Cercocarpus montanus. These look very similar from a distance and the only way to accurately map their extent is to spend many hours hiking through them. Whenever possible, plant associations were viewed from elevated locations in order to more accurately map them.

Concentrations of exotic species were also mapped at this time. Many weedy exotic species are present in the study area. Only the heaviest concentrations were mapped.

### Floristic Surveys:

Plants listed as potentially occurring on the study area were searched for in suitable habitat during the time of season they were in the phenological condition for positive identification. No significant plant species (on the CNHP list of rare and imperiled elements) were located in the study area. Characterization abstracts (summaries of phenology, life history, habitat, etc.) are included for species thought to have the potential to occur in the study area.

#### Faunal Surveys:

Cercocarpus montanus (Mountain mahogany) shrublands on the Hall and Heil Ranches were sampled using both pitfall and Sherman live traps. Sherman live traps (3") were set on 6 transects, 3 each on the Hall and Heil Ranches. Each transect was composed of 50 traps set on 2 parallel lines of 25 traps each, with traps set at 5-m intervals on each trapline, and traplines set 10 m apart. An array of pitfall traps were established on one of the three transects on each ranch. Pitfall arrays were 12 1-gallon cans sunk in the ground, with the lip of the can flush with the surface of the ground. The 12 pitfall traps were placed 5 m outside the live trap transect at regular intervals (6 traps per trapline, set at 25-m intervals). Traps held 1" of 10% formalin. Live trapping was conducted during a three-week period (October 30 - November 18); pit traps were established beginning November 1, and are still open as of November 30.

As of November 30, the trapping effort totaled 2284 trap-nights (TN): 1550 TN with Sherman live traps, 734 TN with pit traps. There were 1184 TN on Hall Ranch, 1100 TN on Heil Ranch (trap effort was greater on Hall Ranch because pit traps were established on this site first, and because Sherman live trap effort was slightly greater [one 50-trap transect run one extra night] on Hall). No shrews were captured in Sherman live traps. One shrew has been captured thus far in pit traps on the pit-trap array on the Hall Ranch which appears to be Sorex cinereus (masked shrew). This is not a species of concern monitored by CNHP.

Aerial photos and maps were used to identify Potential Natural Areas (PNAs) for rare lepidoptera, in other words those areas thought to contain the best potential habitat for those species. This was done to maximize efficiency searching for these species, many of which have relatively short flight seasons. Field surveys were conducted for rare lepidoptera in the appropriate habitat during the normal flight season for that species. In addition, mist netting for bats was done for five nights in suitable habitat. No bat species monitored by CNHP were captured.

Characterization abstracts (summaries of life history, habitat, status, etc.) are included in the appendices for species thought to have the potential to occur in the study area.

# RESULTS

## PROTECTION OF SIGNIFICANT BIODIVERSITY AREAS

The following four sites are recommended to BCPOS as areas in need of special protection. The ranking system used merely ranks sites for protection relative to the rarity and quality of known significant features. Therefore, the sites identified herein comprise the highest priority elements, based on known information, for the conservation of the study area's natural diversity.

Once a Conservation Site has been identified, the first step in protecting the sensitive species or communities is to delineate a preliminary conservation planning boundary. In developing these boundaries, Natural Heritage Program staff considered a number of factors. These included, but were not limited to:

- the extent of current and potential habitat for natural heritage resources, considering the ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the site and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater, e.g. by protecting recharge zones;
- land intended to buffer the site against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species; and
- land necessary for management or monitoring activities.

As the label "conservation planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection goals for natural heritage resources and sensitive species. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

## SITE PROFILES

### CONSERVATION SITE PROFILE

The conservation site is described in a standard site report. The sections of this report and the contents are outlined and explained below.

**SIZE:** The approximate acreage included within the conservation planning boundary for the conservation site.

**BIODIVERSITY RANK:** The overall significance of the conservation site in terms of rarity or imperilment of the natural heritage resources and the quality (health, abundance, etc.) of their occurrences. These ranks range from B1 (Outstanding Significance) to B5 (General Biodiversity Significance). Comments regarding biodiversity rank are also included.

**PROTECTION URGENCY RANK:** The time frame in which conservation protection must occur. In most cases, this rank refers to the need for a major change of protective status (e.g. agency special area designations or ownership). The ranks range from P1 (immediate urgency; within a one year time frame) to P5 (no known urgency). Comments regarding protection urgency are also included.

**MANAGEMENT URGENCY RANK:** The time frame in which a change in management of the element or site must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g. increased fire frequency, decreased herbivory, weed control, etc.). The ranks range from M1 (immediate urgency, within one year) to M5 (no known urgency). Comments regarding management urgency are also included.

**LOCATION:** The general location and the USGS 7.5' quadrangle name and township, range and sections that contain the Conservation Site. The Natural Heritage Program code for the quadrangle is noted in parentheses.

**GENERAL DESCRIPTION:** A brief narrative picture of the topography, vegetation, and current and historical use of the conservation site.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** A synopsis of the rare species and significant natural communities that occur on the conservation site.

**CURRENT STATUS:** A summary of the ownership, degree of protection currently afforded the conservation site, and threats to the site or natural heritage resources as determined to date.

**BOUNDARY JUSTIFICATION:** The preliminary conservation planning boundary delineated in this report includes all known occurrences of natural heritage resources and the adjacent lands

required for protection of the resources and the ecological processes needed for continued survival of the elements.

**PROTECTION AND MANAGEMENT CONSIDERATIONS:** A summary of the major issues and factors that are known or likely to affect the protection and management of the conservation site.

## **Red Hill**

**SIZE:** approximately 2800 acres

**BIODIVERSITY RANK:** B2 - very high biodiversity significance. A concentration (4+) of C-ranked G2 elements.

**PROTECTION URGENCY RANK:** P2 - threat expected within 5 years.

Approximately one half of the site is owned by Boulder County Parks and Open Space. Protection urgency is low for the county owned parcel. The remaining land is in private ownership resulting in the high protection urgency. This land may be highly desirable for development (although conservation easements are in place for some of the this land).

**MANAGEMENT URGENCY RANK:** M3 - management action may be needed within 5 years to maintain the quality of element occurrences.

Exotic plant species are very common to dominant in portions of the site. These species lower the quality of the occurrences at the site and may have a negative impact on animal communities associated with this ecosystem (Bock and Bock 1988), including the rare lepidoptera documented at the site.

**LOCATION:** The site includes most of the first ridge west of Highway 36 from just north of Left hand Canyon to just south of Lyons in Boulder County, Colorado.

Lyons 7.5' Quadrangle (4010523)  
T3N R70W sections 19, 20, 29, 30, 31, 32  
T2N R70W sections 6, 7  
T3N R71W sections 36  
T2N R71W sections 1, 12, 13

**GENERAL DESCRIPTION:** The Red Hill Site is part of the Front Range Hogback system just south of South Saint Vrain Creek. Elevations range from 5400 feet on the east to 6570 feet at Red Hill. The diverse geology primarily includes sandstones with smaller areas of limestone, claystone, and siltstone (Braddock et al. 1988). The geology is an important influence on the major plant communities.

The major plant communities present at the site are coniferous woodlands, deciduous shrublands, and grasslands. Veblin and Lorenz (1991) and Peet (1981) provide more detailed descriptions of the vegetation and environment of the area.

The coniferous woodlands are mostly dominated by Pinus ponderosa (ponderosa pine) with smaller areas of Pseudotsuga menziesii (Douglas-fir). The woodlands are often disturbed by logging and mining. Deciduous Douglas-fir shrublands are common on the Dakota Hogback in the eastern part of the area. These are mostly dominated by Cercocarpus montanus (mountain mahogany). Grassland dominate the lower elevations and are also found in meadows dispersed throughout the woodlands. These are common along Red Hill Gulch and are often dominated by exotic species, especially Bromus japonicus (Japanese brome), Bromus tectorum (cheatgrass),

and Poa compressa (Canada bluegrass). Exotic plant species are common throughout the site and include Bromus tectorum, Bromus japonicus, Carduus nutans (musk thistle), Linaria dalmatiana (dalmatian toadflax), and others.

The Heil Ranch was acquired during the 1940's. Cultivation of the land occurred at one time and silo structures on the property still attest to this fact. Since the 1940's, the ranch has been utilized for the grazing of livestock. The Heil Ranch has several quarry sites which were mined for the Lyons Red Sandstone that was key in the building of many structures in both Lyons and Boulder.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** The site contains several occurrences of globally rare plant associations, one occurrence of a globally rare butterfly, and one occurrence of a state rare butterfly.

Although many of these occurrences are degraded, the concentration of elements at this site would allow for protection of a significant portion of the imperiled natural heritage of the Front Range. Most of the other known occurrences of these elements are on private land owned by many individuals making protection very difficult. The occurrence of these elements on land owned by BCPOS may represent one of the best chances of protecting these elements.

ELEMENT	OCCURRENCE RANK	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
<u>Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii</u> - woodland	B	G2	S2?	--	--
<u>Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii</u> - woodland	C	G2	S2?	--	--
<u>Cercocarpus montanus/Stipa comata</u> - foothills shrubland	B-	G2	S2	--	--
<u>Cercocarpus montanus/Stipa neomexicana</u> - foothills shrubland C	GU	SU	--	--	
<u>Cercocarpus montanus/Stipa neomexicana</u> - foothills shrubland C	GU	SU	--	--	
<u>Cercocarpus montanus/Stipa scribneri</u> - foothills shrubland	BC	GU	SU	--	--
<u>Andropogon gerardii-Schizachyrium scoparium</u> - xeric tallgrass prairie	C	G2	S2	--	--
<u>Stipa comata - East</u> - grassland	C	G2	S2	--	--
<u>Stipa neomexicana</u> - grassland	C	G2	S2	--	--
<u>Stipa neomexicana</u> - grassland	C	G2	S2	--	--
<u>Hesperia ottoe</u> - Ottoe skipper	BC	G3?	S2	--	--
<u>Atrytone arogos</u> - Arogos skipper	BC	G4	S2	--	--

The Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii (ponderosa pine/mountain mahogany/big bluestem) plant association is known only from Colorado. Most known occurrences are small and degraded by the invasion of exotic plant species. This plant association may represent a postsettlement increase of Pinus ponderosa in the lower foothills. The majority of the trees at the Red Hill Site appear to be postsettlement in origin although a few presettlement trees are present. This increase may be the result of fire suppression, overgrazing,

or other factors. Until more information is available this plant association will continue to be included in the CNHP database.

The Cercocarpus montanus/Stipa comata (mountain mahogany/needle and thread) plant association is also only known from Colorado. Although this plant association appears to be locally common along the northern Front Range of Colorado almost all occurrences of this plant association are heavily invaded by Bromus tectorum and/or Bromus japonicus. The occurrence at this site has also been degraded.

The Cercocarpus montanus/Stipa neomexicana (mountain mahogany/New Mexico feathergrass) plant association has only recently been documented and is known only from Colorado and Wyoming. The occurrences at this site are relatively small and have been somewhat degraded by invasion of exotic species. Several occurrences have been identified that are larger and in better condition (CNHP Biological and Conservation Database 1995). Stipa neomexicana appears to reach its northern range limit in east central Wyoming and this association may do the same (S. Kettler, personal observation).

The Cercocarpus montanus/Stipa scribneri (mountain mahogany/Scribner's needlegrass) plant association has only recently been documented and is known only from the northern Front Range of Colorado. More information and field survey is necessary to document the rarity and imperilment of this association. The occurrence at this site has been somewhat degraded by invasion of exotic species.

The Andropogon gerardii-Schizachyrium scoparium (big bluestem-little bluestem) plant association is known from Colorado and Montana. This plant association was thought to have once been much more common and expansive along the Front Range but is now reduced to a few, small patches, most of which are degraded by invasion of exotic species. The occurrence at this site is relatively small.

The Stipa comata - East plant association is only known from Colorado. Very few occurrences have been documented. The occurrence at this site is very small but relatively weed free and diverse.

The Stipa neomexicana plant association is documented only in Colorado but is expected to occur further to the southwest as well. A similar vegetation type has been described from New Mexico (Dick-Peddie 1993, p. 40, p. 104). The occurrences at the Red Hill Site are relatively small but in good condition with few exotic species.

Hesperia ottoe, the Ottoe skipper, in Colorado is known to inhabit relatively intact tallgrass prairie remnants along the Front Range and relies on tallgrass species as food plants in the larval stage. The species is known to avoid weedy conditions (Pyle 1981) and has been noted as declining throughout its range.

Atrytone arogos, the Arogos skipper, is also known to inhabit relatively intact tallgrass prairie remnants along the Colorado Front Range and relies on tallgrass species as food plants in the larval stage. This species is known to have a spotty distribution in the western half of its range (Swengel and Swengel 1995).

**CURRENT STATUS:** Approximately one half of the site has recently been purchased by Boulder County Parks and Open Space. This parcel probably includes the best known occurrences within the site. The remainder of the site is in private ownership.

This report is intended to identify significant elements of natural diversity so these can be addressed in a management plan. Currently there is no specific management for these elements on the public or private land.

**BOUNDARY JUSTIFICATION:** The preliminary conservation boundaries are intended to identify the area needed to support the significant elements and the ecological processes needed for their continued survival.

In general the plant associations present at the site historically have been greatly influenced by fire, herbivory, and more recently by logging (Veblin and Lorenz 1991). These associations occur together in a mosaic that is affected by similar ecological processes and similar management issues. Dominant species in several of the natural communities are essential food plants for the rare butterflies; therefore the butterflies will be affected by similar ecological processes and management issues.

The boundaries presented here are intended to encompass an area that will allow these natural ecological processes to function or be mimicked through management practices. Included are some areas that are heavily degraded but thought to have the potential of recovery with proper management and the mosaic of plant communities with similar ecological needs and influences. The conservation site boundaries include most of the first hogback west of highway 36. The eastern boundary is generally the bottom of the slope to the east (more level land to the east is even more degraded). The western boundary is generally the top of the ridge or lower when major disturbances have impacted the land (i.e. logging west of Red Hill).

At the very least the physical extent of the occurrences should be directly protected, but with the knowledge that this may not insure survival of the elements in the long term. Inclusion of and restoration of heavily degraded areas will help protect the elements within this dynamic mosaic of plant communities.

#### **PROTECTION AND MANAGEMENT CONSIDERATIONS:**

At this site the greatest threat to these plant associations and the associated fauna appears to be invasion of exotic plant species. Further increase of exotic species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Several exotic species occur in the plant communities in various quantities. The most common of these include Bromus tectorum, Bromus japonicus, Carduus nutans, Poa pratensis (Kentucky bluegrass), Poa compressa, Linaria dalmatica, Alyssum minus (alyssum), and Centaurea (knapweed) species. Aggressive management (herbicide application, manual cutting, etc.) may be necessary to control these species. Careful consideration should be given to butterfly species of concern when using herbicides to control exotic species (Moffat and McPhillips 1993). Some exotics (e.g. Cirsium arvense - Canada thistle) are used as nectar sources by the rare butterflies. Early season grazing, burning, or mowing may be effective management tools to control many of the cool season exotic plants and favor warm season dominant native plants. However, such treatments should seek to maintain patchiness since butterflies that specialize on tallgrass prairie are seriously impacted by fire (Swengel and Swengel 1995).

The extent of native grasslands throughout North America has been seriously reduced since European settlement, as have many individual species that use the grasslands as habitat

(Sampson and Knopf 1994). Conversion to agricultural land, overgrazing, and urban development have probably had the most significant impacts. The Soil Conservation Service (SCS) reports that overgrazing by cattle on vegetation similar to the Andropogon gerardii-Schizachyrium scoparium association will result in reduction or elimination of Andropogon gerardii, Sorghastrum nutans (indiangrass), Bouteloua curtipendula (sideoats grama), Muhlenbergia montana (mountain muhly), Panicum virgatum (switchgrass), and Elymus lanceolatus x Pseudoroegneria spicata (Griffith's wheatgrass) (SCS range descriptions #204, #206, #213). Various species in this association are preferred by livestock at different times of the season, therefore planned deferment is recommended to avoid grazing out these species. Reestablishment of vegetation is said to be difficult on this type of site due to slope, rocks, and shallow soils.

Fires were frequent components in the natural disturbance regimen of most grasslands and Pinus ponderosa woodlands (Mehl 1992) and are important in promoting patch dynamics and enhancing community diversity on a large spatial scale (Collins 1990). Anderson (1990) contends that fires were common in most grasslands but that fire was a more important factor in eastern North American grasslands than in arid western grasslands. Grasslands along the Front Range have in general been invaded by Pinus ponderosa woodlands. Fire suppression and intense grazing (which reduces competition from grasses) are often cited as reasons for the expansion.

Variation in fire timing and frequency has been shown to have different effects on different species (both plant and animal). Effects are often dissimilar on similar prairies in different geographic areas (Glenn-Lewin et al. 1990). Moderate grazing may have also have some of the same effects.

Goals for management, possibly species-specific goals, should be developed before a fire and/or grazing management plan is implemented. Disturbance from fires and/or grazing may provide the opportunity for exotic species to increase in dominance. In addition, frequent fires in tallgrass prairie have been shown to reduce the diversity of lepidoptera (Swengel and Swengel 1995). Burning all of the butterfly habitat in one year could potentially extirpate populations (Moffat and McPhillips 1993). We recommend that management goals include a mosaic of vegetation types.

Development of the lands not owned by BCPOS would also degrade the site and threaten the survival of the significant elements. Conservation easements or purchase of this land should be considered.

Figure 2. Occurrence of the Cercocarpus montanus/Stipa neomexicana plant association at the Red Hill Site.



## Plumely Canyon

**SIZE:** approximately 620 acres

**BIODIVERSITY RANK:** B3 - high biodiversity significance. A C-ranked occurrence of a G2 element.

**PROTECTION URGENCY RANK:** P4 - no threat known for the foreseeable future.

The entire site has recently been purchased by Boulder County Parks and Open Space.

**MANAGEMENT URGENCY RANK:** M3 - management action may be needed within 5 years to maintain the quality of element occurrences.

Exotic plant species are very common to dominant in portions of the site. Other exotic plant species are present and may increase in abundance. These exotic species lower the quality of the occurrences at the site and may have a negative impact on animal communities associated with this ecosystem (Bock and Bock 1988), including the rare lepidoptera documented at the site.

**LOCATION:** The site is located approximately 2 miles west of highway 36 and 3 miles north of Left Hand Canyon in Boulder County, Colorado.

Lyons 7.5' Quadrangle (4010523)

T2N R71W sections 2, 11

T3N R71W section 35

**GENERAL DESCRIPTION:** The Plumely Canyon Site includes the riparian zone in Plumely Canyon and several other ephemeral streams, and some steep slopes and cliffs on the adjacent uplands. The elevation ranges from 6000 to 7040 feet. The geology is dominated by Fountain Formation conglomerate and sandstones (Braddock et al. 1988).

The major plant communities present at the site are coniferous woodlands, shrublands, and grasslands. Veblin and Lorenz (1991), Peet (1981) and others provide more detailed descriptions of the vegetation and environment of the area.

The coniferous forests are dominated by Pinus ponderosa (ponderosa pine) with some areas of Pseudotsuga menziesii (Douglas-fir). The forests are often disturbed by logging and mining. Grasslands are dominant in meadows dispersed throughout the woodlands. These are often dominated by exotic species, especially Bromus japonicus (Japanese brome), Bromus tectorum (cheatgrass), and Poa compressa (Canada bluegrass). Exotic species are common throughout the site including Bromus tectorum, Bromus japonicus, Carduus nutans, Linaria dalmatica (dalmatian toadflax), and others.

The Heil Ranch was acquired during the 1940's. Cultivation of the land occurred at one time and silo structures on the property still attest to this fact. Since the 1940's, the ranch has been utilized for the grazing of livestock. The ranch has several quarry sites which were mined for the Lyons Red Sandstone that was key in the building of many structures in both Lyons and Boulder.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** One globally rare plant association and two state rare butterflies are documented from the site.

ELEMENT	OCCURRENCE RANK	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
<u>Andropogon gerardii-Schizachyrium scoparium</u> - xeric tallgrass prairie	C	G2	S2	--	--
<u>Atrytone arogos</u> - Arogos skipper	BC	G4	S2	--	--
<u>Paratrytone snowi</u> - Snow's skipper	BC	G3G4	S3	--	--

The Andropogon gerardii-Schizachyrium scoparium plant association is documented from Colorado and Montana. This plant association was thought to have once been much more common and expansive along the Front Range but is now reduced to few small patches, most degraded by invasion of exotic species. The occurrence at this site is relatively small and invaded by exotic plant species.

Atrytone arogos, the Arogos skipper, is known rare in Colorado, but relatively common globally. This species inhabits relatively intact tallgrass prairie remnants along the Colorado Front Range and relies on tallgrass species as food plants during the larval stage.

Paratrytone snowi, Snow's skipper, is rare in Colorado but more common globally. This species is known to inhabit Pinus ponderosa woodlands and to nectar on Monarda fistulosa (horsemint).

**CURRENT STATUS:** The lands containing the site have recently been purchased by Boulder County Parks and Open Space. This report is intended to identify significant elements of natural diversity so these can be addressed in management plans. Currently there is no specific management for these elements.

**BOUNDARY JUSTIFICATION:** The preliminary conservation boundaries are intended to identify the area needed to support the significant elements and the ecological processes needed for their continued survival.

In general the plant association present at the site historically has been greatly influenced by fire, herbivory, and more recently by logging (Veblin and Lorenz 1991). Dominant species in the natural community are essential food plants for the rare butterflies; therefore the butterflies will be affected by similar ecological processes and management issues. In addition, some plant species used as nectar sources by the butterflies occur in the riparian areas.

The boundaries presented here are intended to encompass an area that will allow these natural ecological processes to function or be mimicked through management practices. Included are some areas that are more heavily degraded but thought to have the potential of recovery with proper management. The boundaries include the slopes of the ridge south of Plumely Canyon, the stream to the east and north of the Canyon and then up to the ridge top north and west to the Forest Service boundary. This boundary is intended to encompass the occurrences and the tallgrass prairie and riparian areas used by the butterflies. Areas to the west of the site were not field surveyed but may also contain significant elements, because of lack of data the western site boundary was delineated at the Forest Service boundary.

At the very least the physical extent of the occurrences should be directly protected, with the knowledge that this may not insure survival of the elements in the long term. Inclusion of and restoration of heavily degraded areas will help protect the elements within this dynamic mosaic of plant communities.

**PROTECTION AND MANAGEMENT CONSIDERATIONS:** At this site the greatest threat to this plant association and the butterflies appears to be invasion of exotic plant species. Further increase of exotic species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Several exotic species occur in the plant communities in various quantities. The most common of these include Bromus tectorum, Bromus japonicus, Carduus nutans, Poa pratensis, Poa compressa, Linaria dalmatica, Alyssum minus, and Centaurea (knapweed) species. Aggressive management (herbicide application, manual cutting, etc.) may be necessary to control these species. Careful consideration should be given to butterfly species of concern when using herbicides to control exotic species (Moffat and McPhillips 1993). Some exotics (e.g. Cirsium arvense - Canada thistle) are used as nectar sources by the rare butterflies. Early season grazing, burning, or mowing may be effective management tools to control many of the cool season exotic plants and favor warm season dominant native plants. However, butterflies known to be tallgrass prairie specialists are known to show serious decline after fire (Swengel and Swengel 1995).

The extent of native grasslands throughout North America has been seriously reduced since European settlement, as have many individual species that use the grasslands as habitat (Sampson and Knopf 1994). Conversion to agricultural land, overgrazing, and urban development have probably had the most significant impacts. The Soil Conservation Service (SCS) reports that overgrazing by cattle on vegetation similar to the Andropogon gerardii-Schizachyrium scoparium association will result in reduction or elimination of Andropogon gerardii, Sorghastrum nutans (indiangrass), Bouteloua curtipendula (sideoats grama), Muhlenbergia montana (mountain muhly), Panicum virgatum (switchgrass), and Elymus lanceolatus x Pseudoroegneria spicata (Griffith's wheatgrass) (SCS range descriptions #204, #206, #213). Various species in this association are preferred by livestock at different times of the season, therefore planned deferment is recommended to avoid grazing out these species. Reestablishment of vegetation is said to be difficult on this type of site due to slope, rocks, and shallow soils.

Fires were frequent components in the natural disturbance regimen of most grasslands and Pinus ponderosa woodlands (Mehl 1992) and are important in promoting patch dynamics and enhancing community diversity on a large spatial scale (Collins 1990). Anderson (1990) contends that fires were common in most grasslands but that fire was a more important factor in eastern North American grasslands than in arid western grasslands. Grasslands along the Front Range have in general been invaded by Pinus ponderosa woodlands. Fire suppression and intense grazing (which reduces competition from grasses) are often cited as reasons for the expansion.

Variation in fire timing and frequency has been shown to have different effects on different species (both plant and animal). Effects are often dissimilar on similar prairies in different geographic areas (Glenn-Lewin et al. 1990). Moderate grazing may have also have some of the same effects.

Goals for management, possibly species-specific goals, should be developed before a fire and/or grazing management plan is implemented. Disturbance from fires and/or grazing may provide the opportunity for exotic species to increase in dominance. In addition, frequent fires in tallgrass prairie have been shown to reduce the diversity of lepidoptera (Swengel and Swengel 1995). Burning all of the butterfly habitat in one year could potentially extirpate populations (Moffat and McPhillips 1993). We recommend that management goals include a mosaic of vegetation types.

Figure 3. Occurrence of the Andropogon gerardii-Schizachyrium scoparium plant association at the Plumely Canyon Site.



## Upper Geer Canyon

**SIZE:** approximately 160 acres

**BIODIVERSITY RANK:** B3 - high biodiversity significance. A C-ranked occurrence of a G2 element.

**PROTECTION URGENCY RANK:** P4 - no threat known for the foreseeable future.

The entire site has recently been purchased by Boulder County Parks and Open Space.

**MANAGEMENT URGENCY RANK:** M3 - management action may be needed within 5 years to maintain the quality of element occurrences.

**LOCATION:** The site is located approximately 3 miles west of highway 36 and 2 miles north of Left Hand Canyon in Boulder County, Colorado.

Lyons 7.5' Quadrangle (4010523)  
T2N R71W sections 9, 10, 15, 16

**GENERAL DESCRIPTION:** The Upper Geer Canyon site is characterized by a narrow riparian zone surrounded by steep, forested slopes. The elevation ranges from 6440 to 7400 feet. The geology is dominated by middle and early Proterozoic pegmatite and early Proterozoic biotite schist (Braddock et al. 1988).

The major plant communities present at the site are coniferous woodlands dominated by Pseudotsuga menziesii (Douglas-fir) and Pinus ponderosa (ponderosa pine), and grasslands dominated by Stipa comata (needle-and-thread grass), Bouteloua gracilis (bluegrama), and Schizachyrium scoparium (little bluestem). Grasslands are dispersed throughout the woodlands. Often, these are dominated by exotic species, especially Bromus japonicus (Japanese brome), Bromus tectorum (cheatgrass), and Poa compressa (Canada bluegrass). Veblin and Lorenz (1991), Peet (1981), and others provide more detailed descriptions of the vegetation and environment of the area.

The Heil Ranch was acquired during the 1940's. Cultivation of the land occurred at one time and silo structures on the property still attest to this fact. Since the 1940's, the ranch has been utilized for the grazing of livestock. The Heil Ranch in particular has several quarry sites which were mined for the Lyons Red Sandstone that was key in the building of many structures in both Lyons and Boulder.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** Two globally rare plant associations are documented at the site.

ELEMENT	OCCURRENCE RANK	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
<u>Pinus ponderosa/Leucopoa kingii</u> - woodland	C	G2	S2	--	--
<u>Betula occidentalis</u> - shrubland	BC	G3	SU	--	--

The Pinus ponderosa/Leucopoa kingii (ponderosa pine/spike fescue) plant association is known only from Colorado. Hess and Alexander (1986) describe this as being a major habitat type on the Roosevelt National Forest but is has not been documented elsewhere.

The Betula occidentalis (water birch) plant association is known from Idaho and Montana, and has only recently been documented in Colorado. In general, riparian areas on the Front Range have been heavily impacted by development, grazing, agriculture, and recreational use. High quality remnants are considered significant.

**CURRENT STATUS:** Most of the lands within the site have been recently purchased by Boulder County Parks and Open Space. This report is intended to identify significant elements of natural diversity so these can be addressed in a management plan by that agency. Portions of the site are owned by the United States Forest Service. Currently there is no specific management for the identified elements.

**BOUNDARY JUSTIFICATION:** The preliminary conservation boundaries are intended to identify the area needed to support the significant elements and the ecological processes needed for their continued survival.

The Pinus ponderosa/Leucopoa kingii plant association present at the site has historically been influenced by fire. The Betula occidentalis plant association is strongly influenced by the hydrologic regime at the site. The boundaries presented here are intended to encompass an area that will allow these natural ecological processes to function.

A 1000 foot buffer zone is included around the riparian zone. This is recommended to protect the occurrence from impacts such as increased sedimentation from adjacent upland land management (i.e. logging or grazing). This buffer also includes the Pinus ponderosa/Leucopoa kingii occurrence and similar potential habitat upslope that was not surveyed during the 1995 field season.

**PROTECTION AND MANAGEMENT CONSIDERATIONS:** No data are available concerning fire frequencies for the Pinus ponderosa/Leucopoa kingii plant association.

The Betula occidentalis plant association has been documented from Montana by Hansen et al. (1988). Several management consideration are presented by those authors. They state that Betula occidentalis is an effective streambank stabilizer, although in Montana it occurs in areas that are susceptible to streambank sloughing. Also the structural diversity provided by this type is reported to be of value to avian species. Betula occidentalis is easily killed by fire but readily sprouts from the roots and seedlings also establish on mineral soils exposed by fire (Hansen et al. 1988).

Figure 4. Occurrence of the Pinus ponderosa/Leucopoa kingii plant association at the Upper Geer Canyon Site.



## **Indian Lookout Mountain**

**SIZE:** approximately 1025 acres

**BIODIVERSITY RANK:** B3 - high biodiversity significance. C-ranked occurrence of a G2 element.

**PROTECTION URGENCY RANK:** P2 - threat expected within 5 years.

Most of the site is owned by Boulder County Parks and Open Space, protection urgency is low for this parcel. The remaining parcels are in private ownership resulting in the high protection urgency. This land may be highly desirable for development.

**MANAGEMENT URGENCY RANK:** M2 - management action may be needed within 5 years to prevent loss of the element occurrences.

Exotic plant species are very common to dominant in portions of the site and have increased in at least one of the occurrences since it was first documented in 1992 (Andropogon gerardii-Schizachyrium scoparium (big bluestem-little bluestem) in the northwest quarter of section 23). These exotic species lower the quality of the occurrences at the site and may have a negative impact on animal communities associated with this ecosystem (Bock and Bock 1988).

**LOCATION:** The site is located just west of Lyons in Boulder County, Colorado.

Lyons 7.5' Quadrangle (4010523)  
T3N R70W sections 18, 19  
T3N R71W sections 13, 14, 23, 24

**GENERAL DESCRIPTION:** The Indian Lookout Mountain site is characterized by moderate to steep slopes with occasional ephemeral drainages, and some rolling hills. The elevation ranges from 5480 to 6533 feet at the top of Indian Lookout Mountain. The diverse geology includes Fountain Formation conglomerate and sandstones, Ingelside Formation sandstone, Lyons sandstone, and some Quaternary colluvium (Braddock et al. 1988). The geology is an important influence on the major plant communities.

The major plant communities present at the site are coniferous woodlands, shrublands, and grasslands. Veblin and Lorenz (1991), Peet (1981) and others provide more detailed descriptions of the vegetation and environment of the area.

The coniferous woodlands are dominated by Pinus ponderosa (ponderosa pine). The shrublands are extensive and dominated by Cercocarpus montanus (mountain mahogany). Grasslands are dispersed throughout the woodlands and shrublands. These are often dominated by exotic species, especially Bromus japonicus (Japanese brome), Bromus tectorum (cheatgrass), and Poa compressa (Canada bluegrass). Bromus tectorum, Bromus japonicus, Carduus nutans (musk thistle), Linaria dalmatica (dalmatian toadflax), and several other exotic species are very common throughout the site.

The Hall Ranch was acquired during the 1940's and divided up as five homesteads. Cultivation of the land occurred at one time and silo structures on the property still attest to this

fact. Since the 1940's, the ranch has been utilized for the grazing of livestock. The Hall Ranch has several quarry sites, mainly in the eastern part of the site.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** The site contains several occurrences of globally rare plant associations. Although many of these occurrences are degraded, the concentration of elements at this site would allow for protection of a significant portion of the imperiled natural heritage of the Front Range. Most of the other known occurrences of these elements are on private land owned by many individuals making protection very difficult. The occurrence of these elements on land owned by BCPOS may represent one of the best chances of protecting these elements.

ELEMENT	OCCURRENCE RANK	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
<u>Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii</u> - woodland	CD	G2	S2?	--	--
<u>Cercocarpus montanus/Stipa comata</u> - foothills shrubland	C	G2	S2	--	--
<u>Cercocarpus montanus/Stipa neomexicana</u> - foothills shrubland	D	GU	SU	--	--
<u>Cercocarpus montanus/Stipa scribneri</u> - foothills shrubland	C	GU	SU	--	--
<u>Andropogon gerardii-Schizachyrium scoparium</u> - xeric tallgrass prairie	C	G2	S2	--	--
<u>Andropogon gerardii-Schizachyrium scoparium</u> - xeric tallgrass prairie	CD	G2	S2	--	--

The Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii (ponderosa pine/mountain mahogany/big bluestem) plant association is known only from Colorado. Most known occurrences are small and degraded by the invasion of exotic plant species. This plant association at this site may represent a postsettlement increase of Pinus ponderosa in the lower foothills. The majority of these trees appear to be postsettlement in origin although a few presettlement trees are present. This increase may be the result of fire suppression, overgrazing, and/or other factors. Until more information is available this plant association will continue to be included in the CNHP database.

The Cercocarpus montanus/Stipa comata (mountain mahogany/needle-and-thread grass) plant association is also only known from Colorado. Although this plant association appears to be locally common along the northern Front Range of Colorado, almost all occurrences of this plant association are heavily invaded by Bromus tectorum and/or Bromus japonicus. The occurrence at this site has also been somewhat degraded.

The Cercocarpus montanus/Stipa neomexicana (mountain mahogany/New Mexico feathergrass) plant association has only recently been documented and is known only from Colorado and Wyoming. The occurrence at this site is relatively small and has been somewhat degraded by invasion of exotic species. Several occurrences have been identified in northern Colorado that are larger and in better condition (CNHP Biological and Conservation Database

1995). Stipa neomexicana appears to reach its northern range limit in east central Wyoming and this association may do the same (S. Kettler, personal observation).

The Cercocarpus montanus/Stipa scribneri (mountain mahogany/Scribner's needlegrass) plant association has only recently been documented and is known only from the northern Front Range of Colorado. More information and field survey is necessary to document the rarity and imperilment of this association. The occurrence at this site has been somewhat degraded by invasion of exotic species.

The Andropogon gerardii-Schizachyrium scoparium (big bluestem-little bluestem) plant association is known from Colorado and Montana. This plant association was thought to have once been much more common and expansive along the Front Range but is now reduced to few small patches, most degraded by invasion of exotic species. The occurrences at this site are of moderate size but have been impacted by gravel mines and associated access roads, and invasion by exotic plant species.

**CURRENT STATUS:** Most of the site has recently been purchased by Boulder County Parks and Open Space. This parcel appears to include the best known occurrences within the site. The remainder of the site is in private ownership.

This report is intended to identify significant elements of natural diversity so these can be addressed in a management plan. Currently there is no specific management for these elements on the public or private land.

**BOUNDARY JUSTIFICATION:** The preliminary conservation boundaries are intended to identify the area needed to support the significant elements and the ecological processes needed for their continued survival.

In general the plant associations present at the site historically have been influenced by fire, herbivory, and more recently by logging (Veblin and Lorenz 1991). These associations occur together in a mosaic that is affected by similar ecological processes and similar management issues. The boundaries presented here are intended to encompass an area that will allow these natural ecological processes to function or be mimicked through management practices. Included are some areas that are heavily degraded but thought to have the potential of recovery with proper management and the mosaic of plant communities with similar ecological needs and influences. The conservation site boundaries include most of the steep slopes and uplands west of Lyons with Pinus ponderosa woodlands, Cercocarpus montanus shrublands, and open grasslands. Lower slopes are generally more degraded and are not included. Other plant communities to the west are not considered to be as significant (for biodiversity protection) and are not included in the conservation site.

At the very least the physical extent of the occurrences should be directly protected, but with the knowledge that this may not insure survival of the elements in the long term. Inclusion of and restoration of heavily degraded areas will help protect the elements within this dynamic mosaic of plant communities.

#### **PROTECTION AND MANAGEMENT CONSIDERATIONS:**

At this site the greatest threat to these plant associations and the associated fauna appears to be invasion of exotic plant species. Further increase of exotic species may decrease the

biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988). Several exotic species occur in the plant communities in various quantities. The most common of these include Bromus tectorum, Bromus japonicus, Carduus nutans, Poa pratensis (Kentucky bluegrass), Poa compressa, Linaria dalmatica, Alyssum minus (alyssum), and Centaurea (knapweed) species. Aggressive management (herbicide application, manual cutting, etc.) may be necessary to control these species. Early season grazing, burning, or mowing may be effective management tools to control many of the cool season exotic plants and favor warm season dominant native plants.

The extent of native grasslands throughout North America has been seriously reduced since European settlement, as have many individual species that use the grasslands as habitat (Sampson and Knopf 1994). Conversion to agricultural land, overgrazing, and urban development have probably had the most significant impacts. The Soil Conservation Service (SCS) reports that overgrazing by cattle on vegetation similar to the Andropogon gerardii-Schizachyrium scoparium association will result in reduction or elimination of Andropogon gerardii, Sorghastrum nutans (indiangrass), Bouteloua curtipendula (sideoats grama), Muhlenbergia montana (mountain muhly), Panicum virgatum (switchgrass), and Elymus lanceolatus x Pseudoroegneria spicata (Griffith's wheatgrass) (SCS range descriptions #204, #206, #213). Various species in this association are preferred by livestock at different times of the season, therefore planned deferment is recommended to avoid grazing out these species. Reestablishment of vegetation is said to be difficult on this type of site due to slope, rocks, and shallow soils.

Fires were frequent components in the natural disturbance regimen of most grasslands and Pinus ponderosa woodlands (Mehl 1992) and are important in promoting patch dynamics and enhancing community diversity on a large spatial scale (Collins 1990). Anderson (1990) contends that fires were common in most grasslands but that fire was a more important factor in eastern North American grasslands than in arid western grasslands. Grasslands along the Front Range have in general been invaded by Pinus ponderosa woodlands. Fire suppression and intense grazing (which reduces competition from grasses) are often cited as reasons for the expansion.

Variation in fire timing and frequency has been shown to have different effects on different species (both plant and animal). Effects are often dissimilar on similar prairies in different geographic areas (Glenn-Lewin et al. 1990). Moderate grazing may have also have some of the same effects.

Goals for management, possibly species specific goals, should be developed before a fire and/or grazing management plan is implemented. Disturbance from fires and/or grazing may provide the opportunity for exotic species to increase in dominance.

Some homes have been built on private lands near the site. Development of those lands within the site which are not owned by BCPOS, may also degrade the site and threaten the survival of the significant elements. Conservation easements or purchase of this land should be considered.

Figure 5. Occurrences of the Cercocarpus montanus/Stipa comata, Cercocarpus montanus/Stipa neomexicana, and Cercocarpus montanus/Stipa scribneri plant associations at the Indian Lookout Mountain Site.



## PROTECTION TOOLS

Intensive land use in Colorado and multiple demands for many areas contribute to the continual degradation of many natural communities, endangered species habitats, and other types of natural areas. Carefully planned management practices can help protect critical buffers, but may not be adequate in the protection of sensitive species and sites. The first and most significant and proactive tool for protection is the continued identification of locations of rare species, natural communities, and the ecosystems that support them. Only with this information can informed decision-making occur.

This document provides base-level information to begin a planned protection effort of the significant biodiversity features within the Hall and Heil Ranches and Trevarton Open Space. By using careful planning, and a monitoring program, the significant elements of natural diversity identified herein will be adequately conserved.

## **RECOMMENDATIONS**

1. **Where appropriate, consider special area designations or special management options for the conservation sites identified in this study.**

This inventory has documented the existence of 4 sites determined to be significant for the protection of Colorado's and the nation's natural diversity. The Boulder County Parks and Open Space should consider including this report's recommendations into a management plan.

2. **Incorporate the information included in this report in the review of activities in or near areas identified as significant.**

The areas identified in this study are known to support unique natural communities and rare species. As proposed activities within the area are considered, they may be compared to the maps presented herein. Should the proposed project potentially impact one of these areas, Boulder County Parks and Open Space staff can decide if it is desirable to contact persons, organizations, or agencies with additional expertise. The Colorado Division of Wildlife, Colorado Natural Areas Program, and Colorado Natural Heritage Program routinely conduct environmental reviews statewide and should be considered as potential information sources.

3. **Increase public awareness of the benefits of protecting areas determined to be significant to the nation's natural diversity.**

Trends over the last twenty years strongly suggest that rare or imperiled species and significant natural areas will continue to decline if not given appropriate protective

measures. Increasing the public's knowledge of the remaining significant areas will build support for the programmatic initiatives necessary to protect them. Such activities could be done through interpretive facilities, conferences or meetings to stimulate public involvement, and information pamphlets.

4. **Promote cooperation with boundary neighbors (private individuals, the State Land Board, U. S. Forest Service) to insure the maintenance of selected sites and ecosystem integrity.**

The long-term protection of several of the sites presented in this report will be facilitated with the cooperation of numerous organizations and individuals.

5. **Properly manage significant elements of natural diversity.**

The development of management plans is a necessary component of natural resource management. This is especially critical for imperiled species and communities. Several organizations and agencies are available for consultation in the development of Management Plans for significant natural lands (e.g., Colorado Natural Areas Program, The Nature Conservancy, and the CNHP). We would also encourage the development of partnerships that could research and develop techniques for maintaining or restoring conservation sites to aid in the preservation of rare or imperiled species or significant natural communities (e.g. Colorado Division of Wildlife, Colorado Native Plant Society, The Nature Conservancy, and various academic institutions).

Other important management activities should include restoration and monitoring. Many of the natural communities identified as significant in the area are degraded. It may be possible to restore some of these communities. This may benefit many native species associated with this ecosystem. A monitoring program for the rare butterflies should be initiated.

6. **Actively manage roads and trails through and to conservation sites to control invasive alien plant.** Active monitoring and management of invasive alien plants is critical to the long term health of sensitive areas. Boulder County Parks and Open Space is encouraged to proactively manage roads and trails to reduce the impacts of these transport corridors.

7. **Continue to identify significant natural resources through inventories and other tools.** The refinement of natural resource data is a necessary goal. Inventories or surveys for priority elements of diversity will identify additional strategic management needs.

8. **Investigate the fire ecology and grazing relationship within all plant communities on the Hall and Heil Ranches and Trevarton Open Space.** Fire played an important role in the development and maintenance of many of these Front Range communities. We

recommend that expertise in fire ecology be utilized to better understand the ecological needs and implications of various fire management scenarios. In addition the effects and impacts of grazing and herbiciding should also be considered.

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APPENDICES - Site Tracking Reports, Element Occurrence Records, Element Characterization  
Abstracts, Ecology Field Notes

## Site Tracking Report and Element Occurrence Records for the Upper Geer Canyon Site

## Site Tracking Report and Element Occurrence Records for the Plumely Canyon Site

## Site Tracking Report and Element Occurrence Records for the Red Hill Site

## Site Tracking Report and Element Occurrence Records for the Indian Lookout Mountain Site

Element Characterization Abstracts

**PLANTS**

## **VERTEBRATES**

## **INVERTEBRATES**

## **PLANT ASSOCIATIONS**

Descriptions for the most common and/or most significant natural communities (those tracked by CNHP (plant associations) or BCPOS) are presented. Much of the study area has been disturbed and has greatly altered species composition. The brief descriptions which follow are from a combination of published literature on relatively undisturbed stands and field observations from the study area. Full characterization abstracts are unavailable for these plant associations. Management information is taken mainly from Forest Service publications and addresses management of timber, grazing, and common wildlife species. General biodiversity management issues are not addressed in the Forest Service documents. CNHP recommends that the areas be managed in a way that replicates the natural ecosystem processes and the range of variability within this ecosystem.

## **GRASSLANDS**

### Andropogon gerardii

This plant association does not appear to be described, although Vestal (1914) briefly describes a plant community that may be similar. It is similar to the association described below but has little to no Schizachyrium scoparium (little bluestem). It may be possible that Schizachyrium scoparium is less able to compete with Bromus tectorum (cheatgrass) and Bromus japonicus (Japanese brome), or that other environmental factors are responsible for the absence of this species.

### Andropogon gerardii-Schizachyrium scoparium - G2/S2 (Bourgeron and Engelking 1994)

This plant association or related types have been well documented in the literature by Branson et al. (1965), Vestal (1914), Hanson and Dahl (1956), Buckner (1994), Livingston (1952), and Moir (1969). Andropogon gerardii (big bluestem) and Schizachyrium scoparium are usually the dominant species. Muhlenbergia montana (mountain muhly), Poa compressa (Canada bluegrass), Poa pratensis (Kentucky bluegrass), Bouteloua curtipendula (sideoats grama), Bouteloua gracilis, Stipa comata (needle-and-thread grass) and Carex heliophila (sun sedge) are other graminoids that are common in the association. Important forbs include Aster porteri (Porter's aster), Heterotheca villosa (hairy golden aster), Liatris punctata (dotted gayfeather), Psoralea tenuiflora (slimflower scurfpea), Eriogonum alatum (winged buckwheat), Artemisia frigida (fringed sage), and Artemisia ludoviciana (Louisiana sagewort). While the dominant species in this association are similar to tallgrass prairies in the midwest and Great Plains, the association in Colorado contains many species common in more montane environments (Buckner 1994).

Branson (1965) concluded that the abundance of more mesic prairie species occurrences from Rocky Flats was due to more rapid infiltration of precipitation and greater available soil moisture in these rocky soils.

The greatest threat to this community is invasion by exotic plant species. Further increase of exotic species may decrease the biodiversity significance of the site by altering the native floral and faunal species composition (Bock and Bock 1988).

The Soil Conservation Service (SCS) reports that overgrazing by cattle on similar sites will result in reduction or elimination of Andropogon gerardii, Sorghastrum nutans (indiangrass), Bouteloua curtipendula (sideoats grama), Muhlenbergia montana (mountain muhly), Panicum virgatum (switchgrass), and Elymus lanceolatus x Pseudoroegneria spicata (Griffith's wheatgrass) (SCS range sites #204, #206, #213). Various important species in this association are preferred by livestock at different times of the season therefore planned deferment is recommended to avoid grazing out these species. Reestablishment of vegetation is said to be difficult on this type of site due to slope, rocks, and shallow soils.

Several exotic species occur in the community in various quantities. These species include Bromus tectorum, Bromus japonicus, Carduus nutans (musk thistle), Poa pratensis, Linaria dalmatica (dalmatian toadflax), Alyssum minus (alyssum), and Centaurea (knapweed) species. Aggressive management (herbicide application, manual cutting, etc.) may be necessary to control these species. Early season grazing, burning, or mowing may be effective management tools to control many of the cool season exotic plants and favor warm season dominant native plants.

The extent of native grasslands throughout North America has been seriously reduced since European settlement, as have many individual species that use the grasslands as habitat (Sampson and Knopf 1994). Conversion to agricultural land, overgrazing, and urban development have probably had the most significant impacts.

Fires were frequent components in the natural disturbance regimen of most grasslands and are important in promoting patch dynamics and enhancing community diversity on a large spatial scale (Collins 1990). Anderson (1990) contends that fires were common in most grasslands but that fire was a more important factor in eastern North American grasslands than in arid western grasslands.

Variation in fire timing and frequency has been shown to have different effects on different species (both plant and animal). Effects are often dissimilar on similar prairies in different geographic areas (Glenn-Lewin et al. 1990). Moderate grazing may have also have some of the same effects.

Grasslands along the Front Range have in general been invaded by Pinus ponderosa (ponderosa pine) woodlands. Fire suppression and intense grazing (which reduces competition from grasses) are often cited as reasons for the expansion.

Specific goals for management, possibly species specific, should be developed before a fire management plan is implemented. Fires and/or grazing may provide the opportunity for exotic species to increase in dominance. Frequent fires in tallgrass prairie in Kansas has been shown to reduce the diversity of lepidoptera (Swingle ).

Stipa neomexicana - G2/S2 (Bourgeron and Engelking 1994)

This plant association has been reported by Moir (1969) from the Front Range of Colorado. The vegetation is dominated by Stipa neomexicana (New Mexico feathergrass). Other common graminoids include Bouteloua gracilis (bluegrama), Stipa comata (needle-and-thread grass), Bouteloua curtipendula, and Aristida (threeawn) species. Forbs contribute little cover.

Moir (1969) describes this association as occurring on excessively drained ridges of shale outcrops and at the margins of alluvial terraces.

Similar communities have been observed on the Comanche National Grassland on shale ridges and around the Mesa de Maya region of southeast Colorado (S. Kettler - personal observation) and reported from New Mexico (Dick-Peddie 1993). Stipa neomexicana is generally more common in the southwestern U.S. and the association may be reaching its northern range limit in northern Colorado and possibly east-central Wyoming.

Published information regarding management concerns appears to be unavailable for this association.

#### Stipa comata-Bouteloua gracilis - G5/S2S3 (Bourgeron and Engelking 1994)

Moir (1969) describes a Stipa comata-Bouteloua gracilis community from near Boulder which is very similar to the communities found at the study area. Stipa comata, Bouteloua gracilis, and Agropyron smithii (western wheatgrass) were the dominant species.

Hess (1981) describes a similar plant association from the Roosevelt National Forest. Dominant species include Stipa comata, Bouteloua gracilis, Artemisia frigida, Agropyron smithii, Carex heliophila (sun sedge), Koeleria cristata (Junegrass), Allium textile (prairie onion), Heterotheca villosa, Eriogonum umbellatum (sulfur buckwheat), and Senecio fendleri (Fendler's groundsel). Hess (1981) indicates that canopy coverage of Antennaria rosea (rose pussytoes) and the dominant climax species (Stipa comata and Bouteloua gracilis) indicate varying levels of impact from past grazing, and that many areas occupied by this plant association have been overgrazed.

Hanson (1955) and Hanson and Dahl (1956) describe a similar association which they refer to as the Stipa comata-Bouteloua gracilis-Bouteloua curtipendula association. The vegetation and environment are similar to the studies mentioned above except that Bouteloua curtipendula is co-dominant and several tallgrass species are often present (although in low abundance), including Andropogon scoparius and Andropogon gerardii.

Johnston (1987) summarizes data from numerous publications (including those mentioned above) to describe the Stipa comata/Bouteloua gracilis plant association and includes the association described by Hanson (1955) and Hanson and Dahl (1956) as a phase of the Stipa comata/Bouteloua gracilis plant association. This plant association is documented from Alberta, Saskatchewan, North and South Dakota, Montana, Wyoming, and Colorado.

Specific information regarding management issues was not available but the most important issue appears to be grazing management. Hanson and Dahl (1956) contend that where Bromus tectorum dominates other forbs and grasses are unable to compete. Hanson (1955) states that this association is resistant to invasion by Bromus tectorum but this species is very common in most stands in the study area. Also, Heterotheca villosa seems to be increasing at most of the

sites. He also indicates that the vegetation on the Dakota Formation appeared more weedy than those on the Morrison Formation.

Occurrences of this plant association on the study area are generally degraded and/or fairly small and of low conservation priority.

#### Schizachyrium scoparium tentative plant association - not ranked

This plant association appears to be similar to the Andropogon scoparius association described by Hanson and Dahl (1956) and the bunch-grass association described by Vestal (1913). Schizachyrium scoparium is the dominant species although Andropogon gerardii, Elymus lanceolatus x Pseudoroegneria spicata (Griffith's wheatgrass), Bouteloua curtipendula, Stipa comata, and Koeleria macrantha are often present. This association is very similar to the Andropogon gerardii-Schizachyrium scoparium association. It may be a possibility that the Schizachyrium scoparium association is a grazing induced phase of the Andropogon gerardii-Schizachyrium scoparium association. Weaver (1954) rates Andropogon gerardii as one of the most preferred prairie species and one of the first to be eliminated with heavy grazing and also states that Schizachyrium scoparium is less preferred and often avoided later in the growing season.

#### Pascopyrum (Agropyron) smithii/Bouteloua gracilis - G5/S4 (Bourgeron and Engelking 1994)

This association has been described by Vestal (1913), Hanson and Dahl (1956), Albertson and Weaver (1944), the Soil Conservation Service, and numerous other authors reported by Johnston (1987) in his Bouteloua gracilis/Elytrigia (Pascopyrum) smithii plant association. The dominant species are Bouteloua gracilis and Pascopyrum smithii. Artemisia frigida, Opuntia (pricklypear cactus) species, and Carex (sedge) species are common associates. In general sites that are heavily disturbed for long periods of time are thought to convert from dominance of tall to mid to shortgrass species. This may be the case at the study area. Some sites listed under this association may be other highly degraded mid or tall grass prairies.

The SCS reports that sites generally fitting this description provide excellent forage. Pascopyrum smithii is said to be very nutritious during the early spring but deferment and rotation are necessary to keep this species from being grazed out. Warm season grasses such as Bouteloua gracilis and Bouteloua curtipendula benefit from deferment during the late spring and early summer and make excellent winter forage because they maintain their nutritious value after maturing (SCS range sites #1, #4).

## **SHRUBLANDS**

### CERCOCARPUS MONTANUS SERIES

The following plant associations in the Cercocarpus montanus (mountain mahogany) series often occur as a complex mosaic on steep ridges and hogbacks in the study area. These

associations often intergrade and are difficult to differentiate. The environmental factors influencing their distribution are not readily apparent.

Cercocarpus montanus/Elymus lanceolatus x Pseudoroegneria spicata

- GU/SU (Bourgeron and Engelking 1994)

Synonyms: Cercocarpus montanus/Elytrigia dasystachya (Johnston 1987), Cercocarpus montanus/Agropyron griffithsii (Hess 1981)

The taxonomy of the dominant grass in this association is confused. Agropyron griffithsii was shown by Dewey (1970) to be a hybrid of Elymus lanceolatus (syn. Elytrigia dasystachya) and Pseudoroegneria spicata. Weber and Wittman (1992) includes Agropyron griffithsii under Elymus lanceolatus and does not list the hybrid. Thus the two synonymous plant associations technically refer to different species of grass as dominants. It appears that they are referring to the same plant association. In the study area the proper name for the dominant grass should be Elymus lanceolatus x Pseudoroegneria spicata (Griffith's wheatgrass). All of the material observed had the long lemma awns of the hybrid.

Hess (1981) describes the association from the Roosevelt National Forest. Cercocarpus montanus and Agropyron griffithsii (Elymus lanceolatus x Pseudoroegneria spicata) are the dominant species. Artemisia frigida is also fairly common. Hess (1981) states that the relatively closed canopy of this association limits recreational and grazing impacts although several stands in the study area were invaded by Bromus tectorum and/or Bromus japonicus.

Cercocarpus montanus/Stipa comata- G2/S2 (Bourgeron and Engelking 1994)

This plant association has been documented by Hess (1981) from the lower boundaries of the Roosevelt National Forest and along the Dakota hogback in Jefferson, Boulder, and Larimer counties (CNHP - unpublished data). Cercocarpus montanus is the dominant species with Stipa comata in the understory. Other common species include Artemisia frigida, Opuntia polyacantha, Bouteloua gracilis, Astragalus species, Allium textile, and Helianthus pumilus. Most occurrences have been degraded by the invasion of exotic species (mainly Bromus tectorum and B. japonicus). Published information regarding management concerns appears to be unavailable although Hess (1981) mentions that recreation and grazing impacts are common but characteristic species remain conspicuous.

Cercocarpus montanus/Stipa neomexicana - GU/SU

This plant association has only been recently documented in Colorado and also appears to occur in east central Wyoming (S. Kettler - personal observation). There is no published description for this association, but high quality occurrences occur near Livermore in Larimer County, Colorado. Stipa neomexicana apparently reaches its northern extent in northern Colorado and east central Wyoming.

### Cercocarpus montanus/Stipa scribneri - GU/SU

This plant association has only been recently documented in Colorado. There is no published description for this association. The vegetation is dominated by Cercocarpus montanus and Stipa scribneri (Scribner's needlegrass) in the understory. Common associated species include Stipa comata, Oryzopsis hymenoides (indian ricegrass), and Elymus lanceolatus x Pseudoroegneria spicata.

### **BETULA OCCIDENTALIS SERIES**

#### Betula occidentalis - G3/SU (Bourgeron and Engelking 1994)

Similar communities have been reported by Hansen et al. (1988). These are deciduous shrublands limited to narrow strips along small streams. Betula occidentalis (water birch) and Acer glabrum (mountain maple) dominate. Alnus incana ssp. tenuifolia (alder) appears to be absent or infrequent.

Hansen et al. (1988) comment that Betula occidentalis is an effective streambank stabilizer and dense stands provide cover for many wildlife species.

#### Cercocarpus montanus-Rhus trilobata/Andropogon gerardii - GU/SU

This association has been reported from near Boulder, Colorado (CNHP files) although little information or quantitative data are available. This community is somewhat similar to SCS range site #204. The vegetation is dominated by Cercocarpus montanus and/or Rhus trilobata (skunkbush sumac), although either species may be nearly absent from some stands. Andropogon gerardii is the dominant herbaceous species in stands in good condition.

### **FORESTS AND WOODLANDS**

The Pinus ponderosa (ponderosa pine) series covers about two-thirds of the surveyed area. It is the dominant forest cover for the area. Numerous plant associations within this series are documented at the study area.

The Pinus ponderosa plant associations have, for the most part, been logged to varying degrees. Some areas have had most of the trees removed. Other areas have been selectively logged. Most of the trees are less than 16 inches DBH (diameter breast height). Mehl (1992) determined that in general for the Front Range, diameters greater than 16 inches DBH could be assigned to presettlement origin. Diameters less than 12 inches are generally postsettlement in origin. Diameters between 12 and 16 inches may be either pre or postsettlement. Few trees greater than 16 inches remain in the survey area. The majority are less than 12 inches.

Many plant associations in this series represent a disturbed situation. Pinus ponderosa increased once fire suppression began. This increased shading of the understory and changed its composition. Later logging reopened the canopy with a probable increase in shrubby and herbaceous vegetation. This new understory is not necessarily of the same composition as the pre-settlement understory as evidenced by the large number and cover of exotic, weedy species especially Bromus japonicus and Bromus tectorum. Native early seral species such as Danthonia spicata (poverty oatgrass) are dominant in some areas.

The Pinus ponderosa series occurs on all slopes and aspects. It is most abundant on east, south, and west slopes respectively. On north slopes and at higher elevations it begins to be replaced with Pseudotsuga menziesii (Douglas-fir). On lower slopes, where it joins grasslands, it is usually very weedy. Exotic species may dominate the understory.

Fire frequencies for the Pinus ponderosa cover type are estimated to have been 8-15 years and because of anthropogenic disturbance few stands over 150 years old exist (Mehl 1992). De Velice et al. (1986) state that dominance of forb species such as Hymenoxys species, Heterotheca villosa or the graminoids Bromus tectorum or Poa pratensis indicates over grazing.

Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii - G2/S2 (Bourgeron and Engelking 1994)

This plant association has only been reported from Colorado and is imperiled throughout its range (G2/S2). There is some question as to the naturalness of this association in regards to fire suppression. This plant association was first identified on the Heil Ranch in 1991 by Rick Brune. It is dominated by an open stand of Pinus ponderosa with an understory of Cercocarpus montanus and Andropogon gerardii. This plant association appears to represent a postsettlement increase of Pinus ponderosa in the lower foothills. The majority of the Pinus ponderosa appear to be postsettlement in origin although a few presettlement trees are present. This increase in Pinus ponderosa may be the result of fire suppression, overgrazing, or other factors. Some consideration should be given to the probable anthropogenic origin of this plant association when reviewing the ranking. Studies should be undertaken to determine what the "natural" community would have been in presettlement conditions. This community will continue to be tracked by CNHP until further information warrants otherwise.

Pinus ponderosa/Leucopoa kingii - G2/S2 (Bourgeron and Engelking 1994)

This plant association has been documented by Hess and Alexander (1986) and Hess (1981). Peet (1981) also describes several communities with Pinus ponderosa and Leucopoa kingii (spike fescue) as important components.

Pinus ponderosa forms a relatively closed canopy and is moderately productive. The understory is sparse but usually dominated by Leucopoa kingii. Other common understory species include Artemisia frigida, Ribes cereum (was current), Allium geayeri (Geyer's onion),

Geranium cespitosum (piney woods geranium), Harbouria trachypleura (whiskbroom parsley), and Sedum lanceolatum (spearleaf stonecrop).

Hess and Alexander (1986) describe this as being a major habitat type on the Roosevelt National Forest but it has not been documented elsewhere. They also say potential for timber productivity is moderate. Standard and group shelterwood methods usually will result in good regeneration. Forage potential is moderate as Leucopoa kingii appears to be palatable but as tree densities increase Leucopoa kingii seems to become less dense. No data is available concerning fire frequencies for this specific plant association.

Pinus ponderosa/Arctostaphylos uva-ursi - G5/S3 (Bourgeron and Engelking 1994)

De Velice et al. (1986) and Livingston (1949) describe this association from southern Colorado and northern New Mexico. In addition, Johnston (1987) reports this association from the Medicine Bow National Forest in Wyoming and the Black Hills National Forests in South Dakota.

The overstory vegetation is dominated by Pinus ponderosa with Pseudotsuga menziesii being present but in minor amounts. Arctostaphylos uva-ursi (kinnikinnick) is the dominant species in the understory although several graminoids may be present in small amounts.

Timber production is poor and wildlife use is moderate (De Velice et al. 1986).

Pinus ponderosa/Carex heliophila - G3/S2 (Bourgeron and Engelking 1994)

Livingston (1949) describes this association from the Black Forest north of Colorado Springs, CO. In addition, Johnston (1987) reports this association from the Roosevelt National Forest, northern New Mexico, North Dakota, Montana, and the Black Hills National Forest.

The vegetation is described as being dominated by Pinus ponderosa with few other tree species occurring (Livingston 1949). Common shrubs include Artemisia frigida, Rosa arkansana (prairie rose), Rhus trilobata, and Ribes cereum (Johnston 1987). The understory is dominated by Carex heliophila (sun sedge) with lesser amounts of Muhlenbergia montana, Heterotheca villosa, Koeleria macrantha, and Geranium caespitosum.

Livingston (1949) states that the savannah-like appearance of the forest was a result of thinning and grazing and that the more undisturbed forest forms a closed canopy. This is somewhat contradictory to the present thought regarding the role of fires in Pinus ponderosa forests.

Pinus ponderosa/Cercocarpus montanus - G4/S4 (Bourgeron and Engelking 1994)

This plant association has been described by Hess and Alexander (1986) and Hess (1981) from the Roosevelt National Forest. It is a major type in the foothills and lower montane environments of the Colorado Front Range. It occurs on relatively steep slopes with a lot of exposed parent material.

The vegetation is dominated by Pinus ponderosa with occasional Pseudotsuga menziesii. Cercocarpus montanus dominates the shrub layer. The understory is dominated by Elymus

lanceolatus x Pseudoroegneria spicata, Koeleria macrantha, Stipa comata, Eriogonum umbellatum, and Geranium caespitosum.

This association has low timber and livestock productivity but does provide bighorn sheep and mule deer winter range (Hess and Alexander 1986).

Pinus ponderosa/Purshia tridentata - G5/S3 (Bourgeron and Engelking 1994)

This plant association has been described by Hess (1981) and Hess and Alexander (1986) from the Roosevelt National Forest. Similar plant associations have been reported from Oregon, Washington, Montana, Idaho and Utah (Johnston 1987). Hess (1981) mentions that at the lower elevational limit for this association it is restricted to exposed sites. This corresponds to the occurrences found in the study area but all were very small.

The overstory is dominated by Pinus ponderosa with Pseudotsuga menziesii and Juniperus scopulorum (Rocky Mountain juniper) occasionally occurring. The shrub layer is dominated by Purshia tridentata (antelope bitterbrush). Common herbaceous species include Muhlenbergia montana, Leucopoa kingii, Koeleria macrantha, Geranium caespitosum, Drymocallis fissa (bigflower cinquefoil), and Eriogonum umbellatum (sulfur buckwheat).

Timber productivity is low and successful tree regeneration is difficult. Forage production is low but the association has potential to be excellent winter range for mule deer and elk. This association is also highly preferred habitat for the mountain cottontail (Hess and Alexander 1986). Purshia tridentata is reported to recover slowly from fire. Fire may increase forbs and graminoids improving forage value.

Pinus ponderosa/Muhlenbergia montana - G5/S2S3 (Bourgeron and Engelking 1994)

This plant association has been described from Colorado (Hess 1981, Hess and Alexander 1986), New Mexico (De Velice et al. 1986), and from Utah (Johnston 1987). This association is synonymous with the Pinus ponderosa-Pseudotsuga menziesii/Muhlenbergia montana plant association reported by Johnston (1987).

The overstory vegetation is dominated by Pinus ponderosa which forms an open, low canopy (Hess 1981). Pseudotsuga menziesii and Juniperus scopulorum are usually present but in low abundance. Shrubs are of minor importance. The herbaceous layer is dominated by Muhlenbergia montana. Other important species are Elymus lanceolatus x Pseudoroegneria spicata, Leucopoa kingii, Heterotheca villosa, and Geranium caespitosum.

This association has low to very low productivity for timber and tree regeneration is irregular (Hess and Alexander 1986). Forage production is moderate but overgrazing can cause serious degradation of the site. This association has high potential for early winter or transitional range for bighorn sheep (Hess and Alexander 1986, De Velice et al. 1986).

Pseudotsuga menziesii Series

This series is limited in occurrence in the survey area due to the low elevation. This is the lower limit for Pseudotsuga menziesii. Occurrences are limited mostly to north-facing slopes, sheltered west-facing slopes in narrow ravines, and west-facing slopes mixed with boulder fields which provide more mesic conditions. Pseudotsuga menziesii is usually mixed with Pinus ponderosa on lower sites. Only occurrences on the extreme western margin of the area have little Pinus ponderosa.

Mehl (1992) states that lack of frequent low intensity fires which keep Pseudotsuga menziesii from becoming established in Pinus ponderosa forests, is allowing Pseudotsuga menziesii to invade that type. Old growth Pseudotsuga menziesii stands would contain overstory trees that are mostly that species or some Pinus ponderosa on drier sites. Dead standing trees would be present and some of the overstory trees would have large, open tops with some rot (Mehl 1992).

#### Pseudotsuga menziesii/Jamesia americana - G3G4/S3 (Bourgeron and Engelking 1994)

Hess and Alexander (1986) describe this association on the Arapaho and Roosevelt National Forests. It is said to have a broad geographical distribution but is not abundant in any one locality. This association has also been documented from the Gunnison and Pike National Forests (Johnston 1987).

Pseudotsuga menziesii dominates the overstory with occasional Pinus ponderosa and Juniperus scopulorum. Jamesia americana (cliffbush) dominates the understory although Acer glabrum, Physocarpus monogynus (mountain ninebark), and Juniperus communis (common juniper) may also be important. Common herbaceous species include Fragaria virginiana (Virginia strawberry) and Drymocallis fissa (Hess and Alexander 1986).

This plant association occurs in slightly more mesic situations than the Pseudotsuga menziesii/Physocarpus monogynus association and on much steeper and/or rockier terrain (Hess 1981). Potential for timber production is low generally because of steep slopes and surface boulders. Forage production and wildlife use are low (Hess and Alexander 1986).

#### Pseudotsuga menziesii/Physocarpus monogynus - G4/S4 (Bourgeron and Engelking 1994)

Hess and Alexander (1986) describe this association on the Arapaho and Roosevelt National Forests. It is said to be the most common Pseudotsuga menziesii habitat type east of the Continental Divide. This association has also been documented in several National Forests in Wyoming and New Mexico.

Pseudotsuga menziesii dominates the overstory with occasional Pinus ponderosa and Juniperus scopulorum. Physocarpus monogynus dominates the understory although Jamesia americana, Juniperus communis, and Symphoricarpos albus (common snowberry) also occur in minor amounts. Common herbaceous species include Leucopoa kingii, Achillea lanulosa (western yarrow), Galium boreale (northern bedstraw), Geranium cespitosum, and Drymocallis fissa. The soil surface is almost completely covered by vegetation and needle litter with very little bare soil or rock exposed (Hess 1981).

Hess and Alexander (1986) describe this community as the most productive in the *Pseudotsuga menziesii* series. Tree reproduction is described as being difficult with any cutting method and the occurrence of this association on steep slopes makes harvesting difficult. Livestock production is listed as being low. This association is said to provide thermal cover for deer and elk.

ECOLOGY FIELD NOTES Numbers and letters correspond to locations on the Lyons 1:24,000 USGS quadrangle and the orthophotos provided by the County. The entire area was not surveyed on the ground. Boundaries between vegetation types were, in most cases, not distinct and were therefore extrapolated using maps and aerial photos. Much of the area between site numbers and letters is degraded grasslands or Ponderosa pine stands that were difficult to classify and/or somewhat degraded. Several descriptions may have been done within one mapped polygon. This polygon represents a Series level classification within which several plant associations occur.

Plant Associations of the Heil and Hall Ranches/Trevarton Open Space:

The major plant associations are those dominated by coniferous forests, deciduous shrublands, and grasslands. These usually have many exotic weeds present.

The coniferous forests occupy the largest part of the survey area. They are mostly dominated by *Pinus ponderosa* with smaller areas of Douglas fir (*Pseudotsuga menziesii*). The major type is the *Pinus ponderosa*/*Carex heliophila* plant association. The forests are often disturbed by logging and mining.

Deciduous shrublands are common on the Dakota Hogback in the eastern part of the area. These are mostly dominated by mountain mahogany (*Cercocarpus montanus*). The most common type is *Cercocarpus montanus*/*Elytrigia dasystachya*. Along riparian areas there are small amounts of river birch (*Betula occidentalis*) and mountain maple (*Acer glabrum*) dominated shrublands.

Grasslands are dominant along the lower elevations and are also found in meadows dispersed throughout the forests. They are common along Red Hill Gulch. They are often dominated by introduced and early seral species, especially Japanese brome (*Bromus japonicus*), cheatgrass (*Bromus tectorum*), and Canada bluegrass (*Poa compressa*).

Weed fields are present where most native species are replaced by exotics and early seral species are common. These cannot be assigned to any plant association with certainty.

Minor amounts of wetlands are present. These usually are dominated by introduced weeds. Most are associated with small springs.

Heil Ranch

Transcription of Field Notes

PINUS PONDEROSA SERIES (mapped as PIPO/PSME)

The ponderosa pine (*Pinus ponderosa*) series covers about two-thirds of the surveyed area. It is the dominant forest cover for the area. Approximately 10 different plant associations are described.

The *Pinus ponderosa* series plant associations have, for the most part, been logged to varying degrees. Some areas have had most of the trees removed. Other areas have been selectively logged. Most of the trees are less than 20-inches DBH (diameter breast height). Brune determined that in general for the foothills of the Front Range, diameters greater than 20 inches DBH could be assigned to presettlement origin (Brune 1992). Diameters less than 12 inches are generally postsettlement in origin. Diameters between 12 and 20 inches may be either pre- or postsettlement. Few trees greater than 20 inches remain in the survey area. The majority are less than 12 inches.

Many plant associations in this series represent a disturbed situation. *Pinus ponderosa* increased once fire suppression began. This increased shading of the understory and changed its composition. Later logging reopened the canopy with a probable increase in shrubby and herbaceous vegetation. This new understory is not necessarily of the same composition as the pre-settlement understory as evidence by the large number and cover of exotic, weedy species - especially Japanese brome (*Bromus japonicus*) and cheatgrass (*Bromus tectorum*). Native early seral species such as poverty oatgrass (*Danthonia spicata*) are dominant in some areas.

The *Pinus ponderosa* series occurs on all slopes and aspects. It is most abundant on east, south, and west slopes respectively. On north slopes and at higher elevations it begins to be replaced with Douglas fir (*Pseudotsuga menziesii*). On lower slopes, where it joins grasslands, it is usually very weedy. Exotic species may dominate the understory.

Most occurrences of the association are on Lyons Sandstone (Ply) or Fountain Formation (PPf) with smaller amounts on Middle and Early Proterozoic pegmatite (YXp) and Biotite schist, Early Proterozoic (Xqs). Soils are stony, sandy loams of the Baller (BaF), Goldvale (GrF), Pinata (PrF) and Sixmile (SmF) Series.

The following *Pinus ponderosa* plant associations were identified during the survey. Where applicable, authors names follow the references to denote where the plant association is described. Species lists show typical species encountered but are not exhaustive. Photographs exist for most of the sites

described. Site numbers correspond to the number on the map for the general area where the description was compiled.

(I) following a species name indicates an introduced species not native to the area.

**Pinus ponderosa/Arctostaphylos uva-ursi plant association**

(Bourgeron 1994, Johnston 1987) G5S3

Site number: Heil 69.

This is a questionable occurrence of ponderosa pine (*Pinus ponderosa*)/kinnikinnik (*Arctostaphylos uva-ursi*). In this area the *Pinus ponderosa* are smaller and have an understory of *Arctostaphylos uva-ursi*. The canopy is often nearly closed. There has been logging in the area. It is possible that this is just a part of the larger *Pinus ponderosa*/*Carex heliophila* plant association but it is rather distinct. The exact borders are unknown. This occurrence is on a flat area near the top of the Lyons hogback.

Geology: Lyons Sandstone (Ply)

Species: *Achillea lanulosa*  
*Arctostaphylos uva-ursi*, 20% cover  
*Carex heliophila*  
*Danthonia spicata*  
*Drymocallis cf fissa*  
*Elymus elymoides*  
*Erigeron flagellaris*  
*Pinus ponderosa*, dominant  
*Pseudotsuga menziesii*, infrequent  
*Sedum lanceolatum*

**Pinus ponderosa/Carex heliophila plant association**

(Bourgeron 1994, Johnston 1987) G3S2

Site Numbers: Heil 1, 2, 3, 8, 12, 18, 21, 39, 45, 51, 52, 53, 55, 55.5, 57, 58, 59, 68, 70, 75, 79, 81, 83, 99, 107.

This is the most widespread *Pinus ponderosa* plant association. It varies from very poor condition (59) with exotic species dominating to fairly good condition (1, 8, 21). Most of the association has been logged to

varying degrees. Sites 57 and 81 are heavily logged. Large areas have been subject to moss rock removal and quarrying for building stone.

Some of the sites assigned to the plant association may in fact be other associations. Areas with *Danthonia spicata* as dominant or codominant with *Carex* (58) are assigned here since they appear to occur within the main association. The dominant *Carex* appears to be sun sedge (*Carex heliophila*) although very little was in flower. Other carices may be present and possibly codominant.

This plant association is in better condition on steeper slopes where access by cattle is somewhat limited. Lower slopes adjoining meadows tend to be very weedy as do areas with less canopy cover. Canopy cover approaching 100% shows more dominance by *Carex*, less species diversity, and fewer weeds (21).

**Site Heil 1:** This is a generally open, east-facing *Pinus ponderosa* forest. The lower slopes are weediest with fewer weeds on the middle slopes. Light logging has occurred. Some areas of doghair type closed-canopy *Pinus ponderosa* are present. *Carex heliophila* is dominant under some *Pinus ponderosa*, especially in the mid to upper areas. *Bromus japonicus* is dominant in many areas. Tumble knapweed (*Acosta diffusa*) is abundant near the quarries south of Geer Canyon.

Geology: Lyons Sandstone (Ply)

Species: *Acosta diffusa* (I), abundant near quarries.  
*Allium cernuum*  
*Allium textile*  
*Alyssum minus* (I)  
*Ambrosia psilostachya*  
*Andropogon gerardii*, fairly common,  
especially lower  
*Aristida longiseta*  
*Bouteloua curtipendula*, rare  
*Bromus briziformis* (I)  
*Bromus japonicus* (I)  
*Bromus lanatipes*, infrequent  
*Bromus tectorum* (I)  
*Carex heliophila*, common  
*Carduus nutans* (I), scattered throughout  
*Cerastium arvense*, common

Cirsium sp.  
Dalea purpurea  
Danthonia spicata  
Elymus elymoides  
Eriogonum alatum  
cf Harbouria trachypleura  
Heterotheca villosa  
Juncus interior  
Leucopoa kingii  
Liatris punctata  
Mertensia lanceolata  
Muhlenbergia montana  
Opuntia macrorhiza  
Opuntia polyacantha  
Oxalis dilenii  
Pinus ponderosa, dominant  
Psoralea tenuifolia  
Ratibida columnifera  
Rhus glabra, near quarries  
Rhus trilobata, rare  
Schizachyrium scoparium, fairly common, lower  
Stipa comata  
Talinum cf parviflorum  
Tragopogon dubius (I)  
Tragia ramosa  
Verbascum thapsus (I), throughout

**Site Heil 2:** This is the upper part of Heil 1. The ridge top was burned for a fire break several years ago. *Pinus ponderosa* formerly dominated. The burned area is very weedy with Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), and mullein (*Verbascum thapsus*). *Ceanothus fendleri* and *Bromus japonicus* dominate.

Geology: Lyons Sandstone (Ply)

Species: *Bromus tectorum* (I), dominant  
*Ceanothus fendleri*, dominant  
*Cirsium arvense* (I), subdominant  
*Carduus nutans* (I), subdominant  
*Muhlenbergia racemosa*, common  
*Stipa scribneri*, on ridge top

**Site Heil 3:** This is the west-facing slope opposite Heil 1 and 2. There is no significant difference in the plant association except more canopy cover and possibly

less diversity. It has widely scattered *Allium cernuum*, *Andropogon gerardii*, *Leucopoa kingii*, and *Stipa comata*.

Geology: Fountain Formation (PPf)

**Site Heil 8:** *Pinus ponderosa* dominates and *Carex heliophila* is common on this east-facing slope (30%). All of the larger trees appear to have been removed. Exotic species are common.

Geology: Fountain Formation (PPf)

Species: *Allium cernuum*  
*Andropogon gerardii*, trace  
*Aristida longiseta*  
*Artemisia ludoviciana*  
*Arctostaphylos uva-ursi*  
*Aster porteri*  
*Bromus japonicus* (I)  
*Bromus tectorum* (I)  
*Carex heliophila*, common  
*Dalea purpurea*  
*Danthonia spicata*  
*Elymus lanceolatus* x *Pseudoroegneria spicata*  
*Heterotheca villosa*  
*Muhlenbergia montana*  
*Pinus ponderosa*, dominant  
*Poa compressa* (I)  
*Poa pratensis* (I)  
*Psoralea tenuifolia*  
*Purshia tridentata*, trace  
*Schizachyrium scoparium*

**Site Heil 12:** This is an open *Pinus ponderosa* forest with *Carex heliophila* common in the understory. It occurs on a south-facing slope (25%). Large areas are covered with a pine-needle mulch. The area has been logged but *Pinus ponderosa* over 20 inches DBH are present. Doghair stands of small *Pinus ponderosa* are present but they don't dominate. This site is near Heil 13 which is *Pinus ponderosa/Leucopoa kingii*, an association of special concern.

Geology: mostly Fountain Formation (PPf)

Species: *Allium cernuum*, trace  
*Artemisia ludoviciana*, common  
*Bromus japonicus* (I)

Bromus lanatipes, rare  
Bromus tectorum (I)  
Carex heliophila, common  
Corallorhiza sp.  
Elymus elymoides  
Grindelia squarrosa, rare  
Koeleria macrantha  
Leucopoa kingii  
Melandrium (Lychnis) alba (I)  
Muhlenbergia montana  
Pinus ponderosa, dominant  
Scutellaria brittonii

**Site Heil 18:** This is an east-facing slope (30%) dominated by an open canopy of *Pinus ponderosa* with *Carex heliophila*. Open areas are very weedy.

Geology: Fountain Formation (PPf)

Species: *Andropogon gerardii*, trace  
*Artemisia frigida*  
*Artemisia ludoviciana*  
*Bromus japonicus* (I), common  
*Elymus elymoides*  
*Heterotheca villosa*, dominant  
*Muhlenbergia montana*  
*Poa compressa* (I)  
*Stipa comata*  
*Thermopsis montana*  
*Verbascum thapsus* (I)

**Site Heil 21:** This is an east-facing slope dominated by *Pinus ponderosa* and *Carex heliophila*. This is similar to Heil 1 but probably not as diverse since there are more doghair stands of *Pinus ponderosa*. Most trees are less than 8 inches DBH. The lower slopes are very open *Pinus ponderosa* with Canada bluegrass (*Poa compressa*) dominant in the understory. There is much more *Bromus tectorum*, *Bromus japonicus*, and hairy golden aster (*Heterotheca villosa*) on the lower slopes than the middle.

Geology: Lyons Sandstone (Ply)

Species: *Allium cernuum*  
*Andropogon gerardii*, trace  
*Asclepias* sp.  
*Bouteloua gracilis*

Bromus cf lanatipes  
Bromus japonicus (I)  
Bromus tectorum (I)  
Carex heliophila, dominant  
Cerastium arvense  
Elymus elymoides  
Elymus lanceolatus x Pseudoroegneria spicata  
cf Harbouria trachypleura  
Helianthus pumilus  
Heterotheca villosa, frequent, lower slopes  
Koeleria macrantha  
Leucopoa kingii, trace  
Liatris punctata  
Lycurus phleoides  
Opuntia macrorhiza  
Pinus ponderosa, dominant  
Poa compressa (I)  
Psoralea tenuifolia  
Stipa comata  
Yucca glauca

**Site Heil 39:** This is an east-facing slope (25%) dominated by Pinus ponderosa and Poa compressa with Carex heliophila. It is in very poor condition. There has been much removal of moss rock. The lower, eastern margin is essentially Pinus ponderosa/Bromus japonicus and very weedy.

Geology: Lyons Sandstone (Ply)

Species: Andropogon gerardii, trace, mostly lower  
Artemisia ludoviciana  
Bromus briziformis (I)  
Bromus japonicus (I)  
Bromus tectorum (I)  
Carex heliophila, common  
Carduus nutans (I)  
Cerastium arvense  
Danthonia spicata  
Drymocallus cf fissa  
Geranium fremontii  
Grindelia squarrosa  
Juniperus scopulorum, infrequent  
Lepidium sp.  
Leucopoa kingii, rare  
Opuntia macrorhiza  
Pinus ponderosa, dominant  
Poa compressa (I), dominant

Psoralea tenuifolia  
Purshia tridentata, trace on north aspect  
Sporobolus cf cryptandrus  
Verbascum thapsus (I)

**Site Heil 45:** This is an east-facing slope (40%) dominated by *Pinus ponderosa* with *Carex heliophila* common in the shade and *Muhlenbergia montana* common in open areas.

Geology: Lyons Sandstone (Ply)

Species: *Andropogon gerardii*  
*Artemisia frigida*  
*Artemisia ludoviciana*  
*Aster porteri*  
*Bouteloua curtipendula*  
*Bromus briziformis* (I)  
*Bromus japonicus* (I)  
*Carex heliophila*, dominant in shade  
*Cerastium arvense*  
*Elymus lanceolatus* x *Pseudoroegneria spicata*  
*Grindelia squarrosa*  
*Helianthus pumilus*  
*Juniperus scopulorum*, trace  
*Leucopoa kingii*  
*Liatris punctata*  
*Muhlenbergia montana*, dominant, open areas  
*Pinus ponderosa*, dominant  
*Poa compressa* (I)  
*Poa pratensis* (I)  
*Purshia tridentata*, trace  
*Schizachyrium scoparium*  
*Stipa comata*  
*Yucca glauca*

**Site Heil 51:** This area has a few older *Pinus ponderosa* but has been logged. Mostly southeast-facing slope (15%).

Geology: Quaternary landslide deposit (Qls)

**Site Heil 52:** This east-facing slope (25%) is north of Heil 51 and dominated by *Pinus ponderosa*, Kentucky bluegrass (*Poa pratensis*), and probably *Carex heliophila*. *Elymus elymoides* is common and possibly subdominant. The whole general area has been heavily logged. It is trashy and in poor condition. The entire

area of Heil 51, 52, 53, and 54 has large amounts of musk thistle (*Carduus nutans*).

Geology: Fountain Formation (PPf)

Species: *Achillea lanulosa*  
*Artemisia frigida*  
*Aster porteri*  
*Bromus tectorum* (I)  
*Campanula rotundifolia*  
*Cerastium arvense*  
*Carduus nutans* (I), common  
*Ceanothus fendleri*  
*Cirsium arvense* (I)  
*Corallorhiza cf maculata*  
*Elymus elymoides*, subdominant?  
*Elymus lanceolatus* x *Pseudoroegneria spicata*  
*Juncus interior*  
*Leucopoa kingii*  
*Liatris punctata*  
*Muhlenbergia montana*  
*Pinus ponderosa*, dominant  
*Poa pratensis* (I)  
*Pseudotsuga menziesii*, trace, small trees  
*Purshia tridentata*  
*Ribes cereum*  
*Tragopogon dubius* (I)  
*Verbascum thapsus* (I)

**Site Heil 53:** This is an area of open *Pinus ponderosa* with *Carex heliophila* dominant in the understory in some areas. This site is on a gentle (10%), east-facing slope. It is weedy, disturbed, and some logging has occurred. It is in fair condition.

Geology: Fountain Formation (PPf) and Quaternary colluvium and alluvium (Qc).

Species: *Antennaria* sp.  
*Ambrosia psilostachya*, dominant  
*Artemisia frigida*  
*Aster porteri*  
*Astragalus flexuosus*  
*Bromus tectorum* (I)  
*Carex heliophila*, dominant  
*Carduus nutans* (I), common  
*Geranium fremontii*  
*Heterotheca villosa*

Juncus interior  
Lupinus argenteus cf ssp. ingratus  
Monarda fistulosa  
Pinus ponderosa, dominant  
Ribes cereum  
Plantago purshii  
Poa pratensis (I)  
Stipa viridula  
Thermopsis montana  
Verbascum thapsus (I)

**Site Heil 55:** This is a steep, west-facing slope probably similar to Heil 3. Pinus ponderosa and Carex heliophila dominate. Large areas are covered with pine needle mulch. The area has been partly logged.

Geology: Ingleside Formation, Lower Permian (Pi) and Fountain Formation (PPf)

Species: Antennaria sp.  
Artemisia frigida  
Artemisia ludoviciana  
Bromus tectorum (I)  
Carex heliophila, dominant  
Carduus nutans (I)  
Danthonia spicata  
Elymus elymoides  
Elymus lanceolatus x Pseudoroegneria spicata  
Koeleria macrantha  
Leucopoa kingii  
Linaria dalmatica (I)  
Muhlenbergia montana  
Penstemon virens  
Pinus ponderosa, dominant  
Scutellaria brittonii  
Stipa comata

**Site Heil 55.5:** This is an area of dense, doghair Pinus ponderosa on the saddle to the south of Heil 55. The general area of the saddle is the same as Heil 55. The area immediately to the south is logged. Musk thistle (Carduus nutans) is very abundant immediately to the east.

Geology: Ingleside Formation, Lower Permian (Pi)?

**Site Heil 57:** See also Heil 81 which is part of the same area about 0.25 miles to the north. This area is

dominated by *Pinus ponderosa* and *Danthonia spicata*. It is very weedy. It is included with the inventory of *Pinus ponderosa*/*Carex heliophila* because that appears to be the adjacent plant association. This area has been extensively logged for about 0.75 miles to the north and for about 0.2 miles to the east of the road. The west side of the road is logged to the west rim of the hogback. The logging is much more extensive than shown on the aerial photographs.

Geology: Lyons Sandstone (Ply)

Species: *Achillea lanulosa*  
*Acosta diffusa* (I), rare  
*Bromus japonicus* (I)  
*Bromus tectorum* (I), common  
*Danthonia spicata*  
*Elymus elymoides*  
*Juniperus communis*  
*Pinus ponderosa*, dominant  
*Poa compressa* (I), common

**Site Heil 58:** This is one of the more weed free areas encountered in the *Pinus ponderosa*/*Carex heliophila* plant association. *Danthonia spicata* is co-dominant with *Carex heliophila* in the understory. A dense pine needle mulch is frequently present. *Pinus ponderosa* cover is relatively dense and many trees are presettlement. This occurrence is near the top of the Lyons hogback on a gentle slope (5%).

Geology: Lyons Sandstone (Ply)

Species: *Artemisia ludoviciana*  
*Carex heliophila*, co-dominant  
*Campanula rotundifolia*  
*Cerastium arvense*  
*Corallorhiza* cf *maculata*, frequent  
*Danthonia spicata*, co-dominant  
*Elymus elymoides*  
*Geranium fremontii*  
*Heterotheca villosa*  
*Koeleria macrantha*  
*Leucopoa kingii*  
*Penstemon virens*  
*Pinus ponderosa*, dominant, 50 - 75% canopy cover  
*Poa compressa* (I), dominant in small meadows

Senecio fendleri

**Site Heil 59:** This area is assumed to have been Pinus ponderosa/Carex heliophila although it is extremely weedy. It is immediately below Heil 58 and opposite Lykins Gulch. There is no obvious change in land use, soils, or geology to account for the degraded condition. This occurrence is on a moderate (20%) east-facing slope.

Pinus ponderosa dominates in an open stand with 10 to 20% canopy cover. This compares to 50 to 75% in Heil 58. The understory is dominated by Bromus tectorum.

Geology: Lyons Sandstone (Ply)

Species: Aster porteri  
Bromus tectorum (I), dominant  
Grindelia squarrosa  
Heterotheca villosa  
Pinus ponderosa, dominant, 10 to 20% canopy

**Site Heil 64.5:** This occurrence occupies a moderate, southeast-facing slope (15%) at the extreme north end of the property. There are a few tumble knapweed (Acosta diffusa) plants on the property and a large knapweed stand along the road at the end of Pyrite Way.

Geology: Lyons Sandstone (Ply)

Species: Acosta diffusa (I), abundant to north  
Andropogon gerardii, common in open areas  
Carex heliophila  
Carduus nutans (I)  
Dalea purpurea  
Elymus elymoides  
Helianthus pumilus  
Grindelia squarrosa  
Pinus ponderosa, dominant  
Ratibida columnifera  
Rhus trilobata  
Stipa comata

**Site Heil 68:** This occurrence is along a ridge with Pinus ponderosa dominant with a canopy cover of about 20%. Canopy cover increases to the south. Larger, presettlement Pinus ponderosa are present along with many smaller trees. There is light logging and a strong

browse line shows on some of the Rocky Mountain juniper (*Juniperus scopulorum*).

Geology: Lyons Sandstone (Ply)

Species: *Achillea lanulosa*  
*Artemisia frigida*  
*Artemisia ludoviciana*  
*Aster porteri*  
*Bromus briziformis* (I)  
*Bromus japonicus* (I), dominant  
*Bromus tectorum* (I)  
cf *Drymocallis fissa*  
*Erigeron flagellaris*  
*Elymus elymoides*  
*Eriogonum jamesii*  
*Geranium fremontii*  
*Juniperus scopulorum*, trace  
*Koeleria macrantha*  
*Leucopoa kingii*  
*Muhlenbergia montana*  
*Pinus ponderosa*, dominant, 20% canopy  
*Pseudotsuga menziesii*  
*Purshia tridentata*, rare  
*Rhus trilobata*  
*Scutellaria brittonii*

**Site Heil 70:** This area may be similar to Heil 81 and occupies about the same landscape position. It occurs on a flat to gentle (5%) northeast-facing slope. This area has been logged. *Pinus ponderosa* dominates with Japanese brome (*Bromus japonicus*) dominating the understory. This perhaps should be classified as an unknown *Pinus ponderosa* association. It is extremely weedy.

Geology: Lyons Sandstone (Ply)

Species: *Bromus tectorum* (I), dominant  
*Ceanothus fendleri*  
*Pinus ponderosa*, dominant  
*Purshia tridentata*, infrequent

**Site Heil 75:** This is an area of open *Pinus ponderosa* that was observed from a distance but not surveyed. It occurs on a moderate east-facing slope (30%).

Geology: Quaternary landslide deposit (Qls) and Fountain Formation (PPf).

**Site Heil 79:** This is a relatively flat area (slope about 5%) dominated by *Pinus ponderosa*. Some of the trees are larger and presettlement. *Carex heliophila* and *Danthonia spicata* are dominant under the trees. The understory is weedy and *Bromus tectorum* dominates open areas.

Geology: Lyons Sandstone (Ply)

Species: *Ambrosia psilostachya*  
*Bromus tectorum* (I), dominant  
*Carex heliophila*, dominant  
*Danthonia spicata*, dominant  
*Heterotheca villosa*  
*Juniperus communis*, trace  
*Pinus ponderosa*, dominant  
*Poa compressa* (I)  
*Poa pratensis* (I)

**Site Heil 81:** This area is heavily logged. *Pinus ponderosa* dominates with *Bromus tectorum* dominant in the understory and *Danthonia spicata* very frequent. It is about 0.25 miles north of Heil-57 and part of the same general plant association. Slope is to the northeast at 5 to 10%.

Geology: Lyons Sandstone (Ply)

Species: *Achillea lanulosa*  
*Agrostis scabra*, rare  
*Artemisia ludoviciana*  
*Arctostaphylos uva-ursi*, infrequent  
*Bromus tectorum* (I), dominant  
*Cerastium arvense*  
*Ceanothus fendleri*  
*Carduus nutans* (I)  
*Elymus elymoides*  
*Festuca saximontana*  
*Geranium fremontii*  
cf *Harbouria trachypleura*  
*Heterotheca villosa*  
*Juncus interior*, infrequent  
*Juniperus communis*, frequent  
*Leucopoa kingii*  
*Muhlenbergia montana*

Pinus ponderosa, dominant  
Poa pratensis (I), common  
Scutellaria brittonii  
Selaginella densa  
Tragopogon dubius  
Verbascum thapsus (I)

**Site Heil 83:** This area is immediately east and slightly down slope from the previous logged areas (Heil 57, 81). Pinus ponderosa and Carex heliophila dominate. It appears similar to the southern part of the Lyons hogback (Heil 1, etc?). Most of the Pinus ponderosa are 6 to 8 inches DBH. Slope is to the east at about 15%.

Geology: Lyons Sandstone (Ply)

**Site Heil 99:** This is a heavily logged area of Pinus ponderosa on an east-facing slope (20%). It occupies the same soils and geology as the Pinus ponderosa/Carex heliophila plant associations in the area. It is extremely weedy and in very poor condition. Poa compressa is dominant in the understory and Bromus tectorum is abundant.

Geology: Lyons Sandstone (Ply)

Species: Achillea lanulosa  
Ambrosia psilostachya  
Aster porteri  
Bromus tectorum (I), abundant  
Carduus nutans (I)  
Danthonia spicata  
Elymus elymoides  
Juncus interior  
Linaria dalmatica  
Pinus ponderosa, dominant  
Poa compressa (I), dominant  
Rhus trilobata, infrequent  
Verbascum thapsus (I), common  
Yucca glauca

**Site Heil 107:** This is a steep, west-facing slope (35%) dominated by Pinus ponderosa. Pinus ponderosa greater than 12 inches DBH are rare. Carex heliophila occurs under the trees. The lower slopes are very weedy with Bromus japonicus. There are many cow trails on this slope opposite Geer Canyon.

Geology: Morrison Formation (Jm); Sundance and Jelm Formations (JTrsj); and Lykins Formation, lower part (TrPlu).

Species: Allium cernuum  
Alyssum minus (I)  
Andropogon gerardii  
Antennaria sp.  
Aristida longiseta  
Artemisia frigida  
Asclepias sp.  
Aster porteri  
Bouteloua curtipendula  
Bouteloua gracilis  
Bromus japonicus (I)  
Carex heliophila  
Corallorhiza cf maculata  
Elymus elymoides  
Elymus lanceolatus x Pseudoroegneria spicata  
Erigeron flagellaris  
Geranium fremontii  
Grindelia squarrosa, common  
Gutierrezia sarothrae  
Juniperus scopulorum  
Lepidium sp.  
Opuntia macrorhiza  
Oxytropis sp.  
Pinus ponderosa, dominant  
Poa compressa (I)  
Poa pratensis (I)  
Psoralea tenuifolia  
Ratibida columnifera  
Rhus trilobata, opener areas  
Ribes cereum  
Schizachyrium scoparium, common  
Stipa comata  
Stipa viridula  
Verbascum thapsus (I)

**Site Trev 118:** This is probably Pinus ponderosa/Carex heliophila. It is similar to other areas of Pinus ponderosa, with an understory dominated by Danthonia spicata, that are found in section 36 about one mile to the west. This area has been lightly logged. Bromus tectorum is very common and very small Cercocarpus montanus are widely scattered. Cercocarpus montanus may

be increasing as a result of canopy reduction. This occurrence is on an east-facing slope (15%).

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: Aster porteri  
Bromus tectorum (I), very common  
Cercocarpus montanus, small, widely scattered  
Danthonia spicata, dominant  
Dichanthelium linearifolium  
Elymus elymoides  
Erigeron flagellaris  
Grindelia squarrosa  
Helianthus pumilus  
Juncus interior  
Koeleria macrantha  
Lycurus phleoides  
Muhlenbergia montana  
Opuntia macrorhiza  
Opuntia polyacantha  
Pinus ponderosa, dominant  
Poa compressa (I)  
Solidago sp.

**Pinus ponderosa/Cercocarpus montanus plant association**  
(Bourgeron 1994, Johnston 1987) G4S4

Site Numbers: Heil 25, 85, 93, 106.

Ponderosa pine (*Pinus ponderosa*) and mountain mahogany (*Cercocarpus montanus*) dominate what appears to be this plant association. The understory herbaceous vegetation is often dominated by annual bromes (*Bromus* spp.). Occurrences are typically on east-facing slopes of Lyons Sandstone (Ply) or Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl). Soils are Baller stony sandy loam (BaF) and Pinata-Rock outcrop complex (PrF). Both are rocky and sandy on the surface.

**Site Heil 25:** This occurrence is an open stand of *Pinus ponderosa* with a shrubby understory dominated by *Cercocarpus montanus*. *Cercocarpus montanus* canopy cover is about 30%. Large boulders and rock outcroppings are frequent. It occurs on a northeast-facing slope (25%). This is possibly a degraded occurrence of *Pinus*

ponderosa/Cercocarpus montanus/Andropogon gerardii  
(Q.v.)

Geology: Plainview sandstone member of the South Platte  
Formation and Lytle Formation, undivided (Kspl).

Species: Andropogon gerardii  
Aster porteri  
Bromus briziformis (I)  
Cercocarpus montanus, dominant, 30%  
Cerastium arvense  
Elymus lanceolatus x Pseudoroegneria spicata  
Grindelia squarrosa  
Linaria dalmatica, trace  
Opuntia polyacantha  
Pinus ponderosa, dominant  
Poa compressa (I)  
Rhus trilobata, trace  
Stipa comata  
Yucca glauca

**Site Heil 85:** This is an open stand of Pinus ponderosa  
with a few larger trees. Cercocarpus montanus is  
scattered throughout. The herbaceous vegetation is  
dominated by exotic weeds. This occurrence is on a 25%  
east-facing slope.

Geology: Lyons Sandstone (Ply)

Species: Aristida longiseta  
Artemisia frigida  
Bouteloua gracilis  
Bromus japonicus (I), codominant  
Bromus tectorum (I), codominant  
Cerastium arvense  
Cercocarpus montanus, common, dominant shrub  
Erigeron flagellaris  
Eriogonum umbellatum  
Gutierrezia sarothrae  
Heterotheca villosa  
Koeleria macrantha  
Liatris punctata  
Pinus ponderosa, dominant  
Plantago purshii  
Poa compressa (I), codominant  
Rhus trilobata

**Site Heil 93:** Most of the *Pinus ponderosa* in this area have been burned. *Cercocarpus montanus* is the dominant shrub with an understory of *Bromus tectorum*. The area is extremely weedy and in poor condition. It may not be this association. This association is on a steep (50%) south and east-facing slope.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl).

Species: *Bromus tectorum* (I), dominant  
*Cercocarpus montanus*, dominant  
*Pinus ponderosa*, former dominant  
*Verbascum thapsus* (I), common

**Site Heil 106:** *Pinus ponderosa* and *Cercocarpus montanus* dominate with an understory completely dominated by *Bromus tectorum*. The area is in extremely poor condition. It is possibly not this association. The site is on a 35% southeast-facing slope.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl).

Species: *Andropogon gerardii*, trace  
*Bromus japonicus* (I)  
*Bromus tectorum* (I), dominant  
*Cercocarpus montanus*, dominant  
*Pinus ponderosa*, dominant

**Site Trev 120:** This area is east of *Pinus ponderosa*/*Cercocarpus montanus*/*Andropogon gerardii* occurrence Trev 125. *Andropogon gerardii* is present but much reduced. Canada bluegrass (*Poa compressa*) forms high monocultures of 10,000 square feet or more. The area was logged in part but not recently. This site is on a moderate (25%) southeast-facing slope.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl).

Species: *Allium textile*  
*Andropogon gerardii*  
*Artemisia frigida*  
*Aster porteri*  
*Bromus japonicus* (I)  
*Cercocarpus montanus*, 2% canopy.  
*Dichanthelium* cf *lanuginosum*

Elymus elymoides  
 Koeleria macrantha  
 Lycurus phleoides  
 Opuntia macrorhiza  
 Pinus ponderosa, dominant, 5% cover  
 Rhus trilobata, trace  
 Schizachyrium scoparium  
 Stipa comata

**Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii**  
**plant association** (Bourgeron) G2S2

Site Numbers: Heil 124 (91BR002), Trev 113 (91BR004),  
 Trev 116,125 (91BR006)

This plant association was first identified on the Heil Ranch in 1991 by Rick Brune (Brune 1992). It is dominated by an open stand of Pinus ponderosa with an understory of Cercocarpus montanus and big bluestem (Andropogon gerardii). The three dominants each provide about 10% canopy cover. This plant association appears to represent a postsettlement increase of Pinus ponderosa in the lower foothills. The majority of the Pinus ponderosa appear to be postsettlement in origin although a few presettlement trees are present. This increase in Pinus ponderosa may be the result of fire suppression, overgrazing, and/or change to a more mesic environment in an unstable transition area that is sensitive to disturbance. Some consideration should be given to the probable anthropogenic origin of this plant association when reviewing the ranking.

The cover classes given in the following data were measured in 1991.

**Site Heil 124 (91BR002):** This area is a small, marginal occurrence of EO Rank C. It is on an east-facing slope (25%). Pinus ponderosa, Cercocarpus montanus, and Andropogon gerardii each provide about 10% cover.

Geology: Lyons Sandstone (Ply)

Species Class	Cover Class	Species	Cover
Ambrosia psilostachya	1	Grindelia squarrosa	1
Andropogon gerardii	10	Gutierrezia sarothrae	1
Arenaria fendleri	1	Juncus interior	1

Artemisia frigida	1	Lepidium virginicum	1
Artemisia ludoviciana	3	Muhlenbergia montana	1
Aster porteri	1	Muhlenbergia wrightii	1
Aster sp.	1	Poa compressa	1
Bouteloua curtipendula	1	Potentilla fissa	1
Bromus japonicus (I)	1	Purshia tridentata	1
Cerastium arvense	1	Rhus trilobata	1
Cercocarpus montanus	10	Ribes cereum	1
Cryptantha thyrsiflora	1	Schizachyrium scoparium	1
Cyperus fendleriana	1	Scutellaria brittonii	1
Dichanthelium linearifolium	1	Sporobolus cryptandrus	1
Erigeron flagellaris	3	Stipa comata	1
Eriogonum umbellatum	1	Talinum cf parviflorum	1
Evolvulus nuttallianus	1	Tragia ramosa	1

**Site Trev 113 (91BR004):** This area is in good condition but was grazed by horses prior to 1991. It is EO Rank B+. It is on an east-facing slope (25%). It has an exposed rock cover of 60% compared to 10% for the adjacent *Andropogon gerardii* dominated grassland.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species	Cover Class	Species	Cover Class
Allium textile	1	Gutierrezia sarothrae	1
Ambrosia psilostachya	1	Juncus interior	1
Andropogon gerardii	10	Koeleria macrantha	1
Aristida longiseta	1	Lepidium virginicum	1
Artemisia ludoviciana	1	Liatris punctata	1
Artemisia frigida	1	Muhlenbergia montana	1
Bouteloua curtipendula	1	Muhlenbergia wrightii	1
Bouteloua gracilis	3	Opuntia macrorhiza	1
Bromus briziformis (I)	1	Pinus ponderosa	10
Bromus japonicus (I)	1	Potentilla fissa	1
Bromus tectorum (I)	1	Prunus virginiana	1
Carex heliophila	1	Rhus trilobata	1
Cerastium arvense	1	Schizachyrium scoparium	1
Cercocarpus montanus	10	Sorghastrum nutans	1
Cirsium canescens	1	Sporobolus asper	1
Cryptantha thyrsoflora	1	Sporobolus cryptandrus	1
Erigeron flagellaris	3	Stipa comata	1
Euphorbia sp.	1	Tragia ramosa	1
Grindelia squarrosa	1	Tragopogon dubius (I)	1

**Trev 116, 125 (91BR006):** This is the highest ranked occurrence of Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii, EO Rank A-. It is free of exotic annual grasses but it still contains some Poa compressa and Poa pratensis. Rhus trilobata is present in amounts about equal to Cercocarpus montanus in parts of the association. This is indicative of deeper soils. Occasional Pinus ponderosa up to 20 inches DBH are present. This site occurs on an east-facing, 10% slope.

Trev 116 is the southwestern-most part of Trev 125. It is a very mesic area. Big bluestem (Andropogon gerardii) is present up to five feet tall along with Indiangrass (Sorghastrum nutans). Pinus ponderosa forms an open stand with scattered Cercocarpus montanus and Rhus trilobata. Areas to the south and southeast have been logged.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl).

Species	Cover Class	Species	Cover Class
Agropyron smithii	3	Liatris punctata	1

Ambrosia psilostachya	1	Muhlenbergia montana	1
Andropogon gerardii	3	Muhlenbergia wrightii	1
Artemisia ludoviciana	1	Onosmodium molle	1
Aster porteri	1	Opuntia macrorhiza	1
Bouteloua curtipendula	1	Poa compressa	1
Bouteloua gracilis	3	Poa pratensis	1
Carex heliophila	1	Elymus lanceolatus x	
Cercocarpus montanus	10	Pseudoroegneria spicata	1
Cirsium canescens	1	Ratibida columnifera	1
Dalea purpurea	1	Rhus trilobata	10
Elymus elymoides	1	Rosa sp., cultivated	1
Grindelia squarrosa	1	Schizachyrium scoparium	3
Gutierrezia sarothrae	1	Sisyrinchium montanum	1
Juncus interior	1	Sorghastrum nutans	1
Koeleria macrantha	1	Stipa spartea	1
		Stipa viridula	1

**Pinus ponderosa/Cercocarpus montanus/Stipa neomexicana plant association** (Brune) GUSU

Site Numbers: Heil 40, 100.

Two small occurrences of this plant association occur along narrow strips of the Lykins Formation, lower part (P11). This may be a phase of Pinus ponderosa/Cercocarpus montanus although it is not quite contiguous. Occurrence Heil 100 is adjacent to Heil 102, a Stipa neomexicana mixed prairie (Bourgeron). It is immediately below Pinus ponderosa/Carex heliophila site number 99. Occurrence Heil 40 is similarly adjacent to Pinus ponderosa.

**Site Heil 40:** This occurrence is strangely weed free considering the general weediness of the area. It occurs on a slight northeast-facing slope (8%).

Geology: Lykins Formation, lower part (P11)

Species: Asclepias sp.  
 Bouteloua curtipendula  
 Cercocarpus montanus, dominant  
 Eriogonum alatum  
 Evolvulus nuttallianus  
 Gaura coccinea  
 Oryzopsis hymenoides  
 Pinus ponderosa, dominant  
 Psoralea tenuifolia  
 Thelesperma megapotamicum

Stipa comata  
Stipa neomexicana, dominant

**Site Heil 100:** This occurrence, like the previous, is nearly weed free even though the immediate area to the west is extremely weedy. It is similar in appearance to Heil 40. It occurs on a slight northeast-facing slope (15%).

Geology: Lykins Formation, lower part (P11)

Species: Cercocarpus montanus, dominant  
Pinus ponderosa, dominant  
Stipa neomexicana, dominant

**Pinus ponderosa/Grassland plant association**, unclassified

Site Number: Heil 44.

This is possibly related to the Pinus ponderosa/Schizachyrium scoparium-Elytrigia smithii plant association of Johnston. The area is suggestive of an ecotone between woodland and prairie with significant numbers of species from both. It does not readily fit any classification. Pinus ponderosa and Purshia tridentata suggest woodlands. The remaining species suggest grasslands but many also occur in woodlands. It is probable related to the south-facing slopes in Geer Canyon 0.75 miles to the south (Heil 20). This occurrence is on a steep, south-facing slope (60-70%).

Geology: Fountain Formation (PPf)

Species: Andropogon gerardii, common  
Artemisia frigida  
Bromus japonicus (I), dominant  
Bromus tectorum (I)  
Dalea purpurea  
Elymus lanceolatus x Pseudoroegneria spicata,  
subdominant  
Helianthus pumilus  
Koeleria macrantha  
Oxalis dilenii  
Psoralea tenuifolia  
Pinus ponderosa  
Purshia tridentata, trace

Rhus trilobata  
Schizachyrium scoparium  
Scutellaria brittonii  
Stipa comata  
Tragia ramosa  
Verbascum thapsus (I)  
Yucca glauca

**Pinus ponderosa/Juniperus scopulorum/Cercocarpus montanus**  
**plant association** (Johnston)?

Site Number: 41.

The dominants in this plant association match those described by Johnston but the rest of the species and the habitat do not. It is also not documented for Colorado. This plant association requires further study to classify. It occurs in the lower parts of Red Hill Gulch on a mix of geologic substrates. The topography is irregular with mostly northerly aspects. It occurs mostly on low slope areas.

Geology: A mixture of Quaternary colluvium and alluvium (Qc); Lykins Formation, lower part (Pl1); and Lyons Sandstone (Ply).

Species: Aristida longiseta  
Bouteloua curtipendula  
Cercocarpus montanus, dominant  
Elymus lanceolatus x Pseudoroegneria spicata  
Eriogonum alatum  
Juniperus scopulorum, dominant  
Liatris punctata  
Oryzopsis hymenoides  
Pinus ponderosa, dominant  
Stipa comata  
Thelesperma megapotamicum

**Pinus ponderosa/Leucopoa kingii plant association** (Bourgeron 1994, Johnston 1987) G2S2

Site Number: Heil 13.

This plant association is dominated by Pinus ponderosa with and understory of spike fescue (Leucopoa kingii). The occurrence is not very diverse. A mulch of pine

needles covers part of the ground. It occurs on a relatively steep (35-40%), south-facing slope where it may receive some protection from grazing. Other areas on the same slope are quite weedy, however. There has been some logging in the area. Most of the trees are 4 to 10 inches DBH which would make them postsettlement. Several acres of this association were observed. Additional searching in the area may increase the size of this area or reveal additional occurrences.

Geology: Middle and Early Proterozoic pegmatite (YXp).

Species: Achillea lanulosa  
Artemisia ludoviciana  
Bromus lanatipes  
Elymus elymoides, common  
Leucopoa kingii, dominant, 5-15%  
Muhlenbergia montana, opener areas  
Pinus ponderosa, dominant, 25-50%  
Ribes cf inerme  
Rock, 2-5%  
Litter (pine needles), 90%

**Pinus ponderosa/Rhus trilobata/Andropogon gerardii plant association** (Baker)

Site number: Trev 121.

This is a very small occurrence on a north-facing slope (25%) dominated by an open stand of Pinus ponderosa and three-leaf sumac (Rhus trilobata) with Andropogon gerardii.

Geology: Morrison Formation (Jm)

Species: Andropogon gerardii, dominant  
Bouteloua curtipendula  
Bromus japonicus (I), common  
Erigeron flagellaris  
Gutierrezia sarothrae  
Pinus ponderosa, dominant, 1-2%  
Poa compressa (I)  
Rhus trilobata, dominant, 1-2%  
Rosa sayi  
Yucca glauca

**Pinus ponderosa/Weed plant associations**

These are areas dominated by *Pinus ponderosa* where the natural understory is replaced by exotic species. Some of the *Pinus ponderosa*/*Cercocarpus montanus* occurrences should perhaps be included here (Heil 85, 93, 106).

**Site Heil 9:** *Pinus ponderosa*/*Bromus japonicus*. This is a very open *Pinus ponderosa* and meadow site. There are essentially no native species in the understory. The understory is dominated by *Bromus japonicus* and *Bromus tectorum*. *Ambrosia psilostachya* and *Carduus nutans* are also present.

Geology: Fountain Formation (PPf) and Quaternary colluvium and alluvium (Qc).

**Site Trev 123:** *Pinus ponderosa*/*Bromus japonicus*. This area is an east-facing slope (20%) dominated by *Pinus ponderosa* with an understory dominated by *Bromus japonicus* and *Poa compressa*. It is adjacent to the west border of Trev 122 which itself is in very good condition.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

## PSEUDOTSUGA MENZIESII SERIES

This series is limited in occurrence in the survey area due to the low elevation. This is the lower limit for Douglas fir (*Pseudotsuga menziesii*). Occurrences are on mostly north-facing slopes, sheltered west-facing slopes in narrow ravines, and west-facing slopes mixed with boulder fields which provide moister conditions. *Pseudotsuga menziesii* is usually mixed with *Pinus ponderosa* on lower sites. Only occurrences on the extreme western margin of the area have little *Pinus ponderosa*.

(I) following a species name indicates introduced species not native to the area. Species lists are not complete.

### Pseudotsuga menziesii/Jamesia americana plant association (Johnston)? G3G4S3

Site Numbers: Heil 11, 15, 49.5.

This plant association is dominated by Douglas fir (*Pseudotsuga menziesii*) and waxflower (*Jamesia americana*). Occurrences are on steep, north or west-facing slopes with exposed rock or boulders.

Site Heil 11: This area is dominated by *Pseudotsuga menziesii* and *Jamesia americana* with large amounts of *Pinus ponderosa* at lower elevations. It occurs on a steep (100%, 45 degree), north-facing slope with much exposed rock. The area described was inadvertently located just south of the survey area.

Geology: Biotite schist, Early Proterozoic (Xqs) and Middle and Early Proterozoic pegmatite (YXp).

Species: *Acer glabrum*, common  
*Achillea lanulosa*  
*Allium cernuum*  
*Antennaria* sp.  
*Aster* sp.  
*Campanula rotundifolia*  
*Carex* sp.  
*Cerastium arvense*  
*Danthonia spicata*  
*Dryocallus* cf *fissa*  
*Elymus elymoides*  
*Heuchera* sp.  
*Jamesia americana*, dominant  
*Juniperus communis*

Koeleria macrantha  
Leucopoa kingii  
Pinus ponderosa, dominant  
Poa pratensis (I)  
Populus tremuloides, infrequent  
Pseudotsuga menziesii, dominant  
Prunus virginiana  
Pulsatilla patens  
Ribes cf inerme, common  
Smilacena sp.  
Solidago sp.  
Stipa sp. (S. scribneri?)  
Symphoricarpos sp.

**Site Heil 15:** This is the western part of the same area (Heil 11) with more prominent *Pseudotsuga menziesii*.

Geology: Biotite schist, Early Proterozoic (Xqs)

**Site Heil 49.5 including Heil 49:** This plant association occupies a steep, north-facing slope (65%). Mostly closed canopy *Pseudotsuga menziesii* dominates. The understory ranges from rather dense shrubs of *Jamesia americana* and *Acer glabrum* in moist ravines (49) to open areas with fewer shrubs and a pine needle mulch. *Juniperus communis* is common in the understory.

Geology: Paleocene dacite (PEid) partly overlain by Quaternary landslide deposit (Qls).

Species: *Acer glabrum*, dominant in ravine  
*Cirsium arvense* (I)  
cf *Harbouria trachypleura*  
*Jamesia americana*, common  
*Juniperus communis*, common  
*Pinus ponderosa*  
*Pseudotsuga menziesii*, dominant  
*Prunus virginiana*  
*Rubus* sp.  
*Smilacena* sp.  
*Solidago* sp.  
*Viola* sp.

**Pseudotsuga menziesii/Physocarpus monogynus plant association** (Bourgeron 1994, Johnston 1987)? G4S4  
or possibly:

*Pseudotsuga menziesii*/*Jamesia americana* (Bourgeron 1994, Johnston 1987)

Site Numbers: Heil 67, 77, 80. Note: All of these are part of the same plant association in the same area.

**Sites Heil 67 & 80:** This association is dominated by *Pseudotsuga menziesii* with *Pinus ponderosa* sometimes codominant in the northern parts. Some of the *Pseudotsuga menziesii* and *Pinus ponderosa* are presettlement. Numerous small (< 6 inches DBH) *Pseudotsuga menziesii* are present in the southern parts. The understory is very shrubby with *Physocarpus monogynus* the dominant shrub. Slopes are very steep (100%, 45 degrees) and rocky. Large talus slopes (Quaternary talus (Qta)) break up the plant association and apparently increase available moisture below.

Geology: Fountain Formation (PPf)

Species: *Acer glabrum*  
*Allium cernuum*  
*Bromus japonicus* (I)  
*Bromus cf lanatipes*  
*Carex* sp.  
*Cercocarpus montanus*, trace  
*Elymus triticoides*, common  
cf *Heuchera* sp.  
cf *Harbouria trachypleura*  
*Jamesia americana*, trace  
*Juniperus communis*, infrequent to common  
*Juniperus scopulorum*, infrequent to common  
*Leucopoa kingii*  
*Oryzopsis micrantha*, lower slopes  
*Penstemon virens*  
*Physocarpus monogynus*, probably a hybrid with  
*P. opulifolius*  
*Pinus ponderosa*, codominant  
*Prunus virginiana*  
*Ribes cereum*

**Site Heil 77:** This occurrence is immediately west of Heil 67 and 80 on a steep (40%), north-facing slope. The slope is contiguous with that of Heil 67 and 80. It appears to be slightly drier since there is more *Pinus ponderosa* and less *Pseudotsuga menziesii*. Immediately adjacent on the west, however, the plant association is again dominated by *Pseudotsuga menziesii*.

Geology: Fountain Formation (PPf)

Species: Allium cernuum  
Artemisia frigida  
Aster porteri  
Carex sp., subdominant in shaded areas  
Cercocarpus montanus, common  
Helianthus pumilus  
Jamesia americana  
Juniperus scopulorum  
Leucopoa kingii  
Liatris punctata  
Muhlenbergia montana, subdominant, open areas  
Penstemon virens  
Pinus ponderosa, dominant  
Pseudotsuga menziesii  
Schizachyrium scoparium, in open areas  
Solidago sp.  
Yucca glauca

**Pseudotsuga menziesii, unclassified**

These are areas with Pseudotsuga menziesii that are not assigned to any classification.

Site Numbers: Heil 43, 49.8.

**Site Heil 43:** This area is dominated by Pseudotsuga menziesii and Pinus ponderosa. It occurs on the north facing slopes of Plumely Canyon.

Geology: Fountain Formation (PPf)

**Site Heil 49.8:** possibly Pseudotsuga menziesii/Arctostaphylos uva-ursi-Juniperus communis (Johnston) or Pseudotsuga menziesii/Arctostaphylos uva-ursi (Bourgeron) G4S3.

This plant association occurs on a gentle east-facing slope (20%). The vegetation is dominated by an open stand of Pinus ponderosa and Pseudotsuga menziesii. Ceanothus fendleri and Arctostaphylos uva-ursi are common shrubs. A small amount of Purshia tridentata is present. It is assigned here mainly because of the shrubs present. The overall species list better fits Pinus ponderosa/Purshia tridentata except that Purshia tridentata is nowhere dominant. Steve Kettler and I thought this area looked "unusual". Older Pinus ponderosa and Pseudotsuga menziesii are present.

Geology: Fountain Formation (PPf)

Species: Achillea lanulosa  
Arctostaphylos uva-ursi, common  
Artemisia frigida  
Aster porteri  
Carex sp.  
Ceanothus fendleri, common  
Danthonia spicata  
Elymus elymoides  
Eriogonum cf umbellatum  
Geranium fremontii  
Grindelia squarrosa  
Juniperus communis  
Leucopoa kingii  
Muhlenbergia montana  
Pinus ponderosa, dominant  
Pseudotsuga menziesii, dominant  
Rhus trilobata, infrequent  
Purshia tridentata  
Rosa cf sayi  
Tragopogon dubius (I)

## JUNIPERUS SCOPULORUM SERIES

This series is dominated by Rocky Mountain juniper (Juniperus scopulorum).

(I) following the species name indicates an introduced species not native to the area. Species lists are not complete.

### Juniperus scopulorum/Cercocarpus montanus plant association (Bourgeron 1994, Johnston 1987) G2S2

Site Number: Heil 71.

This plant association is dominated by Juniperus scopulorum (1%) and Cercocarpus montanus (30%). The understory is often dominated by Poa compressa. It occurs mostly on steep (40%), north-facing slopes. Outcrops are common and soils are shallow and gravelly. Elevation is 6200-6400 feet.

Geology: Fountain Formation (PPf)

Species: Allium cernuum  
Allium textile  
Artemisia frigida  
Aster porteri  
Bouteloua gracilis  
Bouteloua hirsuta, near edges  
Bromus japonicus (I)  
Calochortus gunnisonii  
Cercocarpus montanus, dominant, 30% cover  
Cerastium arvense  
Elymus lanceolatus x Pseudoroegneria spicata  
Eriogonum jamesii  
Gutierrezia sarothrae  
cf Harbouria trachypleura  
Helianthus pumilus  
Juniperus scopulorum, dominant, 1% cover  
Lesquerella sp.  
Opuntia polyacantha  
Oryzopsis hymenoides  
Oxytropis lambertii  
Poa compressa (I), dominant  
Sedum lanceolatum  
Stipa comata  
Stipa robusta  
Stipa scribneri  
Stipa viridula



## DECIDUOUS SHRUBLANDS

### BETULA OCCIDENTALIS SERIES

These are deciduous shrublands limited to narrow strips along small streams. River birch (*Betula occidentalis*) and mountain maple (*Acer glabrum*) dominate. Alder (*Alnus incana* ssp. *tenuifolia*) appears to be absent or infrequent.

(I) following a species name indicates introduced species not native to the area. Species lists are not complete.

#### Betula occidentalis plant association (Bourgeron)? G3SR

Site Heil 7: This is a very narrow, steep-sided ravine. The bottom is often choked with vegetation. *Acer glabrum* and *Betula occidentalis* are common. *Pinus ponderosa* and *Pseudotsuga menziesii* grow on the slopes next to the bottom. The small stream is probably intermittent.

Geology: Middle and Early Proterozoic pegmatite (YXp)

Species: *Acer glabrum*, common  
*Betula occidentalis*, common  
*Mahonia repens*  
*Monarda fistulosa*  
*Phleum pratense* (I)  
*Pinus ponderosa*  
*Poa pratensis* (I)  
*Potentilla* sp.  
*Pseudotsuga menziesii*  
*Prunus virginiana*  
*Rosa woodsii*  
*Symphoricarpos* sp.  
*Thermopsis montana*  
*Toxicodendron rydbergii*  
*Trifolium repens*

Site Heil 17: This area is dominated by *Acer glabrum* and *Betula occidentalis*. The cover provided by the two species is about 70%. It is about equally divided. No *Alnus incana* ssp. *tenuifolia* was observed although it appears to be excellent alder habitat. The best areas of the plant association are below the south-facing meadows in section 10. This is a very pretty area in spite of numerous exotic species in the understory. An

old, narrow wagon road parallels the stream on the north side.

Geology: Biotite schist, Early Proterozoic (Xqs) and, to the east, Quaternary colluvium and alluvium (Qc).

Species: Acer glabrum, dominant, 30-40%  
Agrostis gigantea (I)  
Betula occidentalis, dominant, 30-40%  
Delphinium sp.  
Geranium sp.  
Glyceria striata  
Jamesia americana  
Juniperus communis, trace  
Monarda fistulosa  
Phleum pratense (I)  
Populus tremuloides  
Prunus americana, trace  
Prunella vulgaris (I)  
Rosa woodsii  
Symphoricarpus sp.  
Thermopsis montana  
Viola sp.

## CERCOCARPUS MONTANUS SERIES

The major shrublands in the area are dominated by mountain mahogany (*Cercocarpus montanus*). These reach their best development along the upper slopes of the Dakota Hogback in the eastern part of the survey area. Three-leaf sumac (*Rhus trilobata*) is sometimes present in minor amounts.

Two undescribed shrublands were also identified. These have Scribner needlegrass (*Stipa scribneri*) and New Mexico feathergrass (*Stipa neomexicana*) as dominants.

(I) following the species name indicates introduced species not native to the area. Species lists are not complete.

### Cercocarpus montanus/Elytrigia dasystachya plant association

(Bourgeron) GUSU

### Cercocarpus montanus/Elytrigia dasystachya plant association

(Johnston) =

*Cercocarpus montanus*/*Agropyron griffithsii* (Hess)

Site Numbers: Heil 29, 33?, 95, 104.

This is the dominant shrubland in the area. It is dominant on steep (about 40%), north-facing slopes and common on west-facing slopes. It occurs at elevations from 5600 feet to 6600 feet. The exact extent is unknown since other *Cercocarpus montanus*-dominated plant associations occur that are very similar in appearance. Parts of the *Cercocarpus montanus*/grass association remain undifferentiated.

The taxonomy of the dominant grass in this association is confused. *Agropyron griffithsii* was shown by Dewey (Dewey 1970) to be a hybrid of *Elymus lanceolatus* (syn. *Elytrigia dasystachya*) and *Pseudoroegneria spicata*. Weber (Weber 1992) lumps *Agropyron griffithsii* under *Elymus lanceolatus* and does not list the hybrid. Thus the two synonymous plant associations technically refer to different species of grass as dominants. I believe, however, that they are referring to the same plant association. The proper dominant name for the dominant grass should be *Elymus lanceolatus* x *Pseudoroegneria spicata* in the area surveyed. All of the material I observed had the long lemma awns of the hybrid.

**Site Heil 29:** *Cercocarpus montanus* (10-20% cover) and *Elymus lanceolatus* x *Pseudoroegneria spicata* (50% cover) dominate this steep (40%), north-facing slope. More mesic or moist areas support colonies of snowberry

(*Symphoricarpos* sp.) and dense musk thistle (*Carduus nutans*).

Geology: Morrison Formation (Jm); Sundance and Jelm Formations (JTrsj); and Lykins Formation, lower part (TrPlu).

Species: Artemisia frigida  
Bouteloua curtipendula  
Cercocarpus montanus, dominant, 10-20%  
Elymus lanceolatus x Pseudoroegneria spicata, dominant, 50%  
Eriogonum jamesii  
Gutierrezia sarothrae  
Helianthus pumilus, abundant  
Linum lewisii  
Oenothera cf brachycarpa  
Oryzopsis hymenoides  
Oxytropis lambertii  
Paronychia jamesii  
Poa pratensis (I)  
Prunus virginiana  
Rhus trilobata, widely scattered  
Stipa comata  
Stipa viridula  
Symphoricarpus sp.

**Site Heil 33:** This is a narrow band of Cercocarpus montanus and Elymus lanceolatus x Pseudoroegneria spicata just below a small cliff at the summit of the Dakota Hogback. It is on a west-facing slope and appears to be quite mesic to moist.

Geology: Morrison Formation (Jm)

Species: Cercocarpus montanus, dominant  
Elymus canadensis  
Elymus lanceolatus x Pseudoroegneria spicata, common  
cf Elymus triticoides

**Site Heil 95:** This is a steep, north-facing slope dominated by Cercocarpus montanus and Elymus lanceolatus x Pseudoroegneria spicata. It is slightly drier and more open than Heil 29.

Geology: Morrison Formation (Jm); Sundance and Jelm Formations (JTrsj); and Lykins Formation, lower part (TrPlu).

Species: Astragalus tridactylus

Calochortus gunnisonii  
Cercocarpus montanus, dominant  
Elymus lanceolatus x Pseudoroegneria spicata,  
dominant  
Grindelia squarrosa  
Gutierrezia sarothrae  
Helianthus pumilus  
Liatris punctata  
Poa pratensis (I)  
Rhus trilobata, scattered, common  
Stipa comata

**Site Heil 104:** This is a steep (40%), north-facing slope dominated by dense Cercocarpus montanus. It is more mesic than the other sites. Elymus lanceolatus x Pseudoroegneria spicata is present but it is being out-competed by Poa compressa which is often nearly 100% of the herbaceous cover.

Geology: Morrison Formation (Jm); Sundance and Jelm Formations (JTrsj); and Lykins Formation, lower part (TrPlu).

Species: Allium cernuum  
Alyssum minus (I)  
Artemisia frigida  
Bromus briziformis (I)  
Bromus tectorum (I), common  
Calochortus gunnisonii  
Cerastium arvense  
Drymocallis cf fissa  
Elymus lanceolatus x Pseudoroegneria spicata  
Grindelia squarrosa  
Gutierrezia sarothrae  
Oryzopsis hymenoides, trace  
Opuntia polyacantha  
Poa compressa (I), dominant  
Poa pratensis (I)  
Rhus trilobata, scattered  
Sporobolus cf cryptandrus  
Stipa comata  
Stipa scribneri

**Cercocarpus montanus-Rhus trilobata/Andropogon gerardii**  
**plant association** (Johnston)?

Site Number: Trev 115.

Cercocarpus montanus dominates this moderate (20%), east-facing slope joining the west side of Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii site Trev 125. Rhus trilobata is present but widely scattered. Andropogon gerardii is the dominant grass. This is one of the most weed free Cercocarpus montanus plant associations on east-facing slopes.

Bourgeron may treat this as synonymous with Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii but it appears distinctly different and well differentiated visually. Elevation 6350 feet.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: Andropogon gerardii, dominant  
Asclepias sp.  
Bromus japonicus (I)  
Cercocarpus montanus, dominant, 20-30%  
Elymus lanceolatus x Pseudoroegneria spicata  
Gutierrezia sarothrae  
Liatris punctata  
Muhlenbergia montana  
Pinus ponderosa, widely scattered  
Poa compressa (I), common  
Poa pratensis (I), common  
Rhus trilobata  
Stipa comata  
Tragopogon dubius (I)

**Cercocarpus montanus/Stipa comata plant association**

(Bourgeron 1994, Johnston 1987) G2S2

Site Number: Heil 92.

This is a steep (40%), southeast-facing, rocky slope dominated by Cercocarpus montanus (20-30%) with about 5% Stipa comata in the better areas. The lower slope is extremely weedy with Bromus japonicus and Bromus tectorum. This is probably a degraded example of this plant association.

Geology: Morrison Formation (Jm) on upper slopes, Sundance and Jelm Formations (JTrsj) on lower slopes.

Species: Allium textile

Artemisia frigida  
Bromus japonicus (I), abundant, lower slopes  
Bromus tectorum (I), abundant, lower slopes  
Cercocarpus montanus, dominant, 20-30%  
Delphinium geyeri  
Gutierrezia sarothrae  
Helianthus pumilus  
Oryzopsis hymenoides  
Physaria sp. (See note)  
Stipa comata, dominant, 5% in better areas  
Yucca glauca

Cercocarpus montanus/Stipa scribneri plant association  
undescribed GUSU

Site Number: Heil 90.

This plant association is on a steep (20-40%), west-southwest-facing slope. The vegetation is dominated by *Cercocarpus montanus* (20%) and Scribner needlegrass (*Stipa scribneri*) (2-10%). There is less *Stipa scribneri* on the lower slopes. Additional studies are needed of this plant association.

Geology: Lykins Formation, lower part (TrPlu)

Species: *Artemisia frigida*  
*Bouteloua curtipendula*  
*Bromus japonicus* (I)  
*Cercocarpus montanus*, dominant, 20-40%  
*Gutierrezia sarothrae*  
*Helianthus pumilus*  
*Opuntia polyacantha*  
*Oryzopsis hymenoides*  
*Oxytropis sericea*, common  
*Physaria* sp. (See note)  
*Stipa comata*  
*Stipa scribneri*, dominant, 2-10%  
*Tragia ramosa*

Note: W.A. Weber identified this *Physaria*, which appears to be *P. bellii*, as a lobeless form of *Physaria vitulifera* when it was collected on the Heil Ranch by Rick Brune in 1991. It is in need of further study.

Note: W.A. Weber identified this *Physaria*, which appears to be *P. bellii*, as a lobeless form of *Physaria vitulifera* when it was collected on the Heil Ranch by Rick Brune in 1991. It is in need of further study.

Cercocarpus montanus/Stipa neomexicana plant association  
undescribed GUSU

Site Numbers: Heil 23, 87.

This plant association is dominated by mountain mahogany (*Cercocarpus montanus*) and New Mexico feathergrass (*Stipa neomexicana*). It occurs on various slopes and aspects but

apparently not north-facing slopes. It was first observed by Steve Kettler in 1994 and found on the Hall Ranch east of Lyons in 1995. Soils are gravelly and rocky. The geologic substrate varies. This association needs further quantitative and distribution studies.

**Site Heil 23:** This occurrence is on a steep (25%), southwest-facing slope. It is dominated by *Cercocarpus montanus* with 3-5% *Stipa neomexicana*. It occurs in a relatively weed free area. This site is visible in the photo taken at Heil 29 showing the view to the north. It is in the area of white rock outcropping in the upper center of the photo. Boundaries to the north and south are uncertain. Elevation 6000-6200 feet.

Geology: Lykins Formation, lower part (TrPlu) or possibly the Pine Butte Member of the Sundance Formation (JTrsj). The Pine Butte Member is slightly above the mapped area but fits the visual appearance better.

Species: *Aristida longiseta*  
*Artemisia frigida*  
*Bouteloua curtipendula*  
*Bouteloua gracilis*  
*Bromus japonicus* (I)  
*Cercocarpus montanus*, dominant, 25%  
*Eriogonum jamesii*  
*Eriogonum effusum*  
*Gaura coccinea*  
*Helianthus pumilus*  
*Linaria dalmatica* (I)  
*Linum lewisii*  
*Opuntia macrorhiza*  
*Oryzopsis hymenoides*  
*Oxytropis sericea*  
*Rhus trilobata*, trace  
*Physaria* sp. (See note)  
*Stipa comata*  
*Stipa neomexicana*, dominant, 3-5%  
*Stipa scribneri*  
*Tragia ramosa*

Note: W.A. Weber identified this *Physaria*, which appears to be *P. bellii*, as a lobeless form of *Physaria vitulifera* when it was collected on the Heil Ranch by Rick Brune in 1991. It is in need of further study.

**Site Heil 87:** This occurrence is mostly on a moderate (12%), east-facing slope. A small part is on the west-facing slope across a small gully to the east. This site is dominated by an open stand of *Cercocarpus montanus* (10-20%) with *Stipa neomexicana* (variable, 2-10%). It is relatively weed free. Ponderosa pine (*Pinus ponderosa*) is beginning to invade. Elevation 6000 to 6200 feet.

Geology: Lykins Formation, Forelle Limestone Member (Plf).

Species: *Alyssum minus* (I)  
*Aristida longiseta*  
*Artemisia frigida*, trace  
*Astragalus tridactylus*  
*Bouteloua curtipendula*, common  
*Bromus japonicus* (I)  
*Calochortus gunnisonii*  
*Carduus nutans* (I)  
*Cerastium arvense*  
*Cercocarpus montanus*, dominant. 10-20%  
*Comandra umbellata*  
*Delphinium geyeri*  
*Elymus elymoides*  
*Erigeron flagellaris*  
*Evolvulus nuttallianus*  
*Gutierrezia sarothrae*, common  
cf *Harbouria trachypleura*  
*Hymenopappus filifolius*  
*Linaria dalmatica* (I), northern part  
*Linum lewisii*  
*Oryzopsis hymenoides*  
*Penstemon* cf *secundiflorus*  
*Physaria* sp. (See note)  
*Pinus ponderosa*, invading  
*Psoralea tenuifolia*  
*Schizachyrium scoparium*, trace  
*Stipa neomexicana*, dominant, 2-10%  
*Thelesperma megapotamicum*  
*Tragia ramosa*

Note: W.A. Weber identified this *Physaria*, which appears to be *P. bellii*, as a lobeless form of *Physaria vitulifera* when it was collected on the Heil Ranch by Rick Brune in 1991. It is in need of further study.

**Cercocarpus montanus, unclassified**

These are shrublands which don't readily fit any classification.

**Site Heil 65:** This shrubland occurs on a steep (75%), north-facing slope. *Rhus trilobata* is the dominant shrub. *Cercocarpus montanus* and rabbitbrush (*Chrysothamnus nauseosus* ssp. *graveolens*) are common. *Pinus ponderosa* is present by widely scattered. *Poa compressa* is the dominant grass.

Geology: Ingleside Formation, Lower Permian (Pi)

Species: *Ambrosia psilostachya*  
*Andropogon gerardii*  
*Astragalus drummondii*  
*Astragalus flexuosus*  
*Bromus inermis* (I)  
*Bromus japonicus* (I)  
*Campanula rotundifolia*  
*Carex* sp.  
*Cercocarpus montanus*  
*Chrysothamnus nauseosus* ssp. *graveolens*, common  
*Elymus lanceolatus* x *Pseudoroegneria spicata*  
*Eriogonum umbellatum*  
*Helianthus pumilus*  
*Heterotheca villosa*  
*Juniperus scopulorum*, trace  
*Opuntia polyacantha*  
*Oxybaphus* sp.  
*Pinus ponderosa*, widely scattered  
*Poa compressa* (I), dominant  
*Poa pratensis*  
*Psoralea tenuifolia*  
*Rhus trilobata*, dominant  
*Rosa sayi*  
*Stipa comata*  
*Stipa viridula*  
*Tragopogon dubius* (I)  
*Verbascum thapsus* (I), frequent  
*Yucca glauca*

**Site Heil 72:** This is a weedy riparian area along a small, seep-fed, intermittent stream.

Geology: Along fault or fracture zone in Fountain Formation (PPf)

Species: Acer glabrum  
Agrostis gigantea (I)  
Carduus nutans (I)  
Cirsium arvense (I)  
Clematis ligusticifolia  
Monarda fistulosa  
Negundo aceroides  
Populus sp., infrequent  
Oryzopsis micrantha, adjacent lower slope  
Toxicodendron rydbergii  
Viola spp.

### **Cercocarpus montanus/Weed**

Site Numbers: Heil 24.5, 26, 91.

These are extremely weedy plant associations where the classification is unknown beyond the dominant species. One of the dominant species is usually introduced.

### **Cercocarpus montanus/Alyssum minus**

**Site Heil 91:** This is a very weedy, east-facing slope dominated by Cercocarpus montanus and Alyssum minus.

Geology: Lykins Formation, lower part (TrPlu)

Species: Alyssum minus (I), dominant  
Artemisia frigida  
Bromus japonicus (I), common  
Bromus tectorum (I)  
Cercocarpus montanus, dominant  
Descurainia sp.  
Opuntia macrorhiza  
Sporobolus sp.  
Stipa neomexicana, trace  
Tragopogon dubius (I)

### **Cercocarpus montanus/Bromus japonicus**

**Site Heil 24.5:** This is an extremely weedy site near the summit of a rocky, east-facing ridge. Cercocarpus montanus and Bromus japonicus dominate. It is possible related to Trev 112 about one mile to the southeast.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: Andropogon gerardii, trace  
Bromus briziformis (I)  
Bromus japonicus (I), dominant  
Cercocarpus montanus, dominant  
Elymus lanceolatus x Pseudoroegneria spicata  
Heterotheca villosa  
Koeleria macrantha  
Stipa comata

**Site Heil 26:** This is on a gentle, east-facing slope and was observed only from a distance. The dominants appear to be Cercocarpus montanus and probably Bromus japonicus and/or Bromus tectorum.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

**Site Trev 110 in part:** Within site Trev 110, described in the grasslands section, are colonies of Cercocarpus montanus with the understory dominated by Bromus japonicus. Erigeron flagellaris is very common forming numerous colonies several square meters in extent. Tragia ramosa is also abundant. These are similar to the much larger and weedy Cercocarpus montanus/Bromus japonicus site Trev 112.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: Bromus briziformis (I)  
Bromus japonicus (I), dominant  
Cercocarpus montanus, dominant  
Elymus lanceolatus x Pseudoroegneria spicata  
Erigeron flagellaris, dominant forb  
Grindelia squarrosa  
Gutierrezia sarothrae  
Liatris punctata  
Onosmodium molle  
Pinus ponderosa, widely scattered  
Rhus trilobata  
Stipa comata  
Tragopogon dubius (I)

Tragia ramosa

**Site Trev 112:** This is an extremely weedy east-facing slope (30%) dominated by a rather open stand of *Cercocarpus montanus* and *Bromus japonicus*. *Poa compressa* is very common. Ragweed (*Ambrosia psilostachya*) and *Aster porteri* are dominant forbs.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: *Ambrosia psilostachya*, common, dominant forb  
*Andropogon gerardii*, trace  
*Apocynum* sp., trace  
*Artemisia ludoviciana*  
*Aster porteri*, common, dominant forb  
*Bromus japonicus* (I), dominant  
*Celtis reticulata*, rare  
*Cercocarpus montanus*, dominant  
*Pinus ponderosa*, scattered  
*Poa compressa* (I), common  
*Rhus trilobata*, scattered  
*Rosa sayi*  
*Toxicodendron rydbergii*

## ANDROPOGON GERARDII SERIES

### Andropogon gerardii Foothills Grasslands

Site Numbers: Heil 20, 34, 46, 105, 110, 111, 122, 124.

The following grasslands are often dominated by big bluestem (*Andropogon gerardii*) but have little, if any, little bluestem (*Schizachyrium scoparium*). Exotic weeds make up a major part of the cover. These may be degraded examples of the *Andropogon gerardii*/*Schizachyrium scoparium* xeric tallgrass prairie but I am hesitant to classify them as such. They have apparently suffered a long period of abuse.

(I) following the species name indicates introduced species not native to the area. Species lists are not complete.

**Site Heil 20:** This area is basically dominated by exotic weeds, especially *Bromus japonicus* and *Bromus tectorum*. *Andropogon gerardii* is common throughout. The presence of native species indicates the area could recover if the exotic weeds are controlled. This occurrence is on a moderate (25%), south-facing slope.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Agropyron smithii*  
*Andropogon gerardii*, scattered  
*Asclepias* sp1  
*Asclepias* sp2  
*Bouteloua curtipendula*  
*Bromus japonicus* (I), dominant  
*Bromus tectorum* (I), dominant  
*Carduus nutans* (I)  
*Dalea purpurea*  
*Lactuca serriola* (I)  
*Opuntia macrorhiza*  
*Pinus ponderosa*, widely scattered  
*Psoralea tenuifolia*, dominant  
*Ratibida columnifera*  
*Rhus trilobata*, trace  
*Rosa* sp.  
*Schizachyrium scoparium*  
*Stipa comata*  
*Verbascum thapsus* (I)  
*Yucca glauca*

**Site Heil 34:** This is a small, mesic area of *Andropogon gerardii* and *Rhus trilobata*. It occurs north of the fence near the center of section 31. It is very weedy and in poor condition.

Species: *Artemisia* sp.  
*Artemisia ludoviciana*  
*Andropogon gerardii*, common  
*Bromus japonicus* (I), dominant  
*Dalea purpurea*  
*Elymus canadensis*  
*Geranium* sp.  
*Heterotheca villosa*  
*Onosmodium molle*  
*Poa pratensis* (I)  
*Psoralea tenuifolia*  
*Rhus trilobata*, dominant  
*Thermopsis montana*  
*Yucca glauca*

**Site Heil 46:** This is a very steep (60%), east-facing slope dominated by *Andropogon gerardii*. It joins the southeast part of Heil 47 and may be part of that plant association. It has, however, very little if any *Schizachyrium scoparium*. It is also on a different geologic substrate.

Geology: Quaternary landslide deposit (Qls)

Species: *Andropogon gerardii*, dominant, 20-30%  
*Artemisia frigida*  
*Artemisia ludoviciana*  
*Bromus briziformis* (I)  
*Bromus tectorum* (I), dominant  
*Elymus lanceolatus* x *Pseudoroegneria spicata*  
*Grindelia squarrosa*  
*Liatris punctata*  
*Pinus ponderosa*, widely scattered  
*Poa pratensis* (I)  
*Psoralea tenuifolia*  
*Stipa comata*  
*Tragia ramosa*, common  
*Verbascum thapsus* (I), trace  
*Yucca glauca*

**Site Heil 105:** This is an extremely weedy, open meadow with large clones of *Andropogon gerardii*. It is dominated by introduced grasses, especially *Bromus*

japonicus, Bromus tectorum, and Poa compressa. It is possibly related to Heil 57 which is dominated by Andropogon gerardii with much Schizachyrium scoparium. Both occur on east-facing slopes at about the same elevation (Heil 57 ca 6500'; Heil 105 ca 6300'). The slope of Heil 105 is about 15%.

Geology: Quaternary landslide deposit (Qls)

Species: Ambrosia psilostachya, codominant forb  
Andropogon gerardii, scattered large colonies  
Artemisia frigida  
Artemisia ludoviciana  
Asclepias pumilus  
Astragalus agrestis  
Astragalus drummondii  
Bouteloua gracilis, rare  
Bromus tectorum (I), dominant  
Bromus tectorum (I), dominant  
Gaura coccinea  
Gutierrezia sarothrae  
Geranium fremontii  
Helianthus annuus  
Lactuca serriola (I)  
Lygodesmia juncea  
Opuntia macrorhiza  
Oxybaphus cf hirsutus  
Pinus ponderosa, invading  
Poa compressa (I), dominant  
Poa pratensis (I)  
Psoralea tenuifolia, codominant forb  
Ratibida columnifera  
Rhus trilobata, widely scattered  
Schizachyrium scoparium  
Senecio spartioides  
Stipa comata  
Stipa viridula  
Verbascum thapsus (I), few  
Vicia americana  
Yucca glauca

**Sites Trev 110, 111, 124 (91BR005).**

These three sites are part of the same plant association on an east-facing slope. Big bluestem (Andropogon gerardii) ranges from common, about 5% cover, to dominant with about 20% on some upper slopes.

All of the area is weedy but becomes less so with increasing elevation. Site 124 was quantitatively sampled in 1991 by Rick Brune (Brune 1992). This area has a fair possibility of being a degraded *Andropogon gerardii*/*Schizachyrium scoparium* prairie if weeds could be controlled. The area was grazed by horses prior to 1991. A local landowner may still graze a few horses on the property.

**Site Trev 110:** This is the mid-slope area of Trev 110, 111, and 124. Exotic species nearly dominate and *Andropogon gerardii* is common. There are scattered, very weedy colonies of *Cercocarpus montanus*. (See the *Cercocarpus montanus*/*Bromus japonicus* descriptions for Heil 110.)

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: *Agropyron smithii*, subdominant  
*Alyssum minus* (I), abundant to dominant  
*Ambrosia psilostachya*  
*Andropogon gerardii*, common, about 5%  
*Artemisia ludoviciana*  
*Bouteloua gracilis*, common  
*Bromus japonicus* (I), dominant  
*Opuntia macrorhiza*  
*Opuntia polyacantha*

**Site Trev 111:** This is the upper slope area of Trev 110, 111, 124. *Andropogon gerardii* is dominant (10-15%). There is much less *alyssum* (*Alyssum minus*) than Trev 110.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: *Alyssum minus* (I), much less than Trev 110.  
*Ambrosia psilostachya*  
*Andropogon gerardii*, dominant, 10-15%  
*Artemisia frigida*  
*Aristida longiseta*  
*Artemisia ludoviciana*  
*Aster porteri*  
*Bouteloua curtipendula*  
*Bromus briziformis* (I)

Bromus japonicus (I), dominant  
Cerastium arvense  
Elymus lanceolatus x Pseudoroegneria spicata  
Gaillardia aristata  
Erigeron flagellaris, dominant forb  
Gutierrezia sarothrae  
Koeleria macrantha  
Liatris punctata  
Opuntia macrorhiza  
Opuntia polyacantha  
Poa compressa (I), infrequent  
Poa pratensis (I)  
Psoralea tenuifolia  
Ratibida columnifera  
Rosa sayi, dominant shrub  
Senecio spartioides  
Stipa comata  
Tragia ramosa, common  
Yucca glauca

**Site Trev 122:** (*Pinus ponderosa*)/*Andropogon gerardii*/  
*Panicum virgatum*

This is an unusual area. The dominant grasses are those expected in a mesic tallgrass prairie. The site, while obviously mesic, is near the summit of an east-facing ridge on the Dakota hogback. The site is far enough towards the top of the ridge that it does not appear to collect more water due to its slope position than do the adjacent areas. The slope is to the east at about 20%.

Ponderosa pine is frequent and scattered throughout - sometimes densely so. It is unlikely many are presettlement. If they were, they should be much larger given the mesic conditions. Fires in this rich grassland would have certainly suppressed most *Pinus ponderosa* growth. For that reason, I am including this plant association in the grasslands since grassland is probably the climax vegetation. This general area appears quite mesic compared to other areas of the Dakota or Lyons hogbacks. *Sorghastrum nutans* and *Stipa spartea* both also occur about 0.5 miles to the southwest on the Dakota hogback.

Big bluestem (*Andropogon gerardii*) and switchgrass (*Panicum virgatum*) are the dominant grasses. *Panicum virgatum* forms large stands dominating over 400 sq.ft. Indiangrass (*Sorghastrum nutans*) and little bluestem (*Schizachyrium scoparium*) are scattered through but never dominant. The *Andropogon gerardii* is of the deepest, wine-red color I've ever seen.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl).

Species: *Agropyron smithii*  
*Allium textile*  
*Aristida longiseta*  
*Andropogon gerardii*, dominant  
*Aster porteri*  
*Astragalus agrestis*  
*Bouteloua curtipendula*  
*Bouteloua gracilis*  
*Bromus japonicus* (I), infrequent  
*Dalea purpurea*  
*Dichanthelium linearifolium*  
*Lithospermum incisum*

Geranium fremontii  
 Helianthus rigidus  
 Juncus interior  
 Koeleria macrantha  
 Opuntia macrorhiza  
 Panicum virgatum, dominant  
 Pinus ponderosa  
 Psoralea tenuifolia  
 Rhus trilobata  
 Schizachyrium scoparium  
 Sorghastrum nutans  
 Stipa comata  
 Tragia ramosa, infrequent

**Trev 126 (91BR005):** This site is the uppermost part of sites Trev 110 and 111. It joins Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii site Trev 113. Andropogon gerardii dominates with about 20% cover. There is little invasion by Cercocarpus montanus and Pinus ponderosa. A small amount of Rhus trilobata and yucca (Yucca glauca) are present. Bromus japonicus and Bromus tectorum constitute about 20% of the cover. The area has a predominantly tallgrass appearance. It is on a moderate (20%), east-facing slope. It was quantitatively sampled in 1991.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl).

Species	Cover Class	Species	Cover Class
Ambrosia psilostachya	1	Koeleria macrantha	1
Andropogon gerardii	20	Lactuca serriola (I)	1
Aristida longiseta	1	Lepidium virginicum	1
Artemisia ludoviciana	3	Muhlenbergia wrightii	1
Aster porteri	1	Opuntia macrorhiza	1
Bouteloua curtipendula	1	Opuntia polyacantha	1
Bouteloua gracilis	1	Oxybaphus hirsutus	1
Brickellia rosmarinifolia	1	Poa compressa (I)	1
Bromus japonicus (I)	10	Psoralea tenuifolia	1
Bromus tectorum (I)	10	Ratibida columnifera	1
Carex heliophila	1	Rhus trilobata	1
Cirsium canescens	1	Rosa sayi	1
Dalea purpurea	1	Schizachyrium scoparium	1
Echinocereus viridiflorus	1	Senecio spartioides	1
Eriogonum umbellatum	1	Stipa comata	1
Evolvulus nuttallianus	1	Sorghastrum nutans	1

Geranium fremontii	1	Tragia ramosa	10
Gutierrezia sarothrae	1	Tragopogon dubius (I)	1
Heterotheca villosa	1	Yucca glauca	1

**Andropogon gerardii/Schizachyrium scoparium plant association** (Bourgeron 1994, Johnston 1987) G2S2

Site Numbers: Heil 47.

This may be a relict of *Andropogon gerardii*/*Schizachyrium scoparium* xeric tallgrass prairie. *Pinus ponderosa* is invading this small, four acre occurrence. It adjoins site Heil 46 (15 acres) to the southeast which is also dominated by *Andropogon gerardii* but has little or no *Schizachyrium scoparium*. Both sites are on east-facing slopes. The slope of Heil 47 is about 30% versus 60% for Heil 46. Their geologies are also different. This occurrence was first identified by Steve Kettler in 1995.

Geology: Lyons Sandstone (Ply)

Species: *Ambrosia psilostachya*  
*Andropogon gerardii*, codominant, 10-20%  
*Artemisia frigida*  
*Artemisia ludoviciana*  
*Bromus japonicus* (I), codominant, 20%  
*Eriogonum alatum*  
*Elymus elymoides*  
*Geranium* sp.  
*Helianthus pumilus*  
*Helianthus* sp. (*rigidus*?)  
*Heterotheca villosa*  
*Koeleria macrantha*  
*Liatris punctata*  
*Muhlenbergia montana*  
*Poa compressa* (I), 1%  
*Poa pratensis* (I), codominant, 30%  
*Psoralea tenuifolia*  
*Rosa* cf *sayi*  
*Schizachyrium scoparium*, codominant, 30%  
*Sisyrinchium* cf *montanum*  
*Stipa comata*, rare  
*Thermopsis montana*  
*Tragopogon dubius* (I)  
*Vicia americana*  
*Yucca glauca*

**PASCOPYRUM (AGROPYRON) SMITHII SERIES**

This series is dominated by western wheatgrass (*Agropyron smithii*).

(I) following the species name indicates introduced species not native to the area. Species lists are not complete.

**Pascopyrum smithii/Bouteloua gracilis plant association**

(Bourgeron 1994) G5S4

= **Elytrigia smithii/Bouteloua gracilis plant association**

(Johnston 1987)

= **Bouteloua gracilis/Elytrigia smithii plant association**

(Johnston 1987)

Site Numbers: Heil 4, 10, 21.5, 63, 66.

**Site Heil 4:** This is a small, somewhat weedy grassland adjoining the southeast part of Heil 4.5. The slope (20%) is slightly to the south compared to Heil 4.5's slope to the north. It is potentially similar to Heil 10 further north. Blue grama (*Bouteloua gracilis*) is very common to dominant and western wheatgrass (*Agropyron smithii*) is present. The dominant forbs are ragweed (*Ambrosia psilostachya*) and slim-flowered scurfpea (*Psoralea tenuiflora*). This association could possibly also be *Stipa comata/Bouteloua gracilis*.

*Asclepias stenophylla* (one plant) was seen in this area. It is a rarely-collected, disjunct milkweed that some people believe should be monitored by the Colorado Natural Heritage Program.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Agropyron smithii*  
*Alyssum minus* (I)  
*Ambrosia psilostachya*, dominant forb  
*Aristida longiseta*  
*Artemisia frigida*  
*Asclepias stenophylla*, rarely collected species  
*Asclepias* sp.  
*Aster porteri*  
*Bromus inermis* (I)  
*Bouteloua gracilis*, dominant  
*Bromus japonicus* (I)  
*Carduus nutans* (I), scattered

Dalea purpurea  
Grindelia squarrosa  
Gutierrezia sarothrae, common  
Heterotheca villosa  
Opuntia macrorhiza  
Oxytropis lambertii  
Poa compressa (I)  
Poa pratensis (I)  
Psoralea tenuifolia, dominant forb  
Rosa sayi  
Stipa comata  
Townsendia grandiflora  
Verbascum thapsus (I)

**Site Heil 10:** This area is an open meadow similar to Heil 4.5 but not nearly as weedy. Western wheatgrass (*Agropyron smithii*) is frequent and there are patches of blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*). *Andropogon gerardii* is rare. *Pinus ponderosa* is scattered on rocky knolls. The slope (10-15%) is generally to the east. Elevation is 6200-6400 feet.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Agropyron smithii*, frequent  
*Alyssum minus* (I)  
*Andropogon gerardii*, rare  
*Ambrosia psilostachya*  
*Aristida longiseta*  
*Artemisia frigida*  
*Aster porteri*  
*Bouteloua curtipendula*  
*Bouteloua gracilis*  
*Bromus japonicus* (I)  
*Bromus tectorum* (I)  
*Buchloe dactyloides*  
*Carex* cf *heliophila*  
*Cichorium intybus* (I), dominant  
*Convolvulus arvensis* (I)  
*Dalea purpurea*  
*Geranium fremontii*  
*Heterotheca villosa*  
*Lupinus argenteus* cf *ssp. ingratus*  
*Opuntia macrorhiza*  
*Pinus ponderosa*, on rocky knolls  
*Poa pratensis* (I), dominant

Psoralea tenuifolia  
Thermopsis montana  
Trifolium sp. (I)

**Site Heil 21.5:** The lower slopes below the mountain mahogany (*Cercocarpus montanus*) plant associations in Red Hill Gulch are probably the *Pascopyrum smithii*/*Bouteloua gracilis* plant association. Red Hill Gulch is the valley between the Dakota hogback and the Lyons hogback. *Agropyron smithii* and *Bouteloua gracilis* are common but the area is very weedy. *Rhus trilobata* is widely scattered indicating deeper soils. Heil 38 (q.v.) is probably the same plant association only much weedier. Note that east of the silo (section 31, NE1/4 NE1/4) the *Rhus trilobata* stays east of the north-south fence line. This apparently is related to the effect of grazing on this plant association. Elevations range from about 5500 to 5800 feet.

Geology: mostly Quaternary colluvium and alluvium (Qc).

Species: *Agropyron smithii*, subdominant to dominant  
*Ambrosia psilostachya*  
*Argemone intermedia*  
*Aristida longiseta*  
*Artemisia frigida*  
*Asclepias pumilus*  
*Astragalus drummondii*  
*Bouteloua curtipendula*  
*Bouteloua gracilis*, dominant in better areas, especially upslope.  
*Bromus japonicus* (I), dominant  
*Carex* sp.  
*Chrysothamnus nauseosus graveolens*, widely scattered  
*Delphinium* sp. (geyeri?)  
*Elymus canadensis*  
*Eriogonum effusum*  
*Evolvulus nuttallianus*, common  
*Gutierrezia sarothrae*, frequent  
*Helianthus annuus*  
*Heterotheca villosa*, infrequent  
*Lactuca serriola* (I)  
*Liatris punctata*  
*Opuntia polyacantha*  
*Pinus ponderosa*, widely scattered  
*Psoralea tenuifolia*, dominant forb  
*Rhus trilobata*, widely scattered

Sphaeralcea coccinea  
Stipa comata  
Stipa robusta  
Thelesperma megapotamicum  
Tragopogon dubius (I)

**Site Heil 38:** This is apparently the same plant association as Heil 21.5 but in very poor condition. It is located in the valley of Red Hill Gulch below the Cercocarpus montanus on the east and the Pinus ponderosa on the west. Soils, geology, slope, and aspect are the same as Heil 21.5.

Geology: Quaternary colluvium and alluvium (Qc)

Species: Agaloma (Euphorbia) marginata  
Agropyron smithii, some good areas  
Ambrosia psilostachya  
Antennaria sp.  
Aristida longiseta, dominant over large areas  
Artemisia frigida  
Aster porteri  
Astragalus drummondii  
Bromus japonicus (I), dominant  
Calochortus gunnisonii  
Carduus nutans (I)  
Chrysothamnus nauseosus graveolens  
Cleome serrulata  
Dalea candida  
Dalea purpurea  
Eriogonum aviculare (I)  
Heterotheca villosa  
Lepidotheca suaveolens  
Linaria dalmatica (I), rare  
Liatris punctata  
Lupinus argenteus ingratus  
Melilotus alba (I)  
Poa compressa (I)  
Poa pratensis (I)  
Psoralea tenuifolia, dominant forb  
Ratibida columnifera  
Ratibida columnifera pulcherrima  
Sisymbrium altissimum (I)  
Stipa comata  
Stipa robusta  
Thelesperma megapotamicum  
Tragopogon dubius (I)  
Verbascum thapsus (I)

Xanthium strumarium (I)

**Site Heil 63:** This may be *Pascopyrum smithii*/*Bouteloua gracilis*. It is in the southern part of the valley between the Dakota and Lyons hogbacks. Part of the area includes a weedy prairie dog town. Slope is to the south-southwest at 0 to 10%.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Acosta diffusa* (I), abundant common along road  
*Agropyron smithii*, dominant  
*Agaloma marginata*  
*Aristida longiseta*, common  
*Bromus japonicus* (I)  
*Bromus tectorum* (I)  
*Buchloe dactyloides*  
*Carduus nutans* (I)  
*Comandra umbellata*  
*Physalis lobata*  
*Poa compressa*, common  
*Verbena bracteata*

**Site Heil 66:** This appears to be the same plant association as Heil 21.5. It occurs on the same slope and aspect about one mile to the west of Heil 21.5. It also has a very open stand of *Rhus trilobata*. Elevation is about 6000 feet.

Geology: Fountain Formation (PPf) and Quaternary talus (Qta).

### SCHIZACHYRIUM SCOPARIUM SERIES

This series is dominated by little bluestem (*Schizachyrium scoparium*). It occurs on east and west-facing slopes but is much more frequent on west facing.

(I) following the species name indicates introduced species not native to the area. Species lists are not complete.

Site Numbers: Heil 6, 14, 24, 28, 30.

#### Schizachyrium scoparium grasslands, unclassified

**Site Heil 6:** This is an area dominated by little bluestem (*Schizachyrium scoparium*) with a significant amount of buckbrush (*Ceanothus fendleri*). It occurs near ponderosa pine (*Pinus ponderosa*) but seems to be mostly separate from it. A few *Pinus ponderosa* occur within the community. Heil 14 seems to be a weedier version of this association but it is not as well defined. The appearance is intermediate between grassland and shrubland. The species present are more typical of grasslands. This site is on moderate to steep, east-northeast-facing slope (20-40%). It may represent an ecotone rather than a plant association. To the west, on the same slope, are high stands of *Monarda fistulosa* which indicate mesic to moist conditions in the area.

Geology: Silver Plume granite (YXp)

Species: *Allium cernuum*  
*Andropogon gerardii*, trace  
*Aster porteri*  
*Calochortus gunnisonii*  
*Ceanothus fendleri*, common  
*Dalea purpurea*  
*Geranium fremontii*  
*Heterotheca villosa*  
*Liatris punctata*  
*Poa compressa* (I), subdominant  
*Poa pratensis*  
*Schizachyrium scoparium*, dominant  
*Toxicodendron rydbergii*

**Site Heil 14:** This site is on an east-southeast-facing slope (40%). It is similar to Heil 6 with little bluestem (*Schizachyrium scoparium*) and buckbrush

(*Ceanothus fendleri*). It is much weedier and less defined.

Geology: Biotite schist, Early Proterozoic (Xqs)

Species: Bromus japonicus, abundant  
Ceanothus fendleri, common  
Heterotheca villosa, abundant  
Poa pratensis, common  
Schizachyrium scoparium, dominant

**Site Heil 24:** This site is dominated by little bluestem (Schizachyrium scoparium) (30%) below a stand of Cercocarpus montanus. It is near the top of the Dakota hogback on a 15%, east-facing slope. The occurrence is weed free, however, Bromus japonicus is dominant to the north, east, and also to the west in parts of the Cercocarpus montanus. Areas north and south are possibly the same only degraded.

Geology: Morrison Formation (Jm)

Species: Andropogon gerardii  
Bouteloua curtipendula  
Eriogonum alatum  
Helianthus pumilus  
Heterotheca villosa  
Liatris punctata  
Paronychia jamesii  
Schizachyrium scoparium, dominant, 30%  
Stipa comata  
Stipa neomexicana  
Thelesperma megapotamicum

**Schizachyrium scoparium grasslands, phase Elymus lanceolatus x Pseudoroegneria spicata**

Ours appear to be a phase with Elymus lanceolatus x Pseudoroegneria spicata as a dominant or codominant. It may also be a degraded Andropogon gerardii plant association.

**Site Heil 28:** This is a small area dominated by little bluestem (Schizachyrium scoparium) and relatively free of annual weeds. Andropogon gerardii is subdominant. It occurs on a west-northwest facing slope (25%). This is closely related to Heil 30, 32, 36. The elevation is 5900-6000 feet.

Geology: Morrison Formation (Jm)

Species: Allium textile  
Andropogon gerardii, common, 2%  
Aristida longiseta

Artemisia ludoviciana  
Astragalus tridactylicus  
Bromus japonicus (I)  
Calochortus gunnisonii  
Elymus lanceolatus x Pseudoroegneria spicata,  
common to dominant over large areas.  
Eriogonum alatum  
Eriogonum sp.  
Grindelia squarrosa  
Gutierrezia sarothrae  
Koeleria macrantha  
Linaria dalmatica (I), trace  
Linum lewisii  
Oryzopsis hymenoides, trace  
Oxytropis sericea  
Paronychia jamesii  
Pinus ponderosa  
cf Pneumonanthe affinis  
Poa pratensis (I)  
Ratibida columnifera  
Rhus trilobata, scattered  
Schizachyrium scoparium, dominant 30-40%  
Solidago sp.  
Stipa comata  
Stipa neomexicana  
Stipa viridula  
Thelesperma megapotamicum  
Toxicodendron rydbergii  
Yucca glauca

**Site Heil 30:** This site is dominated by Griffiths wheatgrass (Elymus lanceolatus x Pseudoroegneria spicata) with Schizachyrium scoparium subdominant. It is nearly free of annual weeds. It occurs on a mostly north-facing slope of 35%. This is a very small occurrence, about 2 acres. To the south, Schizachyrium scoparium quickly drops out and Bromus japonicus becomes dominant. The lower part of the south-facing slope to the south is in fairly good condition and is described as Trev 114 in part. The elevation is 6200-6400 feet. This is closely related to Heil 28, 32, and 36.

Geology: Morrison Formation (Jm)

Species: Astragalus agrestis  
Astragalus tridactylicus  
Bromus japonicus (I), trace

Bouteloua curtipendula  
Cercocarpus montanus, widely scattered  
Eriogonum alatum, very common  
Elymus lanceolatus x Pseudoroegneria spicata,  
dominant  
Helianthus pumilus, dominant forb, very  
abundant, subdominant  
Heterotheca villosa  
Liatris punctata  
Linum lewisii  
Lithospermum cf multiflorum  
Opuntia polyacantha  
Oxytropis sericea  
Oryzopsis hymenoides  
Oryzopsis hymenoides  
Rosa sayi  
Schizachyrium scoparium, subdominant  
Stipa comata, common  
Yucca glauca

**Site Heil 32:** This is a generally weed free site dominated by Elymus lanceolatus x Pseudoroegneria spicata with smaller areas dominated by Schizachyrium scoparium. Schizachyrium scoparium may appear more abundant because it has much the same coloration as Elymus lanceolatus x Pseudoroegneria spicata when growing with it. This occurrence is on a steep (50%), west-facing slope. The elevation is 6200-6400 feet. It is closely related to Heil 28, 30, and 36.

Geology: Morrison Formation (Jm) and Sundance and Jelm Formations (JTrsj).

Species: Alyssum minus (I)  
Artemisia frigida  
Astragalus agrestis  
Astragalus drummondii  
Bromus japonicus (I)  
Calochortus gunnisonii  
Cerastium arvense  
Dalea purpurea  
Eriogonum alatum, common  
Elymus lanceolatus x Pseudoroegneria spicata,  
dominant, 60%  
Gaillardia aristata  
Gutierrezia sarothrae  
Helianthus pumilus  
Heterotheca villosa

Liatris punctata, common  
Linaria dalmatica (I)  
Linum lewisii  
Oryzopsis hymenoides  
Oxytropis sericea  
Paronychia jamesii  
Schizachyrium scoparium, dominant over small  
areas, mostly not; 2%  
Stipa comata  
Thelesperma megapotamicum  
Townsendia grandiflora  
Yucca glauca

**Site Heil 36:** Elymus lanceolatus x Pseudoroegneria  
spicata and Schizachyrium scoparium are common on this  
site. Poa compressa is abundant in some areas. This  
site is similar to Heil 28, 30, and 32. The slope is to  
the west at about 40%. The elevation is 6200-6400 feet.

Geology: Morrison Formation (Jm); Sundance and Jelm  
Formations (JTrsj); and possibly Lykins  
Formation, lower part (TrPlu).

Species: Andropogon gerardii, scattered  
Artemisia frigida  
Astragalus tridactylus  
Bromus japonicus (I)  
Calochortus gunnisonii  
Cerastium arvense  
Dalea purpurea  
Elymus lanceolatus x Pseudoroegneria spicata,  
abundant  
Eriogonum alatum  
Geranium fremontii  
Gutierrezia sarothrae  
Helianthus pumilus  
Koeleria macrantha  
Liatris punctata  
Linum lewisii  
Lithospermum multiflorum  
Lupinus sp.  
Opuntia polyacantha  
Oryzopsis hymenoides  
Oxytropis sericea  
Paronychia jamesii  
Poa compressa, abundant in some areas  
Rhus trilobata, scattered  
Schizachyrium scoparium

Stipa comata, common  
Yucca glauca

### STIPA COMATA SERIES

This series has needle-and-thread (*Stipa comata*) as one of the dominant species.

(I) following the species name indicates introduced species not native to the area. Species lists are not complete.

Stipa comata/Bouteloua gracilis plant association (Bourgeron 1994) G5S2S3

Site Numbers: Heil 16, 27, 88, 98.

Needle-and-thread (*Stipa comata*) and blue grama (*Bouteloua gracilis*) are the dominant species in this association. Several of the described sites are very weedy and not reliably assigned to this plant association.

**Site Heil 16:** This is an area of weedy grasslands on a southeast-facing slope (40%). Scattered stands of *Pinus ponderosa* occur with some larger trees (18 inch DBH). There has been some logging. *Stipa comata* and *Rhus trilobata* are common while big bluestem (*Andropogon gerardii*) is rare. *Bouteloua gracilis* was not recorded but likely present. *Bromus japonicus* and *Bromus tectorum* are the dominant grasses. Hairy golden aster (*Heterotheca villosa*) is the dominant forb. Musk thistle (*Carduus nutans*) is common in low areas. Elevation is 6800-7200 feet.

Geology: Biotite schist, Early Proterozoic (Xqs)

Species: *Alyssum minus* (I)  
*Andropogon gerardii*, rare  
*Artemisia frigida*  
*Artemisia ludoviciana*  
*Bouteloua curtipendula*  
*Bromus briziformis* (I), common  
*Bromus japonicus* (I), dominant  
*Bromus tectorum* (I), dominant  
*Carduus nutans* (I), dense colonies in low areas  
*Ceanothus fendleri*  
*Eriogonum alatum*  
*Gaillardia aristata*, frequent  
*Geranium fremontii*  
*Heterotheca villosa*, dominant forb  
*Koeleria macrantha*

Lepidium sp.  
Monarda fistulosa  
Pinus ponderosa, scattered stands  
Poa compressa  
Rhus trilobata, common  
Schizachyrium scoparium  
Sisymbrium altissimum (I)  
Stipa comata, common  
Tragopogon dubius, (I)  
Verbascum thapsus (I)

**Site Heil 27:** There is an apparent soil or geology change from rockier at Heil 24 to loamier at Heil 27. The geologic map shows Quaternary colluvium and alluvium (Qc) a short distance to the east and these may in fact be shallower colluvial soils. There is a distinct change to a weedier vegetation type in Heil 27. The dominants also change. Heil 27 is more of a rolling upland north of Heil 24. The vegetation is dominated by Stipa comata and Bouteloua gracilis along with Bromus japonicus. Helianthus pumilus and Heterotheca villosa are codominant forbs over large areas. The site is generally weedy.

Geology: Morrison Formation (Jm)

Species: Aristida longiseta  
Astragalus drummondii  
Bouteloua curtipendula  
Bouteloua gracilis, dominant  
Bromus japonicus (I), dominant  
Dalea purpurea  
Echinocereus viridiflorus  
Helianthus pumilus, dominant  
Heterotheca villosa, dominant  
Liatris punctata  
Linum lewisii  
Psoralea tenuifolia  
Schizachyrium scoparium, trace  
Stipa comata, dominant  
Thelesperma megapotamicum  
Evolvulus nuttallianus

**Site Heil 88:** This is a rather weedy grassland at the head of Lykins Gulch in the valley between the Dakota and Lyons hogbacks. Stipa comata and Bromus japonicus are the dominant grasses. The site is on a moderate (30%), south-facing slope at about 6000 feet elevation.

This site may indicate that other sites in this valley classified as *Pascopyrum smithii*/*Bouteloua gracilis* should be *Stipa comata*/*Bouteloua gracilis* since the habitats are similar.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Ambrosia psilostachya*  
*Andropogon gerardii*, trace  
*Artemisia frigida*  
*Astragalus drummondii*  
*Astragalus shortianus*, rare  
*Bromus japonicus* (I), dominant  
*Dalea purpurea*  
*Elymus elymoides*  
*Eriogonum alatum*, frequent  
*Grindelia squarrosa*  
*Gutierrezia sarothrae*  
*Heterotheca villosa*  
*Linum lewisii*, common  
*Linaria dalmatica* (I)  
*Lithospermum* cf *multiflorum*  
*Onosmodium molle*  
*Opuntia polyacantha*  
*Oxytropis sericea*  
*Poa compressa*  
*Psoralea tenuifolia*  
*Rhus trilobata*  
*Schizachyrium scoparium*  
*Senecio spartioides*  
*Stipa comata*, common  
*Stipa neomexicana*, common  
*Stipa robusta*  
*Thelesperma megapotamicum*  
*Verbascum thapsus* (I)  
*Yucca glauca*

**Site Heil 98:** This area is very free of weeds relative to the rest of the valley between the Dakota and Lyons hogbacks. In this area there is a change in geology from Quaternary colluvium and alluvium (Qc) to Lykins Formation, lower part (TrPlu). This site slopes to the north from about level to 30%. Elevation is about 6300 feet.

Geology: Lykins Formation, lower part (TrPlu)

Species: *Ambrosia psilostachya*

Aristida longiseta  
Artemisia frigida  
Aster porteri  
Astragalus drummondii  
Bouteloua curtipendula  
Bouteloua gracilis, co-dominant  
Carex cf heliophila  
Cirsium sp.  
Dalea purpurea  
Eriogonum alatum  
Gaillardia aristata  
Gutierrezia sarothrae  
Heterotheca villosa, dominant forb  
Linum lewisii  
Oxytropis sericea  
Poa compressa (I)  
Psoralea tenuifolia  
Rhus trilobata, scattered  
Schizachyrium scoparium, trace  
Stipa comata, co-dominant  
Stipa robusta, common, co-dominant

**Stipa comata - East plant association** (Bourgeron 1994)? G2S2

Site Number: Heil 97.

This is a good condition grassland that is dominated by needle-and-thread (*Stipa comata*), 20% cover. It is quite weed free when compared to other surveyed areas. It is only about 3.5 acres in extent. It occurs on a moderately steep (25%), south-facing slope. The elevation is 6280 to 6400 feet.

Geology : mostly Morrison Formation (Jm).

Species: Andropogon gerardii  
Aristida longiseta  
Artemisia frigida  
Artemisia ludoviciana  
Astragalus adsurgens  
Astragalus drummondii  
Astragalus tridactylus  
Bouteloua curtipendula  
Bromus japonicus (I), infrequent  
Dalea purpurea  
Elymus elymoides  
Eriogonum alatum  
Gutierrezia sarothrae

Helianthus pumilus  
Heterotheca villosa  
Liatris punctata  
Linum lewisii  
Lithospermum incisum  
Oryzopsis hymenoides  
Paronychia jamesii  
Penstemon secundiflorus  
Psoralea tenuifolia  
Rhus trilobata  
Rosa sayi  
Sphaeralcea coccinea  
Stipa comata, dominant, 20%  
Thelesperma megapotamicum  
Tragopogon dubius (I)  
Yucca glauca

**Stipa comata grassland, unclassified**

These grasslands are apparently dominated by needle-and-thread (*Stipa comata*) but their classification is uncertain due to their weediness.

Site Numbers: Trev 73, 74, 78, 114.

**Site Heil 73:** This is a small, isolated grassland dominated by needle-and-thread (*Stipa comata*). It is probably part of the same plant association as Heil 74 and 78. It does not appear to be very diverse. Sleepygrass (*Stipa robusta*) is frequent. It occurs on a moderate (25%) northeast-facing slope. Elevation is 6300'.

Geology: Fountain Formation (PPf)

Species: *Acosta diffusa* (I), rare  
*Ambrosia psilostachya*, dominant  
*Artemisia frigida*  
*Lactuca serriola* (I), common  
*Poa pratensis* (I)  
*Stipa comata*, dominant  
*Stipa robusta*, frequent

**Site Heil 74:** This is a very weedy grassland dominated by *Bromus japonicus*. It is probably part of the same plant association as Heil 73 and 78.

Geology: Fountain Formation (PPf)

Species: *Aster porteri*  
*Bouteloua gracilis*  
*Bromus japonicus* (I), dominant  
*Calochortus gunnisonii*  
*Cercocarpus montanus*, scattered  
*Dalea purpurea*  
*Geranium fremontii*  
*Gutierrezia sarothrae*  
*Liatris punctata*  
*Linum lewisii*  
*Poa pratensis* (I)  
*Rhus trilobata*, scattered  
*Stipa comata*  
*Yucca glauca*

**Site Heil 78:** This is an extremely weedy area. It is probably part of the same plant association as Heil 73 and 74.

Geology: Fountain Formation (PPf)

Species: Andropogon gerardii, trace  
Bromus japonicus (I)  
Lactuca serriola (I), dominant over large areas  
Poa compressa (I)  
Rosa sayi  
Stipa comata, trace

**Site Trev 114:** This grassland occurs in a dip or shallow pass through the top of the Dakota hogback. The upper parts of the south-facing slopes are dominated by Bromus japonicus which decrease downslope as Andropogon gerardii increases. The lower slopes are much less weedy. The north slopes have more Bromus japonicus all over and much Geranium fremontii. This is probably a type of Stipa comata grassland.

Geology: Morrison Formation (Jm)

Species: Ambrosia psilostachya  
Andropogon gerardii, lower slopes  
Aristida longiseta  
Artemisia frigida  
Astragalus drummondii  
Bouteloua curtipendula  
Bouteloua gracilis  
Bromus japonicus (I), dominant  
Carduus nutans (I)  
Cirsium sp. (canescens?)  
Dalea purpurea  
Elymus lanceolatus x Pseudoroegneria spicata  
Eriogonum alatum  
Evolvulus nuttallianus  
Gaura coccinea  
Geranium fremontii  
Gutierrezia sarothrae  
Helianthus pumilus  
Linaria dalmatica (I)  
Lygodesmia juncea  
Monarda pectinata  
Onosmodium molle  
Opuntia polyacantha

Paronychia jamesii  
Psoralea tenuifolia  
Ratibida columnifera  
Rosa sayi  
Schizachyrium scoparium  
Senecio spartioides  
Stipa comata  
Thelesperma megapotamicum  
Tragia ramosa  
Tragopogon dubius (I)  
Yucca glauca

## STIPA NEOMEXICANA SERIES

This series is dominated by New Mexico feathergrass (*Stipa neomexicana*). Both of these occurrences appear to be natural and in fairly good condition. The general weediness of the surrounding area creates some suspicion that these may somehow be artifacts of grazing. However, *Stipa neomexicana* is rated only moderate for palatability.

(I) following the species name indicates an introduced species not native to the area. Species lists are not complete.

*Stipa neomexicana* plant association (Bourgeron 1994)? G2S2?

Site Numbers: Heil 62, 102.

Site Heil 62: This grassland is dominated by *Stipa neomexicana* and *Bouteloua gracilis*. *Bouteloua hirsuta* is frequent. *Alyssum minus* is abundant but not overwhelming. There are widely scattered *Pinus ponderosa*.

Geology: Lykins Formation, Forelle Limestone Member (Plf)

Species: *Alyssum minus* (I), abundant  
*Aristida longiseta*  
*Astragalus tridactylus*  
*Bouteloua curtipendula*  
*Bouteloua gracilis*, dominant, 20-30 %  
*Bouteloua hirsuta*, frequent  
*Eriogonum alatum*  
*Gaura coccinea*  
*Gutierrezia sarothrae*  
cf *Hymenopappus filifolius*, common  
*Lygodesmia juncea*  
*Poa compressa* (I)  
*Psoralea tenuifolia*  
*Thelesperma megapotamicum*  
*Stipa neomexicana*, dominant, 2%  
*Tragia ramosa*  
*Verbascum thapsus* (I)  
*Yucca glauca*

Site Heil 102: This grassland is dominated by New Mexico feathergrass (*Stipa neomexicana*). It occurs on a gentle (10%), east-facing slope. Widely scattered *Pinus*

ponderosa and Cercocarpus montanus are present. It is surprisingly weed free given the weediness of the area to the west.

Geology: Lykins Formation, Forelle Limestone Member (Plf) and Lykins Formation, lower part (Pl1). Species:

Alyssum minus (I), trace  
Artemisia frigida  
Bromus japonicus (I), trace  
Cerastium arvense  
Delphinium cf geyeri  
Eriogonum alatum  
Gutierrezia sarothrae  
Heterotheca villosa  
cf Hymenopappus filifolius  
Linum lewisii  
Penstemon secundiflorus  
Psoralea tenuifolia  
Schizachyrium scoparium  
Townsendia sp.  
Tragia ramosa, common  
Yucca glauca

#### UNCLASSIFIED GRASSLANDS

**Site Heil 5:** This is a weedy grassland on the south-facing slope (about 50%) of a small ridge. It is dominated by Bromus japonicus and Psoralea tenuifolia with small amounts of Andropogon gerardii and Stipa comata. Elevation is about 6400 feet.

Geology: Middle and Early Proterozoic pegmatite (YXp)

Species: Agropyron smithii  
Andropogon gerardii, trace  
Bromus japonicus (I), dominant  
Dalea purpurea  
Heterotheca villosa  
Liatris punctata  
Psoralea tenuifolia, dominant  
Ratibida columnifera, common  
Stipa comata, trace

**Site Heil 76:** This is an open grassland with widely scattered Pinus ponderosa. It was observed only from a distance. It is possibly similar to Heil 74 which it is near.

**Site Heil 86:** This appears to be a high-quality grassland on the Trevarton Conservation Easement in section 6, W1/4. The site was not visited or surveyed since it is out of the survey area. It appears to be dominated by big bluestem (*Andropogon gerardii*) and/or little bluestem (*Schizachyrium scoparium*). The slope is to the west at 30%. Photo Heil 86-1 shows this plant association in the background. This may be similar to Heil 32 and 36 but in better condition.

Geology: Lykins Formation, lower part (TrPlu).

**Site Heil 94:** Possibly *Stipa comata*/*Bouteloua gracilis* grassland. It may be related to Heil 96. This grassland occupies the north and south facing slopes of a saddle. The south-facing slopes are very weedy and dominated by Japanese brome (*Bromus japonicus*). The north-facing slopes are in better condition with low sunflower (*Helianthus pumilus*) dominating. Blue flax (*Linum lewisii*) and needle-and-thread (*Stipa comata*) are very common.

Geology: Morrison Formation (Jm)

Species: *Andropogon gerardii*, trace  
*Aristida longiseta*  
*Artemisia ludoviciana*  
*Bromus japonicus* (I), dominant south slopes  
*Eriogonum alatum*  
*Helianthus pumilus*, dominant north slopes  
*Heterotheca villosa*  
*Liatris punctata*  
*Psoralea tenuifolia*  
*Schizachyrium scoparium*  
*Stipa comata*, common  
*Stipa robusta*  
*Yucca glauca*

**Site Heil 96:** This is a small, weedy grassland with much *Poa compressa* and *Heterotheca villosa*. There is a large colony of *Rhus trilobata*. Slope is about flat.

Geology: Morrison Formation (Jm) and Lykins Formation, lower part (TrPlu).

Species: *Ambrosia psilostachya*  
*Andropogon gerardii*  
*Calochortus gunnisonii*

Chrysothamnus nauseosus graveolens  
Dalea purpurea  
Geranium fremontii  
Gutierrezia sarothrae  
Heterotheca villosa, dominant  
Poa compressa, dominant  
Poa pratensis  
Rhus trilobata  
Stipa comata  
Thelesperma megapotamicum, common

## WEED FIELDS

These are areas dominated by exotic weeds with no native species dominant. They cannot with any reliability be assigned to any plant association. Notes as to possible relationships are indicated where possible.

(I) following the species name indicates introduced species not native to the area. Species lists are not complete.

Site Numbers Heil 4.5, 19, 31.5, 48, 50, 54, 56, 64, 84, Trev 109.

**Site Heil 4.5:** This area is adjacent to Heil 4 to the south and Heil 10 to the north. It is entirely dominated by chicory (*Cichorium intybus*), a European weed. Native species are essentially absent. This area of about 45 acres is in extremely poor condition. It may be the worst condition area in the survey area. Soils and geology suggest that the potential vegetation is probably the same as Heil 4 or Heil 10 although neither of these is in great condition either.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Agropyron* (*Pascopyrum*) *smithii*, trace  
*Artemisia ludoviciana*  
*Bromus japonicus* (I)  
*Bromus tectorum* (I)  
*Buchloe dactyloides*, only several sq.m.  
*Cichorium intybus* (I), dominant  
*Eriogonum aviculare* (I)  
*Juncus bufonius*, along road  
*Juncus interior*  
*Poa pratensis* (I), subdominant

**Site Heil 19:** This is a small weedy meadow dominated by Canada bluegrass (*Poa compressa*) and Kentucky bluegrass (*Poa pratensis*). It occurs on a moderate (20%), east-facing slope. It is possibly the *Pascopyrum smithii*/*Bouteloua gracilis* plant association.

Geology: Fountain Formation (PPf)

Species: *Agropyron smithii*  
*Alyssum minus* (I)  
*Bouteloua gracilis*, trace  
*Carduus nutans* (I)

Carex sp.  
Convolvulus arvensis (I)  
Gutierrezia sarothrae  
Heterotheca villosa  
Lupinus cf argenteus  
Poa compressa (I), common  
Poa pratensis (I), common  
Psoralea tenuifolia  
Stipa viridula  
Thermopsis montana

**Site Heil 31.5:** This is an infestation of klamath weed (Hypericum perforatum).

**Site Heil 48:** This is a small, weedy meadow dominated by Kentucky bluegrass (Poa pratensis).

Geology: Fountain Formation (PPf)

Species: Agropyron smithii, 5-10%  
Ambrosia psilostachya, dominant  
Andropogon gerardii, infrequent  
Aristida longiseta, trace  
Aster porteri  
Aster sp.  
Bouteloua gracilis  
Bromus japonicus (I), common  
Carex sp., not Carex heliophila  
Carduus nutans (I), trace  
Geranium fremontii  
Heterotheca villosa  
Juncus interior  
Lactuca serriola (I)  
Liatris punctata  
Lupinus sp.  
Poa pratensis (I), dominant, 50-70%  
Rosa sayi  
Stipa comata, trace  
Tragopogon dubius (I)  
Verbascum thapsus (I)

**Site Heil 50:** This is a small weedy meadow.

Species: Agropyron smithii  
Aster porteri  
Carduus nutans (I)  
Phleum pratense (I)  
Poa compressa (I)

**Site Heil 54:** This is a large colony of *Carduus nutans*.

Geology: Quaternary colluvium and alluvium (Qc)

**Site Heil 56:** This is a large, weedy meadow dominated by *Poa compressa* and *Poa pratensis*. There are the remains of several structures which were inhabited when the large stone quarry adjacent to the meadow was active.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Achillea lanulosa*  
*Acosta diffusa* (I), rare along road  
*Ambrosia psilostachya*  
*Artemisia frigida*  
*Carduus nutans* (I), abundant around buildings  
*Eriogonum aviculare*  
*Grindelia squarrosa*  
*Juncus interior*  
*Paronychia jamesii*  
*Poa compressa* (I), dominant, 50%  
*Poa pratensis* (I), dominant, 40%  
*Rumex* sp. (I)  
*Townsendia* sp.

**Site Heil 64:** This is a small, flat meadow dominated by Canada bluegrass (*Poa compressa*).

Geology: Quaternary colluvium and alluvium (Qc).

Species: *Agropyron smithii*  
*Ambrosia psilostachya*  
*Andropogon gerardii*, about 1%  
*Bromus japonicus* (I)  
*Carduus nutans* (I)  
*Heterotheca villosa*  
*Liatris punctata*  
*Pinus ponderosa*, scattered in dense stands  
*Poa compressa* (I), dominant, 90% cover  
*Poa pratensis* (I)  
*Psoralea tenuifolia*

**Site Heil 84:** This is a small, flat, weedy meadow dominated by Canada bluegrass (*Poa compressa*). Typical *Pinus ponderosa*/*Carex heliophila* occurs on mid-slope to the north. The area to the west is similar but weedy.

Geology: Lyons Sandstone (Ply)

Species: Ambrosia psilostachya  
Aristida longiseta  
Artemisia frigida  
Bromus japonicus (I)  
Carduus nutans (I)  
Erigeron sp.  
Gutierrezia sarothrae  
Juncus cf arcticus ssp. ater  
Linaria dalmatica (I)  
Poa compressa (I), dominant  
Poa pratensis (I)  
Psoralea tenuifolia  
Stipa comata  
Thermopsis montana

**Site Heil 101:** This is a major stand of musk thistle (Carduus nutans).

Geology: Lyons Sandstone (Ply) and Lykins Formation, Forelle Limestone Member (Plf)

**Site Heil 103:** This is a major stand of musk thistle (Carduus nutans) and mullein (Verbascum thapsus).

Geology: Lyons Sandstone (Ply)

**Site Trev 109:** This is a weed field dominated by exotic and early seral species. It is at the base of the east side of the Dakota hogback. It has probably been heavily grazed by horses.

Geology: mostly South Platte Formation, middle shale member (Ksm).

Species: Alyssum minus (I), dominant  
Aristida longiseta, dominant  
Artemisia frigida  
Bromus japonicus (I)  
Convolvulus arvensis (I)  
Dalea purpurea  
Evolvulus nuttallianus  
Gutierrezia sarothrae  
Heterotheca villosa  
Psoralea tenuifolia  
Schedonnardus paniculatus

Tragia ramosa  
Yucca glauca

**Site Trev 119:** This is a small, weedy meadow dominated by Kentucky bluegrass (*Poa pratensis*). There is a small amount of big bluestem (*Andropogon gerardii*), 1-2%.

Geology: Plainview sandstone member of the South Platte Formation and Lytle Formation, undivided (Kspl)

Species: *Ambrosia psilostachya*  
*Andropogon gerardii*, 1-2%  
*Artemisia ludoviciana*  
*Aster porteri*  
*Bouteloua curtipendula*  
*Dichanthelium acuminatum*  
*Elytrigia repens* (I)  
*Hypericum perforatum* (I), rare  
*Poa compressa* (I)  
*Poa pratensis* (I), dominant  
*Psoralea tenuifolia*  
*Ratibida columnifera*  
*Rhus trilobata*, scattered  
*Schizachyrium scoparium*  
*Stipa viridula*

## WETLANDS

### AGROSTIS GIGANTEA SERIES

These are highly disturbed wetlands dominated by redbtop (*Agrostis gigantea*), an introduced species. Bourgeron classifies them as anthropogenic plant associations. Other introduced species are also often present.

(I) following the species name indicates introduced species not native to the area. Species lists are not complete.

#### Agrostis gigantea plant association (Bourgeron 1994)

Site numbers: Heil 4.2, 9.5, 42, 108.

**Site Heil 4.2:** This is a small, weedy, spring-fed wetland on a gentle south-facing slope. It is dominated by *Agrostis gigantea*. It is badly trampled. A large toad was observed in this wetland and tadpoles were seen in the wetland to the north so toads are living and breeding in the area.

Geology: Contact between Quaternary colluvium and alluvium (Qc) and Fountain Formation (PPf).

Species: *Agrostis gigantea* (I), dominant  
*Carex nebrascensis*  
*Glyceria striata*  
*Juncus* sp.  
cf *Lycopus* sp. (I)  
*Veronica* cf *catenata*

**Site Heil 9.5:** This is a small spring with a wetland below. A pipe has been inserted into the spring and the area is badly trampled. *Agrostis gigantea* dominates and other exotic species are present. *Carex nebrascensis* is dominant in the wetter parts, especially below. The wetland is somewhat incised and active erosion may be occurring. There are a few shallow pools containing water starwort (*Callitriche verna*). At least one of the pools contained tadpoles. Elevation 6350 feet.

Geology: The spring is in the Fountain Formation (PPf); the wetland below is on the contact between Quaternary colluvium and alluvium (Qc) and the Fountain Formation (PPf).

Species: *Agrostis gigantea* (I), dominant  
*Carex nebrascensis*, dominant  
*Callitriche verna*  
*Cichorium intybus* (I)  
*Glyceria striata*  
*Glycyrrhiza lepidota*  
*Juncus arcticus* ssp. *ater*  
*Juncus interior*  
*Juncus* cf *saximontanus*  
*Phleum pratense* (I)  
*Polygonum* sp.  
*Prunella vulgaris* (I)  
*Scirpus* sp.  
*Trifolium pratensis* (I)  
*Trifolium repens* (I)  
*Trifolium* sp. (I)

**Site Heil 42:** This wetland is below a spring that emerges from a small cave. There is no vegetation in the spring but the stream below has *Agrostis gigantea* and *Glyceria striata*. This appears to be a perennial spring with a strong flow. A prairie rattlesnake (*Crotalus viridis*) was observed at the spring. It may reside in the large, adjacent prairie dog town.

The prairie dog town a short distance to the west is a serious weed field. Noxious weeds present are *Carduus nutans* (major amount), *Convolvulus arvensis*, and *Linaria dalmatica*. Also present are *Poa compressa* and *Stipa robusta*.

Geology: The spring is probably at the contact between Quaternary colluvium and alluvium (Qc) and the Lykins Formation, lower part (TrPlu). Elevation is 5680 feet.

**Site Heil 108:** This is a weedy wetland dominated by *Agrostis gigantea* with *Eleocharis* subdominant. It occurs in a disturbed area in Geer Canyon at an elevation of about 6150 feet.

Geology: Quaternary colluvium and alluvium (Qc)

Species: *Agrostis gigantea* (I), dominant  
*Bidens* sp.  
*Carex nebrascensis*  
*Cichorium intybus* (I)  
*Eleocharis* sp., subdominant  
*Epilobium ciliatum*

Festuca pratensis (I)  
Juncus arcticus ssp. ater  
Juncus cf torreyi  
Mentha arvensis (I)  
Mimulus cf guttatus  
Phleum pratense (I)  
Prunella vulgaris (I)  
Scirpus americana  
Trifolium repens (I)  
Verbena hastata  
Verbascum thapsus (I)

**ELEOCHARIS SP. SERIES**

**Site Heil 82:** This is a small, rocky, intermittent wetland near the top of the Lyons hogback. Spikerush (*Eleocharis* sp.) and water plantain (*Alisma triviale*) dominate. This is a logged area but apparently a natural wetland.

There is a large stand of *Linaria dalmatica* about 200 yards northeast of this wetland near the high point of the ridge.

Geology: Lyons Sandstone (Ply)

Species: *Alisma triviale*, dominant  
cf *Coreopsis tinctoria*  
*Eleocharis* sp., dominant  
*Juncus* sp.

**Andropogon gerardii Series**Andropogon gerardii-Schizachyrium scoparium

Sites A, Ab, F, Y

Site Hall A: This site is on a east facing rocky slope. The vegetation is characterized by many tallgrass prairie species and would be classified as the Andropogon gerardii-Schizachyrium scoparium plant association. The area is heavily invaded by exotic species and there are numerous rock quarries within the occurrence.

Species:

Andropogon gerardii

Schizachyrium scoparium

Stipa comata

Opuntia

Dalea purpurea

Eriogonum alatum

Artemisia frigida

Bromus tectorum

Bromus japonicus

Linaria dalmatica

Ambrosia psilostachya

Alyssum minus

Heterotheca vilosa

Lycurus phleoides

Geranium sp.

Psoralea tenuiflora

Liatris punctata

Thelesperma megapotamica

Sorghastrum nutans

Hall Site Ab: The site is located on an east facing slope and is very rocky. The vegetation was classified as the Andropogon gerardii-Schizachyrium scoparium plant association. The occurrence is heavily invaded by Bromus tectorum and Bromus japonicus. This occurrence was originally documented in 1992 and described as being relatively weed free but appears to have been further degraded.

Species:

similar to Hall Site A

Hall Site F: The site is located in a draw between two small mesas. There are stands of Andropogon gerardii and the vegetation is similar to Hall Site A except there is very little Schizachyrium scoparium. Bromus tectorum and Bromus japonicus are very abundant. Rhus trilobata is a common associate on steeper slopes.

Species:  
similar to Hall Site A

Hall Site Y: Small patches (< 1 acre) of the Andropogon gerardii-Schizachyrium scoparium plant association occur in this area. Some of these patches were much less weedy than others found at the Hall Ranch.

### **Pinus ponderosa Series**

Pinus ponderosa/unknown

Hall Site V: This site is characterized by sparse to dense stands of Pinus ponderosa on steep slopes.

(Pinus ponderosa/Rhus trilobata)/Andropogon gerardii

Hall Site B: The site is characterized by open stands of Pinus ponderosa with scattered Rhus trilobata. Bromus tectorum and Bromus japonicus dominate the understory.

Species:  
Pinus ponderosa  
Rhus trilobata  
Bromus tectorum  
Bromus japonicus  
Ambrosia psilostachya  
Lycurus phleoides  
Andropogon gerardii  
Schizachyrium scoparium  
Stipa comata

Pinus ponderosa/Carex heliophila

Sites L, BB, CC

Hall Site L: The site is dominated by young, dense Pinus ponderosa and the understory is sparse. The vegetation appears

similar to that reported by Johnston (1987) in the Pinus ponderosa/Carex heliophila plant association. Evidence of past logging (stumps) is present.

Species:

Pinus ponderosa  
Juniperus scopulorum  
Carex sp.  
Ribes cf. cereum  
Allium sp.  
Elymus sp.

Hall Site BB: The site is dominated by Pinus ponderosa with a mixture of Leucopoa kingii and Carex in the understory.

Species:

Pinus ponderosa  
Leucopoa kingii  
Carex sp.  
Artemisia frigida  
Artemisia ludoviciana  
Purshia tridentata  
Drymocallis cf. fissa  
Eriogonum umbellatum  
Muhlenbergia montana  
Campanula rotundifolia  
Allium sp.  
Pseudotsuga menziesii

Hall Site CC: The site is dominated by Pinus ponderosa and appears to be similar to Hall Site BB. Purshia tridentata is more common on tops of hills and on southerly slopes where Juniperus scopulorum is less common.

Pinus ponderosa/Purshia tridentata

Site GG

Hall Site GG: The site is dominated by Pinus ponderosa with some Pseudotsuga menziesii on more east facing slopes. Windthrown trees are numerous and some are large. Pseudotsuga menziesii is becoming more dominant.

Species:

Pinus ponderosa  
Pseudotsuga menziesii  
Leucopoa kingii  
Elymus lanceolatus x Pseudoroegneria spicata

Carex sp.  
Artemisia ludoviciana  
Koeleria macrantha  
Geranium cespitosa  
Aster porterii  
Cystopteris montanus  
Heterotheca vilosa  
Artemisia frigida  
Purshia tridentata  
Drymocallis cf. fissa  
Eriogonum umbellatum  
Muhlenbergia montana  
Campanula rotundifolia  
Allium sp.  
Juniperus communis  
Elymus elymoides

Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii

Sites C, Ja, N

Hall Site C: The site is dominated by Pinus ponderosa with Cercocarpus montanus in the understory. The site is very weedy and has only sparse cover of the tallgrass species.

Species:

Pinus ponderosa  
Cercocarpus montanus  
Bromus tectorum  
Bromus japonicus  
Linaria dalmatica  
Andropogon gerardii  
Schizachyrium scoparium  
Stipa comata  
Aristida purpurea  
Bouteloua curtipendula  
Lycurus phleoides

Site Hall Ja: The site is dominated by Pinus ponderosa with sparse Cercocarpus montanus in the understory. The site is very weedy but has significant cover of the tallgrass species including some Panicum virgatum. There is little evidence of Pinus ponderosa regeneration.

Species:

Pinus ponderosa  
Cercocarpus montanus  
Bromus tectorum  
Bromus japonicus  
Linaria dalmatica  
Andropogon gerardii  
Schizachyrium scoparium  
Stipa comata  
Lycurus phleoides

Site Hall N: The site is dominated by Pinus ponderosa with Cercocarpus montanus in the understory. The site is very weedy but has significant cover of the tallgrass species. There are various age classes of Pinus ponderosa and some signs of regeneration.

Species:

Pinus ponderosa  
Cercocarpus montanus  
Rhus trilobata  
Bromus tectorum  
Bromus japonicus  
Linaria dalmatica  
Poa compressa  
Andropogon gerardii  
Schizachyrium scoparium  
Stipa comata  
Lycurus phleoides

Pinus ponderosa/Cercocarpus montanus

Sites E, K, P, R, AA

Hall Site E: The site is dominated by open Pinus ponderosa and Cercocarpus montanus. The understory is dominated by exotic species.

Hall Site K: The site is dominated by Pinus ponderosa with some Cercocarpus montanus and Juniperus scopulorum. This type seems similar to the Pinus ponderosa/Cercocarpus montanus plant association reported by Johnston (1987).

Hall Site P: The site is dominated by Pinus ponderosa with some Cercocarpus montanus, Juniperus scopulorum and Purshia tridentata. The site is heavily invaded by exotic species. This

type seems similar to the Pinus ponderosa/Cercocarpus montanus plant association reported by Johnston (1987).

Species:

Pinus ponderosa  
Juniperus scopulorum  
Cercocarpus montanus  
Purshia tridentata  
Stipa comata  
Bromus tectorum  
Bromus japonicus  
Alyssum minus  
Linaria dalmatica

Hall Site R: The site is dominated by Pinus ponderosa, Cercocarpus montanus, and Stipa comata. Bromus tectorum is very abundant.

Hall Site X: The site is dominated by Pinus ponderosa and Cercocarpus montanus. The understory is dominated by exotic grasses.

Species:

Pinus ponderosa  
Cercocarpus montanus  
Purshia tridentata  
Bromus tectorum  
Bromus japonicus  
Carex sp.  
Artemisia frigida  
Opuntia sp.  
Linaria dalmatica  
Muhlenbergia montana  
Andropogon gerardii

Hall Site AA: The site is dominated by Pinus ponderosa with Cercocarpus montanus and scattered Purshia tridentata. Evidence of past logging is present. This type seems to be a transitional stand similar to the Pinus ponderosa/Purshia tridentata and Pinus ponderosa/Cercocarpus montanus plant associations reported by Johnston (1987).

Species:

Pinus ponderosa  
Cercocarpus montanus

Purshia tridentata  
Heterotheca vilosa  
Linaria dalmatica  
Geranium cespitosum  
Carex sp.  
Artemisia frigida  
Opuntia polyacantha  
Juniperus scopulorum  
Ribes cereum  
Leucopoa kingii  
Elymus spicatus spp. lanceolatus

Pinus ponderosa/Juniperus scopulorum

Sites T

Hall Site T: The site is located on steep, rocky slopes and ridges. The vegetation consisted of scattered Pinus ponderosa and Juniperus scopulorum with a very sparse understory.

Pinus ponderosa-Pseudotsuga menziesii/Muhlenbergia montana

Sites U

Hall Site U: The site is dominated by uneven aged Pinus ponderosa with Artemisia frigida, Muhlenbergia montana, and a Carex species common in the understory. Linaria dalmatica is very common. Evidence of past logging is present.

Species:

Pinus ponderosa  
Pseudotsuga menziesii  
Artemisia frigida  
Carex sp.  
Muhlenbergia montana  
Heterotheca vilosa  
Linaria dalmatica  
Juniperus scopulorum  
Juniperus communis  
Purshia tridentata  
Eriogonum effusum  
Ribes sp.  
Stipa comata

Geranium cespitosum

Pinus ponderosa/Leucopoa kingii

Site DD

Hall Site DD: This site is a small patch dominated by Pinus ponderosa with Leucopoa kingii in the understory. This site is near the top of a small ridge on a north slope. The patches are usually less than 1 acre and intergrade with Pinus ponderosa/Carex sp.

### **Cercocarpus montanus Series**

Cercocarpus montanus/Stipa comata

Site G

Hall Site G: The site is dominated by Cercocarpus montanus with a sparse understory dominated by Stipa comata. Bromus tectorum is common. This plant association occurs in a mosaic of several others listed below.

Cercocarpus montanus/Stipa scribneri

Site G

Hall Site G: The site is dominated by Cercocarpus montanus with a sparse understory dominated by Stipa scribneri. Bromus tectorum is common. This plant association occurs in a mosaic of other Cercocarpus montanus plant associations listed under Site G.

Cercocarpus montanus/Stipa neomexicana

Site G

Hall Site G: The site is dominated by Cercocarpus montanus with a sparse understory dominated by Stipa neomexicana. Bromus tectorum is common. This plant association occurs in a mosaic of other Cercocarpus montanus plant associations listed above.

### **Stipa comata Series**

Stipa comata-Bouteloua gracilis

Sites M, Tb

Hall Sites M and Tb: The sites are scattered across the entire study area. The vegetation is generally dominated by Stipa comata with Poa pratensis, Koeleria macrantha, Carex sp., Bouteloua gracilis, Bromus tectorum, Bromus japonicus, Heterotheca vilosa, Aristida purpurea, and Artemisia frigida common throughout. This grassland is heavily invaded by exotic and weedy native species. This seems to be a heavily degraded example of the Stipa comata-Bouteloua gracilis plant association reported by Johnston (1987).

Species:

Stipa comata

Poa pratensis

Carex sp.

Heterotheca vilosa

Bromus tectorum

Bromus japonicus

Bouteloua gracilis

Koeleria macrantha

Aristida purpurea

Artemisia frigida

Pascopyron smithii

Erigeron sp.

Linaria dalmatica

Liatris punctata

Tragapogon dubius

Alium textile

Lupinus sp.

Yucca glauca

Delphinium sp.

Populus angustifolia-Salix amygdaloides/Salix exigua

Site EE

Hall Site EE: This vegetation type occurs as small patches on streams on the eastern side of the Hall Ranch. The vegetation is characterized by narrow stands of Populus angustifolia with some Salix amygdaloides and Salix exigua. The understory is dominated by exotic and weedy native species.

Species:

Populus angustifolia

Salix amygdaloides

Salix exigua

Agrostis stolonifera  
Trifolium sp.  
Chrysothamnus nauseosus  
Bromus tectorum  
Bromus japonicus  
Verbascum thapsus

Hall Site II: This riparian area south of HWY 7 has been heavily altered by grazing, streambank alteration, and road building. Populus angustifolia is common in various densities. In some patches Salix exigua is common in the understory. Alnus incana, Betula occidentalis, Prunus virginiana, and Crataegus occasionally form dense thickets. Scattered Pinus ponderosa and Juniperus scopulorum also occur.

The following sites are dominated by exotic species or native weedy species.

Site D - Conyza canadensis, Verbascum thapsus, Jim Hill mustard, prickly poppy, active prairie dog town.

Site H - Planted hay meadow with Bromus inermis and Agropyron cristatum.

Site I - Very weedy stand of Andropogon gerardii with dense Bromus japonicus and B. tectorum.

\*Site Jb - remnants of Andropogon gerardii-Schizachyrium scoparium with dense Bromus japonicus and B. tectorum. Included in Site A, occurs at the western end of Site A.

Site O - Centaurea sp. along old road. Salix amygdaloides/Salix exigua with weedy understory (Agrostis cf. stolonifera) and Carex nebrascensis?. Grasslands are very weedy to the west with dense Bromus tectorum, B. japonicus, and Carduus nutans.

Site Q - Appears to be an old hay meadow. A lot of Agropyron cristatum, Poa compressa, and Aristida purpurea.

Site S - Weedy meadow with a lot of Bromus tectorum, B. japonicus, Chrysothamnus nauseosus, Trifolium sp., Gutierrezia sarothrae, and Poa compressa.

East of fence - degraded grasslands with a lot of Verbascum thapsus, Linaria dalmatica, Bromus tectorum, Carduus nutans, Chrysothamnus nauseosus.

Site W - Centaurea diffusa, Bromus japonicus, Chrysothamnus nauseosus along road toward ranch.

Site Z - Weedy grassland with a lot of Artemisia frigida, Poa pratensis, Heterotheca villosa, Linaria dalmatica. Probably a degraded Stipa comata-Bouteloua gracilis stand. Appears to have been heavily grazed in the recent past (within the last 2-3 years).

Site FF - dense Bromus tectorum and B. japonicus.

MAPS OF COMMUNITIES AND EXOTIC PLANT CONCENTRATIONS