Range Plant Communities and Range Health Assessment Guidelines for the

Northern Fescue Natural Subregion of Alberta




Northern Fescue

Range Plant Community Guide

RANGE PLANT COMMUNITIES AND RANGE HEALTH ASSESSMENT GUIDELINES FOR THE NORTHERN FESCUE NATURAL SUBREGION OF ALBERTA

Second approximation

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2019

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Table of Contents

List of Figures

List of Tables

Executive Summary

The Northern Fescue Natural Subregion is a diverse subregion in east-central Alberta. The ecological diversity of this subregion creates a landscape that consists of a mosaic of different vegetative communities including a mixture of grasslands, wetlands, shrublands, and forests. This diversity means that these lands are valuable for multiple uses, including summer range for livestock, habitat for many species of wildlife, industrial use (mainly oil and gas), and recreation. Community guides and Ecologically Sustainable Stocking Rates (ESSR) have been developed for each natural subregion in the province to provide a framework for classification and assessment of plant communities. This classification system is designed to be used by field staff to assess carrying capacity and evaluate range health on lands within each subregion.

The second approximation addresses the most common grasslands and shrubland plant communities in the Northern Fescue. This guide represents the analysis of 664 plots described in the Northern Fescue Natural Subregion, in which 51 plant communities are presented. These plant community types are split into:

A. Native grasslands (32 types)

B. Tame/modified grasslands (2 types)

C. Native shrublands (13 types)

D. Native deciduous forests (4 types)

Dominant plant species, canopy cover, environmental characteristics, and response to disturbance are outlined for each type.

Acknowledgements

First Approximation:

The Rangeland Health Assessment Project was initiated in January 1999. Its purpose was to coordinate the development of rangeland health assessment methods and ecological site descriptions for both forested and grassland dominated rangelands in the province and transfer the new technology (awareness, information and tools) to livestock producers, staff and other stakeholders. This document "Range plant communities and range health assessment guidelines for the Northern Fescue Natural Subregion of Alberta, 1st approximation" is a compilation of the range site, ecological range site, and plant community information from the website.

Thanks to Varge Craig (Alta Rangeland Services Ltd.) and Alberta Environment and Parks (AEP) range agrologists; Harry Loonen, Tanya Silzer, and Felix Gebbink whose insight of the Northern Fescue helped us build the Range Site table and whose expertise provided important information on plant communities in the subregion.

Second Approximation:

Thanks to Felix Gebbink and Zoey Zapisocki (AEP range agrologists), Nolan Ball and Nicole Viste (agrologists for Special Areas), and Barry Adams who provided insight on the Northern Fescue ecosystem and specific data gaps for development of the second approximation of this guide. The Special Areas Board generously provided vegetation inventory data for unaddressed gap communities which has been incorporated into this second approximation. Thanks also to Ed Karpuk and Carly Moore (AEP) for assistance with soil and vegetation sampling.

Finally, thanks to Nolan Ball, Bryne Wyrstra, Amanda J. Miller, Felix Gebbink, and Barry Adams for providing review comments on draft versions of this second approximation.

1.0 Introduction

The province of Alberta is covered by a broad spectrum of vegetation regions from prairie in the south, to alpine vegetation in the mountains and dense forests in the central and northern parts of the province. Alberta has been classified into six natural regions and 20 subregions (Natural Regions Committee 2006). Within each subregion, there are groups of plant communities which exist under similar, localized, environmental conditions and can be further influenced by human activities. Sustainable management of these subregions requires an understanding of the ecology of the site as well as the ability to recognize plant communities that have similar productivity and response to disturbance.

Vegetative communities in the province of Alberta are highly regarded by resource managers for their ability to provide a wide variety of benefits. Plant communities can provide summer range for livestock, habitat for many species of wildlife, productive watersheds and recreational areas.

The purpose of this guide is to develop a framework that groups plant community types in the Northern Fescue Natural Subregion with ecologically sustainable stocking rate information. Plant communities are grouped into a hierarchal system based on ecological factors such as soils and topography. These groupings include successional communities which occur under natural succession or disturbance such as fire, grazing or human disturbance. Known successional relationships among communities are described in detail within this guide in table format.

This classification system can be used by field users to assess rangeland health and function, and to assign sustainable stocking rates for sites in order to develop management prescriptions within each subregion.

2.0 Overview

The Northern Fescue Natural Subregion is one of four Natural Subregions in the Grassland Natural Region (Achuff 1994), along with the Mixedgrass, Dry Mixedgrass, and Foothills Fescue (Figure 1). The Northern Fescue Natural Subregion occurs in east-central Alberta, in an arc trending northeast from the Drumheller region to the Saskatchewan border. It is transitional between the Dry Mixedgrass Natural Subregion to the south and the Central Parkland to the north. The Northern Fescue accounts for 25.5% of the Grassland Natural Region area and 3.7% of the area of Alberta (ASIC 2001).

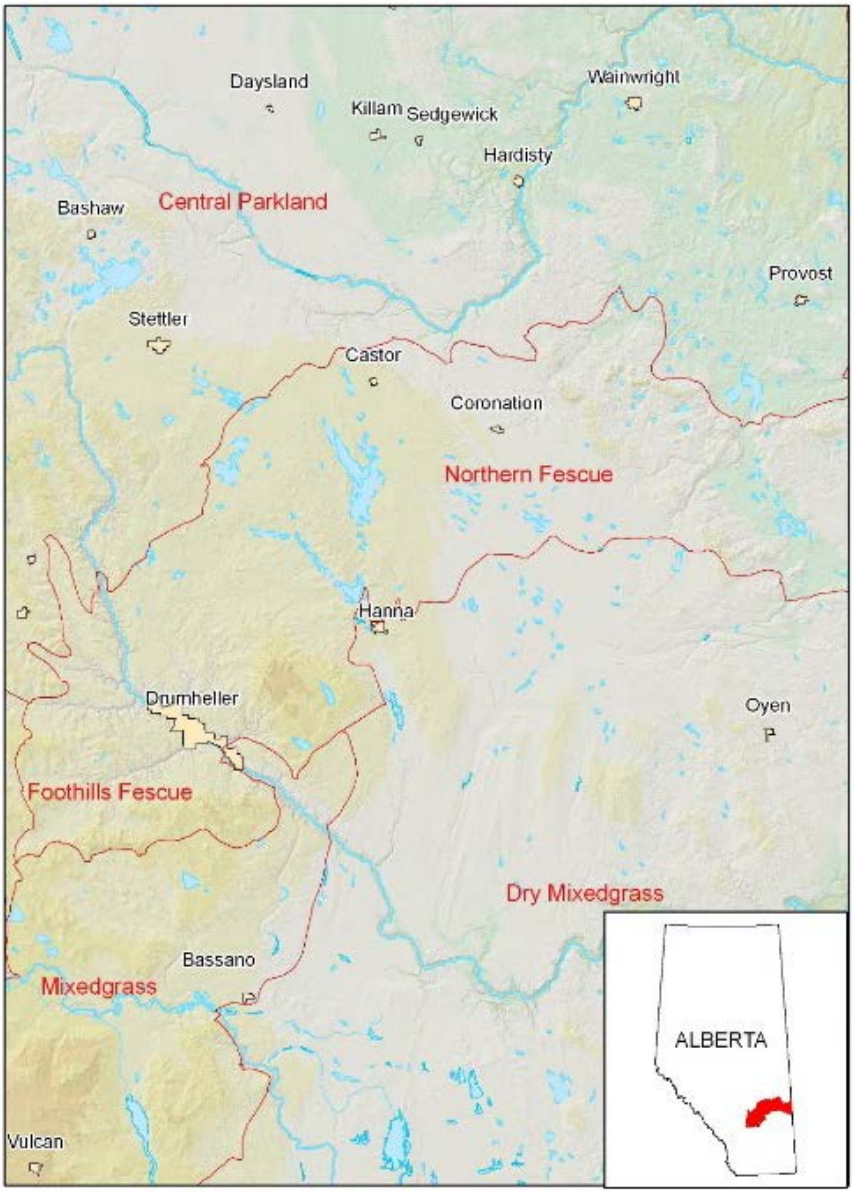

Figure 1: The Northern Fescue and surrounding Natural Subregions portrayed with a hillshade effect.

The Northern Fescue Natural Subregion is dominated by Dark Brown Chernozemic soils (Table 1). Parent materials are dominantly glacial till, but also include glaciofluvial, eolian, and lacustrine materials.

Table 1. Key distinguishing features of the Northern Fescue Natural Subregion compared with neighbouring Natural Subregions.

Natural Subregion	Dominant Soils	Dominant Vegetation	General Climate compared to Northern Fescue
Northern Fescue	Dark Brown Chernozemic and Dark Brown Solonetzic	Plains Rough Fescue	Cold, continental, dry, few chinooks
Mixedgrass	Dark Brown Chernozemic	Wheat grasses and Needle and Thread grass	Moister and warmer; far more subject to chinooks.
Dry Mixedgrass	Brown Chernozemic and Dark Brown Solonetzic	Blue grama and Needle and Thread grass	Drier, warmer summers; more subject to chinooks.
Foothills Fescue	Black Chernozemic	Foothills Rough Fescue	Moister; less evaporation; far more subject to chinooks. Higher frequency of snowfall in late winter and early spring (Achuff 1994).
Central Parkland	Black Chernozemic	Plains Rough Fescue and Aspen groves	Higher precipitation and lower evaporation. Similar temperatures.

The Northern Fescue Subregion is described in the Alberta Regions of Alberta Soil Information Database (AGRASID) (ASIC 2001) as being within Soil Correlation Area (SCA) 4 (Figure 2). The majority of SCA4 is located within the Northern Fescue Natural Subregion. In relation to SCA numbers, the values #1, #3, and #4 in Figure 2 are Soil Correlation Areas, and the area highlighted in red is the Northern Fescue Natural Subregion. Numbers 1 and 3 correlate to the Dry Mixedgrass and Mixedgrass Natural Subregion, respectively and #6 is the Foothills Fescue Natural Subregion.

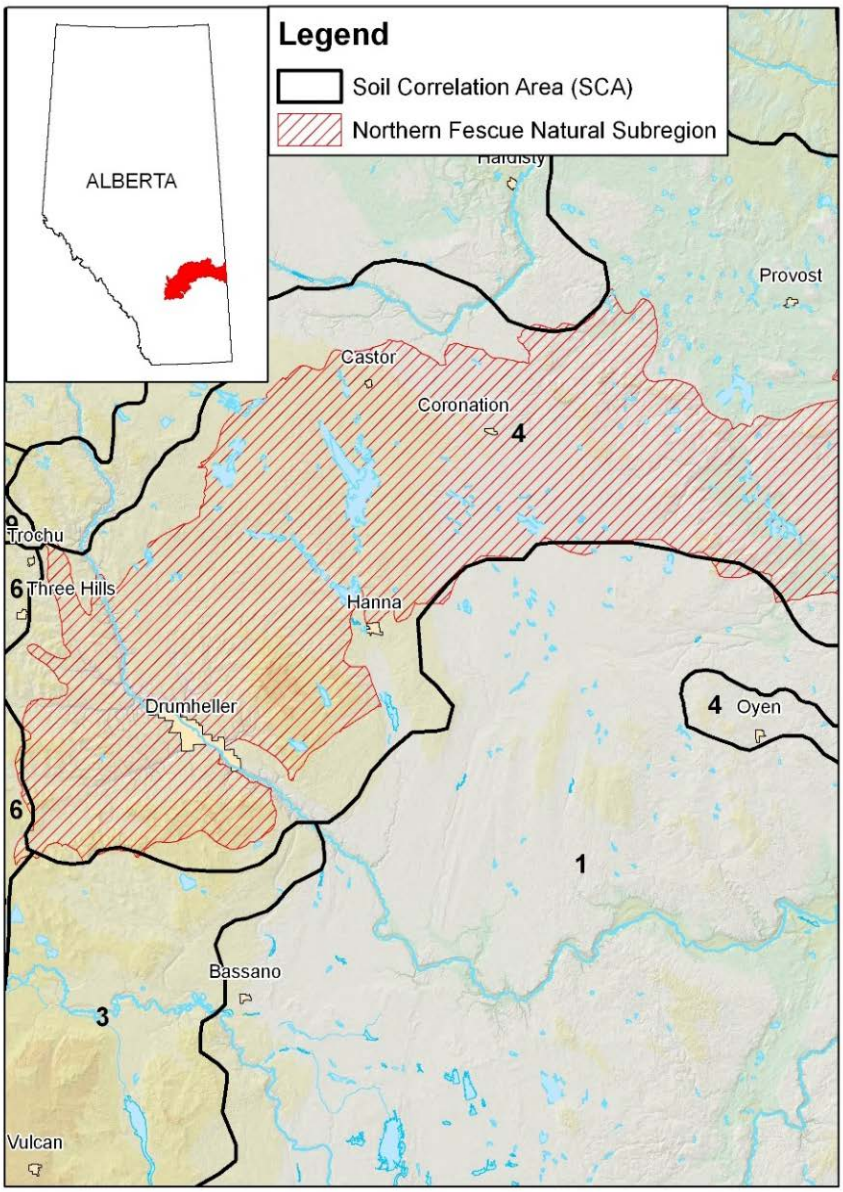

Figure 2. Northern Fescue Natural Subregion in east-central Alberta in relation to Soil Correlation Areas.

AGRASID further delineates each subregion into Ecodistricts. A total of six Ecodistricts are described for the subregion, as wellas an additional outlier near Oyen. The Ecodistricts are: Drumheller Plain, Wintering Hills, Endiang Upland, Castor Plain, Sullivan Lake Plain and Neutral Hills. These six Ecodistricts are identified in AGRASID 3.0 and depicted in Figure 3 (ASIC 2001) (Nikiforuk et al. 1994).

The additional outlier is an isolated highland near Oyen that is surrounded by the Dry Mixedgrass Natural Subregion, called the Benton Upland (which is the delineated area at Oyen shown in Figure 2).

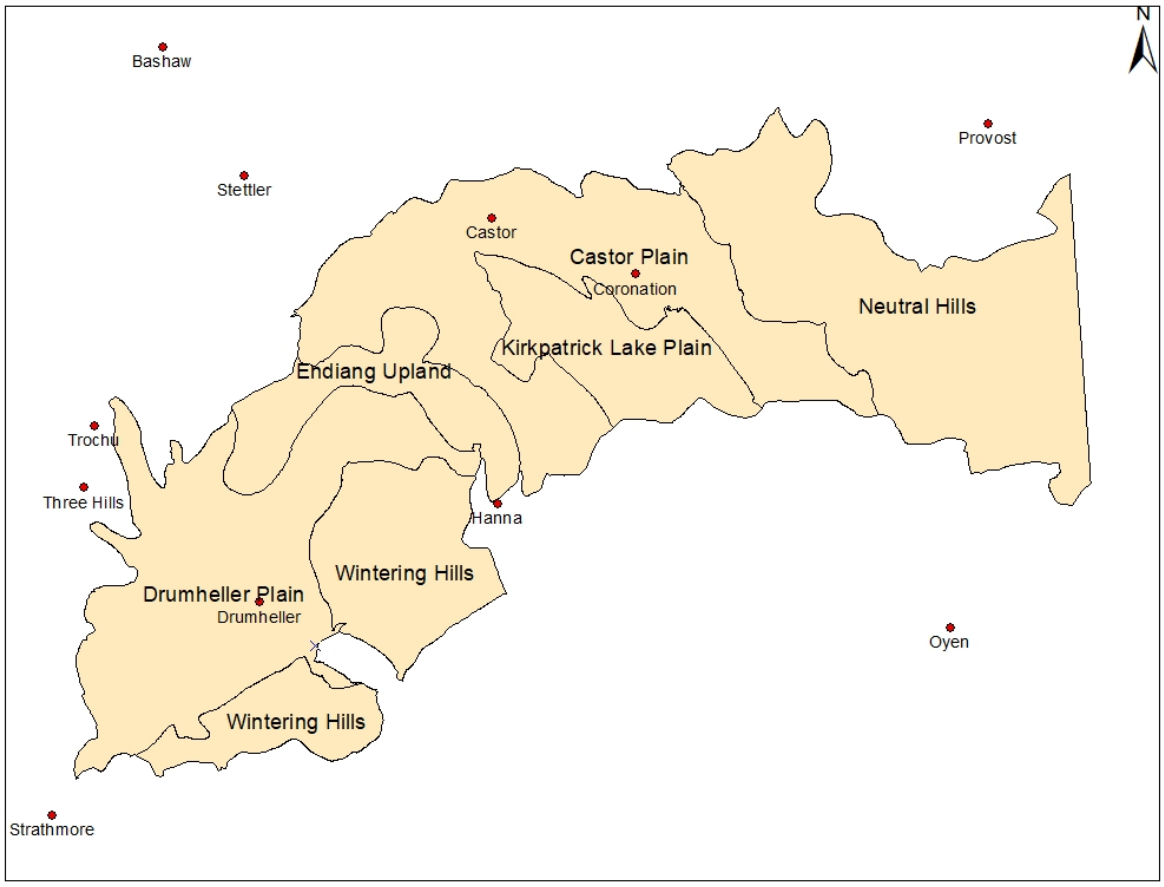

Figure 3. Ecodistricts in the Northern Fescue Natural Subregion.

The Red Deer and Battle Rivers are the major watersheds within the Northern Fescue Natural Subregion. The Red Deer River flows south joining up with the South Saskatchewan River inside the Saskatchewan border. The Battle River flows north, eventually joining up with the North Saskatchewan River further into Saskatchewan. Portions of the Castor, Sullivan Lake, and the Neutral Hills Ecodistricts drain to an internal basin in Saskatchewan via Sounding Creek.

Topography on the plains Ecodistricts is dominantly undulating, while upland Ecodistricts, including the Endiang and Benton Uplands, are dominated by moderate-relief hummocky landscapes. Hill Ecodistricts, including the Neutral Hills and the Wintering Hills, are dominated by rolling and inclined bedrock-controlled landscapes. The central region plains of the Northern Fescue (Castor and Sullivan Lake Plains) are characterized by thin surficial deposits over bedrock. The Drumheller Plain is dominated by glaciolacustrine materials. Each of the seven noted Ecodistricts are described in more detail following Table 4.

Furthermore, there are two Ecodistricts, the Provost and Ribstone (Edgerton) Plains,

which represent a transition between the Northern Fescue and Central Parkland Natural Subregion. The Provost and Ribstone Plains belong to the Dark Brown soil zone, similar to the rest of the Northern Fescue and are distinct from the Black soils of the Central Parkland. However, they are characterized by Central Groveland vegetation (Strong and Leggat 1992; Walker and Wang 1994), which represents a transition between the vegetation of the Northern Fescue and the Central Parkland to the north.

These two Central Groveland Ecodistricts, which extend from Sounding Creek and Bodo north to the Wainwright area, have been treated differently by different authors. Strong and Leggat (1992) did not recognize the Northern Fescue Natural Subregion, and included rough fescue plant communities mainly with the Central Parkland. Achuff (1994) recognized the Northern Fescue Natural Subregion, and included the Ribstone and Provost Plains with the Central Parkland. Achuff (1994) noted that the two Central Groveland Ecodistricts were characterized by Dark Brown soils, as opposed to the Black soils of the rest of the Central Parkland. The Saskatchewan soils map (SERM 1998) also included the Ribstone and Provost Plains with the Central Parkland, while also noting that they are characterized by Dark Brown soils. Alberta's Agricultural Regions of Alberta Soil Information Database (AGRASID) includes the Provost and Ribstone (Edgerton) Plains in SCA4, which encompasses the Dark Brown Soil Zone. For the purpose of this report, these two Ecodistricts are characterized within the Central Parkland Subregion.

3.0 Climate

The climate in the Northern Fescue Natural Subregion is characterized by a continental macroclimate with short summers, cold winters, and low precipitation. Climate data reported in Table 2 compares the Northern Fescue Natural Subregion with neighbouring Natural Subregions.

Based on the recorded stations (Environment Canada 2002), the Northern Fescue and Central Parkland Natural Subregions are colder than the Mixedgrass, Dry Mixedgrass, and Foothills Fescue (North) Natural Subregions (Table 2). The colder annual temperatures reflect the lower intensity of chinooks in the central and eastern parts of the province, and cooler summer temperatures compared to southern Alberta. Total annual precipitation in the Northern Fescue is lower than in all surrounding Natural Subregions except the Dry Mixedgrass, and effective growing-degree days are lower than most of surrounding Natural Subregions (Table 2).

Table 2. Climate comparison for the Northern Fescue and surrounding Natural Subregions, based on Canadian Climate Normals from 1971 to 2000.

Natural Subregion	Mean Daily Temp. (°C)	Total precip. (P) (mm)	Mean precip. as rain (%)	% of ppt. from May to Sept.	Effective Growing-Degree Days (EGDD > 5°C)
Mixedgrass	5.0	419	69	62	1620
Dry Mixedgrass	4.5	343	73	65	1800
Northern Fescue	3.1	383	76	71	1531
Foothills Fescue (North)	3.8	416	76	72	1505
Central Parkland	2.4	430	75	69	1470

Six climate stations representing the Northern Fescue Natural Subregion from 1971 to 2000 are summarized in Table 3. The mean daily temperatures and effective growing degree days are lowest in the eastern part of the Northern Fescue, and highest in the west, reflecting the moderating influence of chinooks in the west. However, Oyen Cappon is an exception as it is located more south in the Benton Upland (Table 3), and is transitional to the Dry Mixedgrass Natural Subregion.

The Sullivan Lake station, which is close to the Central Parkland boundary, has the highest annual precipitation. The central and eastern areas of the Northern Fescue, including Craigmyle, Castor, Coronation, and Sullivan Lake stations have the lowest percentages of precipitation as rain. Precipitation during the growing season is highest in the west, at Drumheller, as well as Oyen Cappon (Table 3).

Table 3. Summary of climatic data for selected stations in the Northern Fescue Natural Subregion.

Ecodistrict	Station	Elev. (m)	°N; °W	Mean Daily Temp. (°C)	Total precip. (P) (mm)	Mean precip. as rain (%)	% of precip from May to Sept.	Effective Growing Degree Days (EGDD > 5°C)
Castor Plain	Coronation	791.0	52.07 111.45	2.3	401	73.5	68.9	1430.9
Sullivan Lake Plain	Castor	807.7	52.13 111.90	n/a	390	74.5	70.7	n/a
	Sullivan Lake	810.7	52.05 111.95	n/a	410.5	73.7	68.4	n/a
Drumheller Plain	Drumheller	719.3	51.47 112.87	n/a	367.6	79.7	72.8	n/a
	Craigmyle	845.8	51.77 112. 28	3.1	407.1	74.3	70.0	1481.4
Benton Upland	Oyen Cappon	792.5	51.17 110.52	3.8	321.5	78.3	72.3	1682.8
Average				3.1	383.0	75.7	70.5	1531.7

Data presented are Canadian Climate Normals for the 1971 – 2000 period, from Environment Canada (2002). The Ecodistricts of Endiang Upland, Wintering Hills and Neutral Hills do not contain climate stations.

4.0 Physiography and Soils

Physiography describes the physical nature of land, related to geology, elevation, aspect, slope, surface pattern and drainage. Physiography in the Northern Fescue Natural Subregion is mainly dominated by the Eastern-Alberta Plain, which is a nearly-level to undulating plain. Exceptions are the rolling Neutral Hills Upland (Pettapiece 1986) and the Wintering Hills, the latter which form the easternmost extent of the Western-Alberta Uplands (Figure 3).

Surficial Geology

Most of southern Alberta is covered with glacial deposits resulting from continental glaciation, which receded from the area about 12,000 years ago. To view maps of surficial geology in Alberta, refer to Shetsen (1987). Glacial till is the dominant surficial deposit in the Northern Fescue Natural Subregion. Glacial till is an unsorted mixture of sand, silt and clay mixed with coarse fragments, deposited directly from the ice.

Glaciofluvial sediments (sometimes called outwash) are the second-most common parent material in the Northern Fescue and are deposited by fast-moving glacial meltwater. Glaciofluvial sediments can include gravel and cobbles, within a coarse-

textured matrix of loamy sand and sand that may occur in lenses or bands. Glaciofluvial materials also occur along the middle and upper terraces of major river and creek valleys. Lower terraces and floodplains along rivers and creeks are dominated by recent fluvial deposits, which can consist of alternating layers of sand, silt and gravel.

Eolian material occurs mainly in the Sullivan Lake Ecodistrict. Eolian material is composed of sandy glaciofluvial material that has been selectively re-sorted by wind into sand dunes.

Glaciolacustrine sediments are of lesser occurrence in the Northern Fescue, with the exception of the Drumheller Plain. Glaciolacustrine sediments consist of clay settled from suspension in ice-marginal glacial lakes.

Bedrock Geology

Most subcropping bedrock in the Northern Fescue was deposited in the upper Cretaceous or Tertiary Periods, between about 100 and 60 million years ago. The bedrock formations in the Northern Fescue Natural Subregion are dominated by the Horseshoe Canyon Formation in the west, the Bearpaw Shale Formation in the central area, and the Belly River Group in the east. The Bearpaw Formation was deposited in a continental sea and is a marine shale deposit. The Horseshoe Canyon Formation is a sandstone, shale and coal deposit characteristic of the brackish tidal and deltaic zone at the edges of the Bearpaw Sea (Mussieux and Nelson 1998). The Belly River Group is a series of fresh (sandstone) and brackish (mudstone and shale) water deposits (Godfrey 1993) that reflects the changing margins of the continental sea as it frequently changed in size. The non-marine Paskapoo Formation, which consists mainly of alternating layers of medium- and coarse-grained sandstone, occurs in the extreme western portion of the Northern Fescue Natural Subregion.

Soil Orders and Great Groups

Dark Brown Chernozemic soils dominate in the Northern Fescue and Mixedgrass Natural Subregions, compared to Black Chernozems in the Foothills Fescue and Central Parkland, and Brown Chernozems in the Dry Mixedgrass (Table 1). Chernozemic soils are well- to imperfectly-drained soils that have developed under grassland communities. They are characterized by a dark-colored surface (A) horizon that is about 10 to 15 cm thick, resulting from the accumulation and decomposition of organic matter derived from grasses and forbs (SCWG 1998). The A horizon of Dark Brown Chernozems has a colour value darker than 3.5 moist and 3.5-4.5 dry. Chroma is usually greater than 1.5 dry. Free lime is generally leached to 50 cm or less. The soil climate is cold, rarely mild, and semiarid (SCWG 1998).

Solonetzic soils contain a high proportion of sodium in the subsoil and they are characterized by a hardpan layer in the subsoil that is massive and hard when dry, and impervious and very sticky when wet. They are usually associated with areas of former saline and sodic groundwater discharge. Groundwater discharge was more common when water table levels were higher at deglaciation. Solonetzic soils can also occur where sodium rich bedrock material occurs at or near the soil surface. Solonetzic soils

are dominant mainly in the Castor and Sullivan Lake Plains, are secondary in the Neutral Hills and Endiang Upland Ecodistricts, and are of a lesser extent in other Ecodistricts.

Regosolic soils occur to a limited extent in the Northern Fescue, mainly on sand dunes in the Sullivan Lake Plain. Regosols lack a B horizon, and may also be characterized by a shallow A horizon. Regosols are weakly developed soils, which can include development on young geologic materials or occur in unstable locations, such as steep slopes, active floodplains or locations prone to wind erosion.

Gleysolic soils are subject to periodic flooding or prolonged wetting, and typically lack oxygen during a portion, or most, of the growing season. Gleysols are often nutrient poor due to denitrification, and because decomposition is hindered by wetness. Gleysols are associated with wetlands enriched by either groundwater discharge or surface-water collection. Saline wetlands occur in all Ecodistricts but are of a more limited extent in the Wintering Hills Ecodistrict. There are numerous freshwater wetlands in the higher elevation areas of the Endiang Upland and the western component of the Wintering Hills Ecodistrict. Other freshwater wetlands occur scattered throughout the Northern Fescue.

Vertisolic soils in the Northern Fescue occur only in the Drumheller Plain. Vertisols are characterized by a high clay content, with the result that they are subject to intense shrink-swell cycles.

Soils of the Ecodistricts in the Northern Fescue Natural Subregion

The major soil series and associated Range Sites for each Ecodistrict in the Northern Fescue Natural Subregion are summarized in Table 4, listed generally from southwest to northeast. The Benton Upland in the southeast is provided as the final listed Ecodistrict. Range Sites and applicable soil series in the Northern Fescue Natural Subregion are also identified in Appendix A.

Table 4. Major soils and associated Range Sites, by Ecodistrict

Ecodistrict	Major Soil Series	Soil Subgroup	Parent Material	Range Site
Drumheller Plain	DMH (Drumheller)	Orthic Humic Vertisol	very fine glaciolacustrine	Clayey (Cy)
	MIC (Michichi)	Dark Brown Solod	fine glaciolacustrine	Blowouts (BlO) and Clayey (Cy)
	PRO (Provost)	Orthic Dark Brown Chernozem	medium fluvial-lacustrine veneer over till	Loamy (Lo)
	HND (Hughendon)	Orthic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	MET (Metisko)	Orthic Dark Brown Chernozem	moderately coarse glaciofluvial	Sandy (Sy)
Wintering Hills	HND (Hughendon)	Orthic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)

Ecodistrict	Major Soil Series	Soil Subgroup	Parent Material	Range Site
Wintering Hills	MET (Metisko)	Orthic Dark Brown Chernozem	moderately coarse glaciofluvial	Sandy (Sy)
	NUT (Neutral)	Calcareous Dark Brown Chernozem	moderately fine glacial till	Limy (Li)
	HAN (Hanalta)	Orthic Black Chernozem	moderately fine glacial till	Loamy (Lo)
	BFD (Brownfield)	Dark Brown Solod	moderately fine glacial till	Blowouts (BlO) and Loamy (Lo)
	THB (Thumb)	Orthic Black Chernozem	moderately fine eolian	Loamy (Lo)
Endiang Upland	HND (Hughendon)	Orthic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	BFD (Brownfield)	Dark Brown Solod	moderately fine glacial till	Blowouts (BlO) and Loamy (Lo)
	HKR (Halkirk)	Dark Brown Solodized Solonetz	moderately fine glacial till	Blowouts (BlO)
	FST (Flagstaff)	Solonetzic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	WES (Wiese)	Dark Brown Solodized Solonetz	moderately fine glaciolacustrine	Blowouts (BlO)
	MET (Metisko)	Orthic Dark Brown Chernozem	moderately coarse glaciofluvial	Sandy (Sy)
	VTR (Victor)	Dark Brown Solonetz	moderately fine glaciolacustrine	Blowouts (BlO)
Castor Plain	HND (Hughendon)	Orthic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	FST (Flagstaff)	Solonetzic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	HKR (Halkirk)	Dark Brown Solodized Solonetz	moderately fine glacial till	Blowouts (BlO)
	BFD (Brownfield)	Dark Brown Solod	moderately fine glacial till	Blowouts (BlO) and Loamy (Lo)
	TLA (Torlea)	Dark Brown Solodized Solonetz	moderately fine softrock	Thin Breaks (TB)
	CNN (Coronation)	Orthic Dark Brown Chernozem	medium glaciolacustrine	Loamy (Lo)
	GLK (Gough Lake)	Saline Rego Gleysol	fine glaciolacustrine	Saline Lowland (SL)
Sullivan Lake Plain	HKR (Halkirk)	Dark Brown Solodized Solonetz	moderately fine glacial till	Blowouts (BlO)
	BFD (Brownfield)	Dark Brown Solod	moderately fine glacial till	Blowouts (BlO) and Loamy (Lo)
	WWT (Wainwright)	Orthic Dark Brown Chernozem	very coarse fluvial - eolian	Sands (Sa)
	SUL (Sullivan Lake)	Dark Brown Solodized Solonetz	moderately coarse glaciofluvial veneer over till	Blowouts (BlO) and Sandy (Sy)

Ecodistrict	Major Soil Series	Soil Subgroup	Parent Material	Range Site
Sullivan Lake Plain	SCD (Scollard)	Orthic Dark Brown Chernozem	gravelly moderately coarse glaciofluvial	Gravel (Gr)
	LHD (Leithead)	Dark Brown Solodized Solonetz	moderately coarse glaciofluvial	Blowouts (BlO)
	VTR (Victor)	Dark Brown Solonetz	moderately fine glaciolacustrine	Blowouts (BlO)
	MET (Metisko)	Orthic Dark Brown Chernozem	moderately coarse glaciofluvial	Sandy (Sy)
	GLK (Gough Lake)	Saline Rego Gleysol	fine glaciolacustrine	Saline Lowland (SL)
Neutral Hills	HND (Hughendon)	Orthic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	NUT (Neutral)	Calcareous Dark Brown Chernozem	moderately fine glacial till	Limy (Li)
	BFD (Brownfield)	Dark Brown Solod	moderately fine glacial till	Blowouts (BlO) and Loamy (Lo)
	FST (Flagstaff)	Solonetzic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	LFE (Lanfine)	Eluviated Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	MET (Metisko)	Orthic Dark Brown Chernozem	moderately coarse glaciofluvial	Sandy (Sy)
	CNN (Coronation)	Orthic Dark Brown Chernozem	medium glaciolacustrine	Loamy (Lo)
	DCY (Dolcy)	Orthic Dark Brown Chernozem	moderately coarse glaciofluvial veneer over till	Sandy (Sy)
	MTR (Monitor)	Rego Dark Brown Chernozem	medium glaciolacustrine	Limy (Li)
	CUR (Currant Lake)	Dark Brown Solodized Solonetz	moderately fine glaciolacustrine	Blowouts (BlO)
	ALT (Altario)	Rego Dark Brown Chernozem	medium-textured calcareous till	Limy (Li)
	KUR (Kirriemuir)	Orthic Dark Brown Chernozem	medium-textured calcareous till	Loamy (Lo)
Benton Upland	HND (Hughendon)	Orthic Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	LFE (Lanfine)	Eluviated Dark Brown Chernozem	moderately fine glacial till	Loamy (Lo)
	NUT (Neutral)	Calcareous Dark Brown Chernozem	moderately fine glacial till	Limy (Li)
	HKR (Halkirk)	Dark Brown Solodized Solonetz	moderately fine glacial till	Blowouts (BlO)
	BFD (Brownfield)	Dark Brown Solod	moderately fine glacial till	Blowouts (BlO) and Loamy (Lo)

Ecodistricts in the Northern Fescue are described in more detail below, with Ecodistricts also arranged from southwest to northeast and the Benton Upland discussed last.

Drumheller Plain. The Drumheller Plain is located in the western portion of the Northern Fescue Natural Subregion, surrounding the Red Deer River on the level plain above the deeply incised river and numerous tributaries. Drainage in the Drumheller Plain is to the Red Deer River, mainly via tributary channels including Serviceberry, Rosebud, Kneehills, Three Hills, and Michichi Creeks. Land use is dominated by dryland annual crop production.

The Drumheller Plain represents a large, deep, long-term glacial lake that is the largest glaciolacustrine deposit in the grassland ecoregion of Alberta, encompassing about 26 townships. The fine-textured (clay) glaciolacustrine sediments follow wide creek valleys, and are interspersed with ridged and rolling glacial till landscapes at higher elevations (McBride et al. 1995). The fine-textured (clay) glaciolacustrine sediments are associated with Clayey Range Sites, and the soils are mainly Orthic Humic Vertisols (Drumheller series) (Table 4) (ASIC 2001). Drumheller soils generally lack a distinct separation between the A, B and C horizons. This is because the high clay content makes these soils prone to intense shrink-swell cycles during both drying and wetting, resulting in overturned soil layers.

Orthic Dark Brown Chernozemic soils and Loamy Range Sites dominate at the glacial lake margins and the adjacent uplands. Glaciolacustrine sediments are thin (veneer over till) or medium textured (Provost) at the glacial lake margins. Glacial till, which occurs at elevations above the lake margins, is dominated by the Hughendon soil series.

Elevations vary from lows of about 700 m in the Red Deer River valley downstream of Drumheller, to a high of 920 m north of Rosebud near the junction of Highways 9 and 840. Surface forms in the Drumheller Plain are nearly level, inclined, and undulating, with occasional hummocky areas. Bedrock is predominantly interbedded sandstone and shale of the Horeshoe Canyon Formation, visible throughout the Red Deer River valley and its tributaries. Sandstone of the Paskapoo Formation also occurs in the northwestern corner of the Drumheller Plain, in the Carbon and Trochu areas.

Wintering Hills. The Wintering Hills Ecodistrict encompasses about 18 townships and occurs in the southwestern part of the Northern Fescue Natural Subregion. The southern boundary forms the contact with the Mixedgrass Natural Subregion.

The Wintering Hills Ecodistrict encompasses both of the Wintering Hills and the Hand Hills, which are separated by the Red Deer River at Dorothy. The Wintering Hills are a rolling bedrock-controlled landscape with occasional escarpments. The Wintering Hills bedrock-controlled spine trends west to east from the Rockyford region to southwest of Dorothy. The Hand Hills, which occur northeast of Dorothy, are a high-elevation plateau representing a remnant of an earlier land surface similar to the Cypress Hills. The Hand Hills are bounded by escarpments on the west and north, and by long, gradual, southeast-trending slopes on the east and south (McBride et al. 1995). The Hand Hills

are capped by a thick pebble-based conglomerate that is especially visible on the western escarpment. Gravels that form the conglomerate were deposited by pre-glacial rivers that flowed from the Rocky Mountains.

Native range is the dominant land cover over most of the Hand Hills plateau and escarpment and in the eastern part of the Wintering Hills block. Western portions of the Wintering Hills block are mainly cultivated. Drainage is almost exclusively to the Red Deer River and tributaries, including Serviceberry, Rosebud, Circus, Bullpound, and Homestead Creeks. Numerous coulees and tributary channels originate in the Wintering and Hand Hills, and drain towards the Red Deer River. Numerous saline wetlands occur on the northeastern and eastern sides of the Hand Hills, fed by discharge from groundwater that originates in the Hand Hills. Numerous freshwater wetlands occur on the flanks, particularly the northern flanks, of the Wintering Hills; some are spring fed and others mainly collect runoff.

Surface forms in the Wintering Hills Ecodistrict are mainly rolling, steep or inclined. Moderate-relief hummocky areas also occur, particularly on the eastern side of the Hand Hills, where a major stagnation moraine occurs. This stagnation moraine extends from the Hand Hills north to the Endiang Upland and south to the Majorville Upland of the Mixedgrass Natural Subregion. Elevations range from a low of 685 m in the Red Deer River valley near Dorothy, to 1100 m on the northwestern corner of the Hand Hills south of Delia.

Parent material on the Wintering Hills Ecodistrict is generally glacial till, which ranges from bedrock exposures to thick deposits. An unglaciated area dominated by loamy and silty loess occurs on the Hand Hills and portions of the Hand Hills Ecological Reserve between about 1000 and 1100 m in elevation. Bedrock geology is dominated by the Horseshoe Canyon Formation, but the overlying Paskapoo sandstone occurs and occasionally outcrops in the Wintering Hills spine. Excellent exposures of the Horseshoe Canyon Formation can be viewed in the Red Deer River valley between East Coulee and Dorothy. Range Sites are dominantly Loamy, but significant components of Limy, Sandy, Thin Breaks, and Blowouts also occur.

The dominant soils (Table 4) are Orthic Dark Brown Chernozems developed on glacial till (Hughendon), and Orthic Black Chernozems developed on till (Hanalta) occur in the higher elevations of the Hand Hills (ASIC 2001). Other soils developed on till are mainly Dark Brown Solods (Brownfield) and Calcareous Dark Brown Chernozems (Neutral).

Endiang Upland. The Endiang Upland encompasses about 17 townships. It extends from near the Sheerness Generating Station north through Hanna and includes the communities of Endiang and Byemoor. Drainage is mainly to internal basins including Gough, Farrell, Chain, and Sullivan Lakes. Dowling Lake is also an internal basin, but overflow from Dowling Lake flows south via Bullpound Creek to the Red Deer River. The majority of the Endiang Upland is devoted to a mixture of dryland crop agriculture, non-native and native pasture. Native range is dominant in the Dark Brown portion of the Rumsey Block, in Townships 33 and 34, Range 19, W4.

Surface forms are dominantly moderate- to high-relief hummocky, with significant

proportions of undulating areas (Brierley et al. 1992). Elevations on the Endiang Upland range from lows of 780 m in the valley of Bullpound Creek near the Sheerness Generating Station, to a high of 890 m in the Antelope Hills on the east side of Dowling Lake in Township 32, Range 14, W4. Bedrock geology is dominated by the Horseshoe Canyon Formation.

The Endiang Upland is mainly a stagnation moraine formed during the most recent deglaciation, and parent material is generally thick glacial till (Brierley et al. 1992). Drift thickness over bedrock is usually greater than 15 m (Kjearsgaard 1988). Dark Brown Chernozemic soils (Hughendon and Flagstaff) and Loamy Range Sites dominate. Some isolated moraine plateaus occur near Endiang. Moraine plateaus are flat to gently-sloping high-elevation areas that were formed by sediment deposition during deglaciation in local ice-walled lakes. Moraine plateaus are characterized by silt- and clay-dominated lacustrine sediments with few to no stones.

The Endiang Upland Ecodistrict includes a large broad valley that has been partially infilled by glacial deposits that impede drainage, with the result that the east side of the valley contains numerous evaporative lakes, including Farrell, Chain, and Dowling Lakes (McBride et al. 1995). The valley trends southeast to Bullpound Creek. It was the drainage of the Red Deer River before the last glaciation, when the Red Deer River became deeply incised through the Drumheller Canyon. The evaporative basins are dominated by Saline Rego Gleysols (Gough Lake) and Saline Lowland Range Sites.

The west side of this broad valley is a nearly level plain that occurs at slightly higher elevations than the evaporative basins. This area is characterized by Sandy Range Sites with Chernozemic soils on glaciofluvial materials (Metisko), and by Blowout Range Sites with Solonetzic soils in lowland areas of former groundwater discharge (Wiese and Victor). Groundwater discharge was more common when water-table levels were higher following deglaciation.

Castor Plain. The Castor Plain is the largest Ecodistrict in the Northern Fescue Natural Subregion, encompassing about 42 townships. The southern boundary extends from Gough Lake in the west, through Spondin, to south of Veteran in the east. The northern boundary is mainly formed by the Battle River, although a small area of about 3.5 townships north of the Battle River occurs at Alliance (MacMillan et al. 1988). The Castor Plain is dominated by undulating topography with very few highland areas.

The Castor Plain has shallow surficial materials with a large proportion of the land area having bedrock at or near the land surface. Parent material is dominated by thin glacial till, with bedrock often less than 2 m from the surface, and usually less than 5 m from the surface. Bedrock is dominated by Bearpaw Shale east of Coronation and by the Horseshoe Canyon Formation west of Coronation. Range Sites are dominantly Blowouts or Thin Breaks due to the high proportion of shallow bedrock. Thin Breaks Range Sites are associated with the Torlea soil series, and occasionally with the landscape models I3m or I3h (Table 4).

Blowout Range Sites also occur, associated with Solonetzic soils (Halkirk and Brownfield) that are directly related to shallow saline and sodic bedrock. Chernozemic

soils (Flagstaff, Hughendon, and Coronation) dominate in isolated locations, and are a significant soil over most of the Castor Plain, particularly where the drift is slightly thicker (Wells and Nikiforuk 1988).

Saline Lowland Range Sites also occur on numerous internally-drained basins, the largest of which are Gough, Sullivan, and Hamilton Lakes. With the exception of internal basins, drainage on the Castor Plain is dominantly to the Battle River via the Paintearth, Castor, and Ribstone Creeks. The southeast corner of the Castor Plain, southeast of Veteran, drains to east to Sounding Creek via Loyalist Creek. In addition, an area south of Sullivan Lake drains south to Berry Creek.

Land use on the Castor Plain is dominated by cultivated agriculture followed by non-native pasture. Native pasture is the third most common land use. The lowest elevation, 780 m, occurs in the Berry Creek valley just south of Spondin, at the boundary between the Northern Fescue and Dry Mixedgrass Natural Subregions. The highest elevation, 855 m, occurs on a glacial till highland between Sullivan Lake and Gough Lake.

Sullivan Lake Plain. The Sullivan Lake Plain encompasses 14 townships and borders on the Sounding Creek Plain Ecodistrict of the Dry Mixedgrass Natural Subregion. It is oriented northwest to southeast, and occurs south and east of the Castor Plain. Surface forms are mainly undulating and low-relief ridged. Drainage is mainly to Sounding Creek via numerous unnamed creeks and ephemeral streams, and to numerous evaporative internally-drained basins including Kirkpatrick and Sullivan Lakes. Only the northwest corner of the Ecodistrict drains to Sullivan Lake.

Land use on the Sullivan Lake Plain is dominantly native pasture, with scattered non-native pasture and some cultivated agriculture, particularly in the northwest corner of the Ecodistrict. Elevations range from lows of 730 m in the Monitor Creek valley south of Consort, to highs of 830 m south of Fleet, in the southeast corner of Township 36, Range 13, W4.

Subcropping bedrock formations are the Bearpaw Shale in the southeastern half of the Sullivan Lake Plain and the Horseshoe Canyon Formation in the northwestern half. Parent material is mainly composed of moderately-coarse and very coarse glaciofluvial sediments in a veneer to blanket overlying glacial till or shallow bedrock. The glaciofluvial materials were deposited by glacial meltwaters flowing from the northwest to the southeast during deglaciation; materials that were eroded from the Castor Plain were deposited as sands and gravels in the Sullivan Lake Plain. In some cases glaciofluvial sands have been remobilized by wind, resulting in sand dunes northeast of Kirkpatrick Lake. Glacial till occurs at the eastern, northern, and western edges of the Sullivan Lake Plain.

The Sullivan Lake Plain contains many representative soil series (Table 4) due to the wide range of parent materials and soil orders (Kjearsgaard 1988). Range Sites are a mixture of Blowouts, Sands, Sandy, Gravels, and Saline Lowlands.

Neutral Hills. The Neutral Hills Ecodistrict represents the northeastern-most extension of the Northern Fescue Natural Subregion. However, Dark Brown soils still occur in the Ribstone and Provost Plains to the north, where the vegetation is characterized by a mix of rough fescue and aspen groves (Strong and Leggat 1992; Walker and Wang 1994).

The Neutral Hills Ecodistrict is composed of a series of mainly northwest- to southeast-trending till and bedrock uplands that are bisected by the north-flowing broad valley of Sounding Creek. The Neutral Hills Ecodistrict extends from north of Veteran into Saskatchewan, and include four major upland areas, called glacial thrust hills: Nose Hill, Misty Hills, the Neutral Hills, and the Altario Upland. These glacial thrust hills were formed when continental glacial ice flowing from the north gouged out huge chunks of bedrock and deposited them farther to the south. The Mud Buttes at Misty Hills, located south of Monitor in Township 33, Range 4, W4, provide an excellent view of the Belly River sandstone deformed by glacial ice (Mussieux and Nelson 1998). The broad Grassy Island Lake depression in the Sounding Creek valley was gouged out and redeposited at the Mud Buttes and the Misty Hills. The Sounding Lake to Metisko basin of the Ribstone Plain Ecodistrict is the broad depression left when the Neutral Hills were formed as glacial thrust hills. The Nose Hill is not readily associated with a nearby depression, suggesting continential ice probably carried the Nose Hill thrust block for a greater distance, possibly from the Houcher Lake depression near Czar. The Altario Upland is a product of the gouging of the Eyehill (Sounding) Creek valley near Bodo.

Drainage on the Neutral Hills Ecodistrict is mainly to Sounding (Eyehill) Creek, but Ribstone Creek drains areas north of Nose Hill and the western part of the Neutral Hills. Land use is a mix of native and non-native range and dryland crop agriculture, with native range being slightly more dominant than the other land uses. Elevations range from a low of 660 m in the Eyehill (Sounding) Creek valley on the Saskatchewan border, to a high of 915 m on Nose Hill north of Veteran.

The dominant surface forms in the upland areas of the Neutral Hills Ecodistrict include moderate- and high-relief hummocky, with inclined to steep escarpments. The basins are nearly level to undulating. Bedrock geology is mainly the Bearpaw Formation, but the Belly River Group occurs in the Sounding Creek valley (Jackson 1981). Parent materials are mainly till on the uplands (Wyatt et al. 1938). The till is generally quite thick, with the result that Solonetzic soils are not common. Drift thickness increases from west to east (Kjearsgaard et al. 1988), and drift is thickest on the Altario Upland. Valleys are a mixture of sandy glaciofluvial and loamy glaciolacustrine materials (Wyatt et al. 1938). The Sounding Creek valley contains some areas where Solonetzic soils are dominant and numerous areas where they are significant, related to areas of former groundwater discharge.

Range Sites in the Neutral Hills Ecodistrict are dominated by Loamy, Limy and Thin Breaks on the uplands, and by Sandy, Sands, Blowouts, and Saline Lowlands in the Sounding Creek valley. Upland areas are dominated by Orthic and Calcareous Dark Brown Chernozems (Hughendon and Neutral), with significant Dark Brown Solods (Brownfield). Numerous other soil series are present in the Sounding Creek valley (Table 4).

Benton Upland. The Benton Upland occurs as an island of Northern Fescue at Oyen (Figure 2) and surrounded by the northeastern portion of the Dry Mixedgrass Natural Subregion. It encompass about five townships. The Benton Upland contains many small internally drained sloughs due to the predominance of low- and moderate-relief hummocky glacial till landscapes. The majority of the Benton Upland is devoted to dryland crop agriculture, with non-native pasture secondary.

Elevations on the Benton Upland range from 730 m at the eastern boundary of the ecodistrict where it borders the Sibbald Plain Ecodistrict of the Dry Mixedgrass, to 810 m on several till highlands. Another island of Northern Fescue may also occur in the Dry Mixedgrass; Buffalo Bird Hill, located 18 km southwest of Oyen, which attains an elevation of 825 m.

Parent material on the Benton Upland is generally thick glacial till. Bedrock geology is dominated by the Bearpaw Shale, but the bedrock is usually deep. The dominant Range Site is Loamy. The dominant soils are Orthic Dark Brown Chernozems developed on glacial till (Hughenden). Other Chernozemic soils include Eluviated Dark Brown (Lanfine) and Calcareous Dark Brown (Neutral). A significant proportion of Solonetzic soils also occur (Halkirk and Brownfield) (Kjearsgaard 1988).

5.0 Key to Range Sites in the Northern Fescue Natural Subregion

The following key provides a simplified procedure for linking Range Sites to soil and landscape information such as Agricultural Region of Alberta Soil Information Database (AGRASID) (ASIC, 2001). The Range Sites are divided into three groups based on their main defining feature of landscape, soil or texture.

Range Sites Defined Mainly by Landscape

Badlands/Bedrock (BdL): Applies to all inclined to steeply sloping landscapes with greater than 10% bedrock exposures of softrock or hardrock. Slopes generally range from 30% to 60% (in isolated cases15% to 100%). Includes I4h and I5 landscape models from AGRASID 3.0 and GVI polygons with BdL components.

Overflow (Ov): Applies to non-saline Chernozemic (soils with A, B and C horizons) and/or Regosolic soils (soils that lack a B horizon >5 cm thick, and may lack an A horizon) on landscapes that are low-relief inclines in valley or basinal settings. Overflow sites are usually fan or apron deposits, where upslope streams enter lowland areas and experience a marked decrease in gradient. Slopes generally range from 2% to 9% (in isolated cases from 0.5% to 15%). Overflow occurs only on lower slope positions or adjacent to stream(s), and the percentage of eligible overflow ranges from 10% to 50% per SLM. Ov includes I3l and I4l landscape models from AGRASID 3.0, and also applies to the soil series Bigknife (BKF). Classified Ov in GVI polygons.

Riparian (Ri): Applies to all stream channels and floodplains. Includes FP1, FP2, FP3, SC1-l, SC1-h, SC2, SC3 and SC4 landscape models from AGRASID 3.0. True riparian areas only include the valley floor (from bottom of bank to bottom of bank on the other side of the valley). In GVI, lentic polygons are designated with the prefix Len, while lotic polygons are designated with Ltc.

Thin Breaks (TB): Applies to: 1) all steeply-sloping landscapes with less than 10% bedrock exposures; 2) largely vegetated areas with bedrock at or near (within 1 m of) the surface; 3) the soil series Delia (DLA), Paintearth (PTE), Sheerness (SHR), or Torlea (TLA); and 4) AGRASID 3.0 landscape models I3h or I4m. Classified as TB in GVI polygons.

Range Sites Defined Mainly by Soil Features

Blowouts (BlO): Applies to all SLMs where soils from the Solonetzic order are dominant (>50%) or co-dominant (30 to 50%). Solonetzic soils have an impervious hardpan layer (Bnt horizon) in the subsoil that is caused by excess sodium (Na^+). The land surface is frequently characterized by eroded pits. Applies to the soil series Brownfield (BFD), Currant Lake (CUR), Fenner (FNR), Halkirk (HKR), Leithead (LHD), Michichi (MICH), Sullivan Lake (SUL), Victor (VTR), and Wiese (WES), and also applies to undifferentiated Solonetz (ZSZ). Classified as BlO in GVI polygons.

Limy (Li): Applies to all immature or eroded soils with free lime (calcium carbonates) at the soil surface or in the B horizon. Free lime is detected by effervescence when soil is treated with 10% hydrochloric acid (HCl). Li soils include Rego or Calcareous Chernozemics, eroded phases, and subgroups from the Regosolic order <u>if</u> they are calcareous. Applies to the soil series Altario (ALT), Neutral (NUT), and Monitor (MTR), and Undifferentiated Eroded (ZER) <u>if not</u> on I3l, I3h, I4m or I4h landscapes. Classified as Li in GVI polygons.

Sub-irrigated (Sb): Applies to all Gleyed, non-saline, medium to very coarse textured soils. Gleyed soils occur where the water table occurs near the soil surface, but does not often occur above the soil surface. Gleyed subgroups have faint to distinct mottles within 50 cm, or prominent mottles between 50 and 100 cm. Classified as Sb in GVI polygons.

Saline Lowland (SL): Applies to all salt-enriched soils, including Saline phase Chernozemic, Saline phase Regosolic, and Saline phase Gleysolic soils. Saline phase soils have an electrical conductivity greater than 4.0 dS/m, which retards most plant growth. Applies to the soil series Gough Lake (GLK), and also applies to undifferentiated saline soils (ZNA). Classified as SL in GVI polygons.

Wetlands (WL): Applies to all non-saline or weakly-saline of the Gleysolic and Organic orders. Gleysolic soils occur in seasonal to semi-permanent wetlands. They are typified by dull colours or prominent mottles with 50 cm, due to prolonged periods of intermittent or continuous saturation, and the lack of oxygen in the soil. Organic soils are dominated by the accumulation of decomposing peat material derived mainly from sedges and reeds and are uncommon to rare in the Northern Fescue Natural Subregion. Applies to the Gleysolic soil series Forestburg (FBG), Fleet (FLT), and Throne (THR), and also applies to undifferentiated wet soils (ZGW). Classified as lentic riparian polygons (Len) in GVI.

Range Sites Defined Mainly by Textural Groupings

Soils are made up of varying components of sand, silt and clay, with the sum of the three equal to 100% (Figure 4). Soils may also include particles larger than 2.0 mm, or coarse fragments (Table 5).

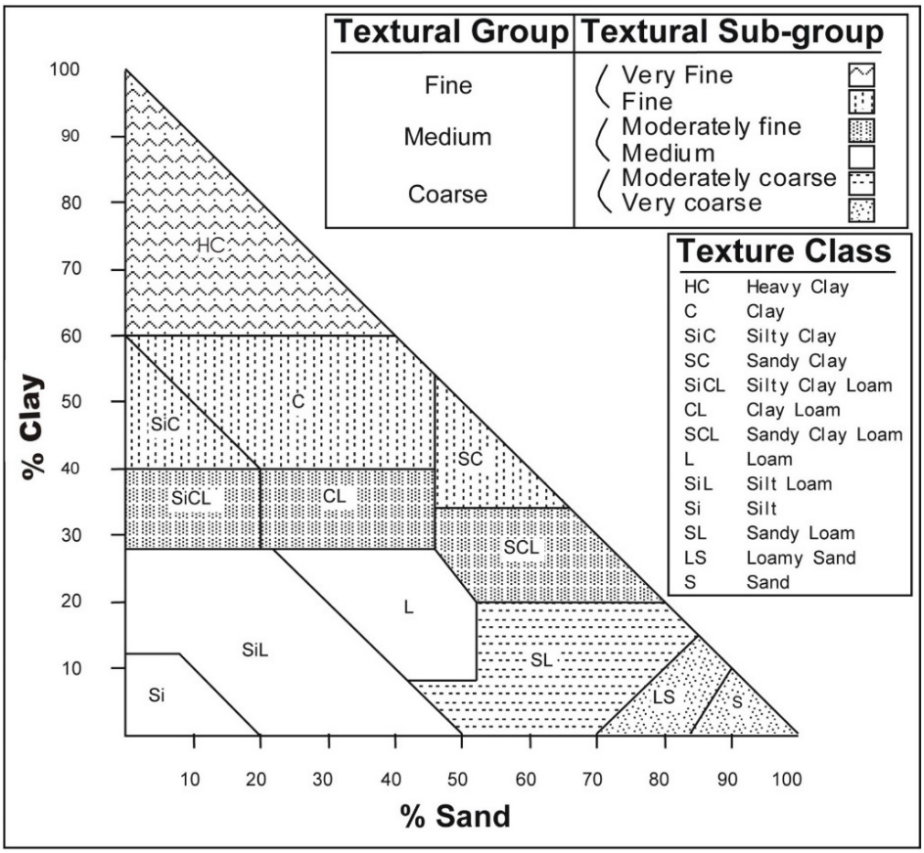

Figure 4. Soil textures and their relationship to Ecological/ Range Sites.

Table 5. Definition of particle sizes.

Category	Particle	Diameter (mm)
Components of soil texture	clay	<0.002
	silt	0.002 to 0.05
	sand	0.05 to 2
Coarse fragments	gravel	2 to 75
	cobbles	75 to 250
	stones	250 to 600
	boulders	>600

Clayey (Cy): Applies to all non-saline and non-gleyed Vertisolic soils (Drumheller, DMH, soil series); **OR** to fine or very fine Chernozemic soils (soils with A, B and C horizons), and to fine or very fine non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) (E.g., clay and silty clay textural subgroups, >40% clay, Figure 4). Classified as Cy in GVI polygons.

Loamy (Lo): Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the **medium and moderately fine** textural subgroups (E.g., loam and clay loam, Figure 4). Applies to the soil series Coronation (CNN), Flagstaff (FST), Hanalta (HAN), Hughendon (HND), Kirriemuir (KUR), Lanfine (LFE), Onnevue (OVE), Provost (PRO), and Thumb (THB). Classified as Lo in GVI polygons.

Sandy (Sy): Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the **moderately coarse** (sandy loam) textural subgroup (Figure 4). Applies to the soil series Dolcy (DCY) and Metisko (MET). Classified as Sy in GVI polygons.

Sands (Sa): Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the very coarse (loamy sand) textural subgroup (Figure 4). Sa does not apply to duned landscapes. Applies to the soil series Houcher (HCH), Ribstone (RIB), and Wainwright (WWT), **but not on duned landscapes.** Classified as Sa in GVI polygons.

Choppy Sandhills (CS): Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the very coarse (loamy sand) textural subgroup. CS applies to soils that occur on duned landscapes, including Dl1, D1m, D1h, D2l, D2m and D2h in AGRASID 3.0. Applies to the soil series Edgerton (ERT), **and to any other Sands Range Sites on duned landscapes.** Classified as CS in GVI polygons.

Gravel (Gr): Applies to any soil with less than 20 cm of a surface mantle of any textural class over **very gravelly or very cobbly** (>50% gravel or cobbles) material. Applies to the Scollard (SCD) soil series. Classified as Gr in GVI polygons.

Shallow to Gravel (SwG): Applies to any soil with 20 to 50 cm of a surface mantle of any textural class overlying **gravelly or very gravelly or cobbley to very cobbly** (>20% gravel or cobbles) material. Classified as SwG in GVI polygons.

6.0 Approach and Methods of Classification

Approach: Ecological classification hierarchy and terminology

The system of classification in this guide was initially based on the community type approach of Mueggler (1988). Mueggler's system was chosen over the habitat type approach (Daubenmire 1952) or ecosystem association approach (Corns and Annas 1986) because it could classify plant communities regardless of their successional status. However, as the philosophy of rangeland health and proper functioning condition of a site evolved, it became apparent (through data analysis) that there was a need to also organize the various plant communities based on their response to disturbance (i.e. disturbance vs. natural succession) within an area under similar environmental influences.

Therefore it was determined that the ecosystem classification system developed by Corns and Annas (1986) and Beckingham et al. (1996) could accommodate this additional requirement. Thus, the new system developed for rangelands is a combination of Mueggler (1988) and Beckingham et al. (1996). Consequently, this guide adopts a similar ecological unit classification hierarchy (range site, ecological range site, plant community). In an effort to link the hierarchical system with the historic rangeland system, and to provide an effective way to classify grassland ecosystems.

Range sites are defined as: "*a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation*" (Task Group on Unity of Concepts and Terminology, 1995). Ecological range sites are a further division to account for minor ecological differences within range site types due to slope, aspect, elevation, and topographic position.

Methods: Plant community classification

Sampling for this guide occurred within the Northern Fescue Natural Subregion. This guide outlines the classification of 664 vegetation plots. The plot sampling procedure followed the Range Inventory Manual (AEP 2018).

Vegetation data was analyzed using the multivariate techniques of classification and ordination. Classification is the assignment of samples to classes or groups based on the similarity of species. Hierarchical cluster analysis was used to group the samples. This technique assigns each sample to a cluster based on similarity of composition. It then agglomerates these clusters into a hierarchy of larger and larger clusters until finally a single cluster contains all the samples (Gauch 1982). Cluster analysis and Euclidean distance was performed in PCORD and R. Groupings generated in cluster analysis were overlain on the site ordination to determine final groupings.

Ordination was used to find relationships among species, communities and environmental variables. Ordination reduces the dimensionality of the data to 1-3 most important axes to which environmental gradients can be assigned. The ordination technique used in the analysis of the data was DECORANA (Detrended Correspondence Analysis). DECORANA detrends and rescales the axes thereby reducing the arching and compression of axes problems associated with other ordination techniques (Reciprocal averaging, Principle Components Analysis). Once final groupings were determined on the ordination specific environmental variables can be assigned to the variation outlined on the ordination axes. Non-metric multidimensional scaling was also used to ordinate data using the R statistical computing program.

Plant community type summaries were generated in Excel, by averaging plant species composition, range in composition, and percent constancy of occurrence, among vegetation inventory plots which were part of a community type. Environmental data was subsequently sorted into the same plant community groupings to create the plant community descriptions outlined in this guide. The number of sample plots on which the description was based is also provided (e.g. n=16).

Ecologically Sustainable Stocking Rates

Ecologically sustainable stocking rates (ESSR) values are provided for each plant community described in this guide. These values reflect the maximum number of livestock (i.e. animal unit month [AUM[1]] per area [e.g. ac]) that can be supported by the plant community given inherent biophysical constraints and the ecological goal of sustaining proper functioning processes within the plant community. When the ESSR is multiplied by the area of a plant community polygon the result is termed ecologically sustainable carrying capacity (ESCC), and is expressed as AUMs. Often the ESCC must be adjusted for management factors (e.g. uneven livestock distribution),

[1] Animal Unit Month (AUM): the amount of forage required by 1 animal unit for 30 days. It is often expressed as a stocking rate [AUM/ha or ac]. Generally, 1 AUM will require 1000 lbs [455 kg] of dry matter per month that includes a 25% forage loss due to trampling (ASRD 2007).

management goals (e.g. multiple use and values, etc.), drought conditions, and other natural phenomena impacting the site (e.g. forage quality, fire, pests, etc.). This adjusted/reduced value is the ecologically sustainable grazing capacity (ESGC). The ESGC values are not provided in the plant community guide because the necessary adjustments are determined by the rangeland resource manager.

Suggested ESSR values are determined from a combination of clipping studies, long-term rangeland reference area data, estimated production, and historical grazing experience. In order to sustain ecological health and function of the plant community, the ESSR will be based on the allocation of up to 25% of total production for forested plant community types, and up to 50% of total production for grass and shrub land types within the Northern Fescue Natural Subregion, expressed in terms of forage requirements one animal unit (i.e. 455 kg or 1000 lb of dry matter per month). The stocking rate ranges provided are based on total forage production depending on the forage value of the contributing plant species and the ecological status of the plant community. For example a plant community with high total production but that is mostly composed of unpalatable or unreachable material will be assigned a relatively low ESSR based on less than 25% of total production. If this same plant community is of low ecological status, a further reduction is made to the recommended stocking rate to allow for the community to recover. Unallocated biomass production (carry over), is needed for the maintenance of ecological function (e.g. nutrient cycling, viable diverse plant communities, hydrological function, and soil protection, etc.) and plant community services (forage production, habitat maintenance, etc.). The allocation of biomass production in this manner is well established, and supported, by the scientific community. The percentage of total plant production allocated as forage varies between Natural Subregions (Holechek et al. 1995).

Range Health

Range Health is determined by comparing the functioning of ecological processes on a site (e.g. plant community polygon) to a standard Reference Plant Community (RPC) described within an ecological site description. An ecological site is similar to the concept of a Range Site. Ecological sites are defined by the Task Group on Unity of Concepts and Terminology (1995) as, "*a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind of amount of vegetation*". In order to conduct Range Health Assessments, this guide can be used to determine the appropriate reference plant community for a given range site.

Rangeland health assessments are utilized to make a rapid determination of the ecological health of rangeland. We use range health terminology (healthy, healthy with problems, or unhealthy), to rank the ability of rangeland to perform certain ecological functions. These functions include: net primary production, maintenance of soil/site stability, capture and beneficial release of water, nutrient and energy cycling and plant species functional diversity. For a detailed description on how to assess rangeland health for various plant communities please refer to "Rangeland Health Assessment for Grassland, Forest and Tame Pasture" (Adams et al. 2016).

Range management objectives tend to favor the later stages of plant succession (late seral to potential natural community (PNC) or good to excellent range condition) (Adams et al. 2016). Later seral plant communities tend to be superior in the efficient capture of solar energy, cycling of organic matter and nutrients, retaining moisture, supporting wildlife habitat values and in providing the highest potential productivity for the site. In contrast, early seral stages represent plant communities with diminished ecological processes, which are less stable and more vulnerable to erosion and invasion by weeds and non-native species. They also have diminished resource values for livestock forage production, wildlife habitat and watershed protection (Adams et al. 2016). Healthy rangelands perform important ecological functions and provide a broader suite of goods and services. In most cases these late seral plant communities are used as the RPC, but sometimes management goals influence the choice of RPC (i.e. a seral grassland versus re- establishment or successional pathway to a late seral forest community).

7.0 How to Use This Guide

The classification system employed in this guide is based on Range Site and Ecological Range Site information. Range Sites (as defined on pages 24-28) are subdivided into ecological range sites based on differences in soil characteristics, slope, aspect, and topographic position.

To use this guide properly, one must first identify the correct Range Site and Ecological Range Site to correctly interpret plant communities, assess range health, set stocking rates, and make management decisions.

Step 1: Pick the appropriate or most likely range site for the area being assessed. Spatial tools such as the Grassland Vegetation Inventory (GVI) and the Agricultural Regions of Alberta Soil Inventory Database (AGRASID) are particularly helpful in determining the appropriate range site type. Detailed descriptions of range site types are found beginning on page 24, and are also helpful in determining site type. GVI and AGRASID stratify the landscape into Range Site (GVI) or soil landscape model (AGRASID) polygons, and can be superimposed over air photos to help the field user determine Range Site and soil series for a given site. However, both tools use relatively large polygons, so the information they provide must be confirmed in the field.

Step 2: Go to the appropriate section of Table 6 as determined in Step 1 and work through the plant communities to find a community that describes the site. In some cases, the community in question will not match any of the known types. When this happens, consider the following information in the detailed plant community descriptions.

In the General Description text:

a. The number of plots utilized to describe the community [n= number of plots]. The higher the “n” value [i.e. information available], the greater the level of confidence in the clarity and accuracy of the description.

b. Information about where the community is found on the landscape, response to disturbance, and natural succession.

Under the Plant Composition heading:

a. The mean (average). This refers to the sum of all the plant species cover divided by the number of samples.
b. The range of a plant species cover. For example, a species with a range of 0-25% may not always be visible on the site, having 0% canopy cover or it may have up to 25% cover.
c. The constancy value. This indicates the percentage of plots in which the species was present. So if n=16 and constancy was 75%, then the species occurred in 12 of the 16 plots.

Step 3. This step is necessary only if you are completing a rangeland health assessment. In order to determine the health status of the site in question, you must decide the appropriate reference plant community (RPC) to compare it to. Depending on the type of disturbance (grazing, oil and gas development, etc.) successional pathways may differ. The RPC is usually the plant community that is at the start of the pathway under minimal or no disturbance (i.e. ungrazed or lightly grazed). Management goals can influence the choice of RPC.

8.0 Results and Discussion

The analysis evaluated 664 vegetation plots and distinguished 51 plant community types. Each plant community is given a code, where the first two letters represent the Natural Subregion (NF= Northern Fescue). The next letter represents a category such as grasslands or deciduous and finally a sequential number.

A. Native grasslands (dominated by grasses and forbs)

B. Tame/modified grasslands (composed by >70% cover of introduced species)

C. Native shrublands (>10% total shrub cover)

D. Deciduous forest (>10% total tree cover)

NFA1= (NF) Northern fescue (A) native grassland (1) sequential number

NFA1 = Plains Rough Fescue - Western Porcupine Grass

The dominant plant species, canopy cover, environmental conditions, forage production and ESSR are outlined for each community type. Reference plant communities and their corresponding successional communities are summarized in Table 6.

Reference plant communities and associated successional communities were defined for six ecological Range Sites including Blowout, Loamy, Overflow, Subirrigated, Saline

Lowlands, and Sandy. The most prevalent of these are the three loamy types, designated as Loamy 1, 2, and 3. Loamy 1 plant communities represent moist upland loamy sites and Loamy 2 and 3 represent drier sites such as southerly aspects. Loamy 1 is the most common Range Site in the Northern Fescue.

Successional community types, where defined are listed for each reference plant community in column three of Table 6 and are ordered in descending successional status. Changes in key species composition, or the absence or presence of indicator species are included in the explanation of the plant community description. An example of a significant change in the composition or ecological status of a plant community could be the invasion of a non-native species such as Kentucky bluegrass.

9.0 General Ecological Descriptions

Northern Fescue Grassland Ecology

The Northern Fescue Natural Subregion has variable ecological conditions. Much of the variation is the result of topography, soils, and climate. Fire is an important factor in determining the composition of grasslands because of the high flammability of the vegetation during dry periods. A lack of fire and an increase in annual precipitation favors the spread of deciduous trees and shrubs onto more mesic sites.

There are multiple grassland reference plant communities described for the Northern Fescue Natural Subregion, and variability is due to ecological conditions associated with the Range Site. Mesic grasslands on loamy soils in western regions are dominated by plains rough fescue, western wheat grass, western porcupine grass and upland sedges. However, in eastern areas on drier, sandier soils dominant species shift to sandgrass, needle grasses, and upland sedges. Grassland communities associated with the wettest sites are dominated by lowland sedges (such as awned, beaked, or water sedge.

Rough fescue grasslands evolved under dormant season grazing, and repeated spring grazing reduces competitiveness between native grasses and introduced grazing tolerant grasses such as Kentucky bluegrass. This has resulted in widespread Kentucky bluegrass invasion of grasslands across the Northern Fescue, and grazing systems that allow for growing season rest, or deferral of grazing until later in the growing season are recommended to conserve remaining intact plains rough fescue grasslands.

Northern Fescue Shrubland Ecology

Higher moisture conditions occur on north-facing slopes and moisture-receiving lower slope positions, and these sites commonly support communities dominated by shrubs. On mesic upland soils with medium to moderately-fine texture, snowberry and silverberry commonly encroach grassland communities, and over time succeed to shrublands dominated by these species. On higher moisture sites adjacent to depressions and wetlands, tall shrubs such as willow, choke cherry, saskatoon, and red osier dogwood are common. Communities dominated by tall shrubs are also found on steep north-facing slopes. Heavy livestock grazing and other types of disturbance

generally lead to reduction in cover of tall shrubs, and disturbed shrubland communities are commonly dominated by medium shrubs such as snowberry and silverberry.

Historically, the Northern Fescue was subject to periodic fire which limited shrub cover. Widespread fire suppression during the last century has enhanced shrub encroachment of grassland communities, and shrublands are very common at present.

Northern Fescue Forest Ecology

Aspen forest is the most successionally mature community type found on north-facing slopes and moisture-receiving lower-slopes surrounding depressions and wetlands. As with shrub encroachment, long-term fire suppression has enhanced aspen encroachment of grasslands, and aspen forest is a common cover type across the Northern Fescue. Sites moist enough to support aspen growth are at high risk of invasion by agronomic grasses such as Kentucky bluegrass and smooth brome. Under heavy disturbance due to grazing or other causes, aspen cover is reduced and communities become dominated by medium shrubs and grasses.

Plant Community Tables

Table 6. Northern Fescue Communities

Ecological Range Site	Ecological Range Site Phase	Reference Plant Community	Grazing Succession	Modified Plant Community
Blowout 1	Grassland	NFA10 Plains Rough Fescue - Sedge	NFA11 Sedge - Plains Rough Fescue	
			NFA17 Sedge - Western Wheat Grass	
	Shrubland	NFC07 Snowberry / Sedge - Plains Rough Fescue		
Blowout 2	Grassland	NFA18 Western Wheat Grass - Plains Rough Fescue - Sedge	NFA19 Sedge - Kentucky Bluegrass	
			NFA20 Sedge - June Grass - Western Wheat Grass	
Blowout 3	Grassland	NFA12 Western Wheat Grass-June Grass	NFA21 Western Wheat Grass	
			NFA22 Prickly Pear / June Grass	
Loamy 1	Grassland	NFA01 Plains Rough Fescue - Western Porcupine Grass	NFA02 Plains Rough Fescue - Kentucky Bluegrass	NFB01 Smooth Brome - Kentucky Bluegrass / Dandelion
			NFA03 Kentucky Bluegrass - Plains Rough Fescue	
			NFA23 Kentucky Bluegrass / Dandelion	NFB02 Kentucky Bluegrass
			NFA24 Creeping Red Fescue - Kentucky Bluegrass	
	Shrubland	NFC01 Snowberry / Plains Rough Fescue	NFC02 Snowberry / Plains Rough Fescue - Kentucky Bluegrass	
			NFC03 Snowberry / Kentucky Bluegrass - Plains Rough Fescue	
			NFC08 Snowberry / Aw	
	Forest	NFD01 Aw / Snowberry / Sedge	NFD02 Aw / Snowberry / Kentucky Bluegrass	
			NFD03 Aw / Snowberry / Plains Rough Fescue	
Loamy 2	Grassland	NFA07 Western Porcupine Grass - Plains Rough Fescue	NFA08 Sedge - Plains Rough Fescue - Western Porcupine Grass	
			NFA09 Blue Grama - Sedge	
	Shrubland	NFC06 Snowberry / Plains Rough Fescue - Western Porcupine Grass	NFC09 Snowberry / Plains Rough Fescue - Blue Grama	

Ecological Range Site	Ecological Range Site Phase	Reference Plant Community	Grazing Succession	Modified Plant Community
Loamy 3	Grassland	NFA25 Western Porcupine Grass - Sedge - Wheatgrass	NFA26 Sedge - Wheatgrass - Western Porcupine Grass	
			NFA27 Western Porcupine Grass - Sedge	
	Shrubland	<RPC NOT DESCRIBED>	NFC10 Snowberry / Kentucky Bluegrass - Western Porcupine Grass	
Overflow 1	Shrubland	NFC14 Basket Willow / Sedge	NFC15 Snowberry / Kentucky Bluegrass	
	Forest	NFD04 Aw / Basket Willow / Sedge		
Subirrigated/wetland	Grassland	NFA15 Awned sedge - Fowl Bluegrass		
		NFA16 Sedge - Creeping Spike Rush		
Saline Lowlands 1	Grassland	NFA35 Western Wheat Grass - Bluegrass	NFA36 Alkali Grass	
			NFA37 Salt Grass	
			NFA38 Foxtail Barley	
Sandy 1	Grassland	NFA28 Plains Rough Fescue - Western Porcupine Grass	NFA29 Sedge - Western Porcupine Grass - Plains Rough Fescue	
			NFA30 Sedge - Western Porcupine Grass	
	Shrubland	NFC11 Silverberry / Western Porcupine Grass - Plains Rough Fescue	NFC12 Silverberry / Smooth Brome - Kentucky Bluegrass	
Sandy 2	Grassland	NFA31 Sandgrass - Sedge	NFA32 Sedge - Sandgrass	
			NFA33 Pasture Sage - Sedge	
	Shrubland	<RPC NOT DESCRIBED>	NFC13 Snowberry / Sedge - Sandgrass	

Table 7. Ecological Sustainable Stocking Rates (ESSRs) for Northern Fescue plant communities.

Ecological Range Site	Community	ESSR (AUM/ac) Avg (min-max)	ESSR (AUM/ha) Avg (min-max)
BlO1	NFA10	0.26 (0.22-0.30)	0.64 (0.54-0.74)
BlO1	NFA11	0.20 (0.15-0.25)	0.49 (0.37-0.62)
BlO1	NFA17	0.15 (0.10-0.20)	0.37 (0.25-0.49)
BlO1	NFC07	0.20 (0.15-0.25)	0.49 (0.37-0.62)
BlO2	NFA18	0.18 (0.10-0.25)	0.44 (0.25-0.62)
BlO2	NFA19	0.15 (0.10-0.20)	0.37 (0.25-0.49)
BlO2	NFA20	0.10 (0.01-0.15)	0.25 (0.02-0.37)
BlO3	NFA12	0.18 (0.12-0.23)	0.44 (0.30-0.57)
BlO3	NFA21	0.13 (0.05-0.20)	0.32 (0.12-0.49)
BlO3	NFA22	0.01 (0.01-0.05)	0.02 (0.02-0.12)
Lo1	NFA01	0.33 (0.30-0.46)	0.81 (0.74-1.14)
Lo1	NFA02	0.33 (0.30-0.46)	0.81 (0.74-1.14)
Lo1	NFA03	0.33 (0.30-0.46)	0.81 (0.74-1.14)
Lo1	NFA23	0.25 (0.18-0.33)	0.62 (0.44-0.81)
Lo1	NFA24	0.28 (0.20-0.33)	0.69 (0.49-0.81)
Lo1	NFB01	0.40 (0.30-0.50)	0.99 (0.74-1.23)
Lo1	NFB02	0.40 (0.30-0.50)	0.99 (0.74-1.23)
Lo1	NFC01	0.36 (0.25-0.45)	0.89 (0.62-1.11)
Lo1	NFC02	0.36 (0.25-0.45)	0.89 (0.62-1.11)
Lo1	NFC03	0.36 (0.25-0.45)	0.89 (0.62-1.11)
Lo1	NFC08	0.20 (0.15-0.30)	0.49 (0.37-0.74)
Lo1	NFD01	0.10 (0.01-0.20)	0.25 (0.02-0.49)
Lo1	NFD02	0.25 (0.10-0.30)	0.62 (0.25-0.74)
Lo1	NFD03	0.25 (0.15-0.30)	0.62 (0.37-0.74)
Lo2	NFA07	0.30 (0.25-0.35)	0.74 (0.62-0.86)
Lo2	NFA08	0.28 (0.21-0.35)	0.69 (0.52-0.86)
Lo2	NFA09	0.21 (0.17-0.25)	0.52 (0.42-0.62)
Lo2	NFC06	0.32 (0.29-0.33)	0.79 (0.72-0.81)
Lo2	NFC09	0.28 (0.21-0.35)	0.69 (0.52-0.86)
Lo3	NFA25	0.30 (0.21-0.36)	0.74 (0.52-0.89)
Lo3	NFA26	0.27 (0.21-0.31)	0.67 (0.52-0.77)
Lo3	NFA27	0.23 (0.15-0.28)	0.57 (0.37-0.69)
Lo3	NFC10	0.30 (0.25-0.35)	0.74 (0.62-0.86)
Ov1	NFC14	0.10 (0.05-0.15)	0.25 (0.12-0.37)
Ov1	NFC15	0.10 (0.05-0.15)	0.25 (0.12-0.37)
Ov1	NFD04	0.10 (0.05-0.15)	0.25 (0.12-0.37)
Sb1	NFA15	0.01 (0.01-0.15)	0.02 (0.02-0.37)
Sb1	NFA16	0.01 (0.01-0.15)	0.02 (0.02-0.37)

Ecological Range Site	Community	ESSR (AUM/ac) Avg (min-max)	ESSR (AUM/ha) Avg (min-max)
SL1	NFA35	0.20 (0.12-0.26)	0.49 (0.30-0.64)
SL1	NFA36	0.10 (0.01-0.15)	0.25 (0.02-0.37)
SL1	NFA37	0.01 (0.01-0.10)	0.02 (0.02-0.25)
SL1	NFA38	0.10 (0.01-0.15)	0.25 (0.02-0.37)
Sy1	NFA28	0.28 (0.23-0.33)	0.69 (0.57-0.81)
Sy1	NFA29	0.23 (0.18-0.25)	0.57 (0.44-0.62)
Sy1	NFA30	0.20 (0.15-0.24)	0.49 (0.37-0.59)
Sy1	NFC11	0.26 (0.22-0.30)	0.64 (0.54-0.74)
Sy1	NFC12	0.26 (0.22-0.30)	0.64 (0.54-0.74)
Sy2	NFA31	0.20 (0.15-0.25)	0.49 (0.62-0.37)
Sy2	NFA32	0.15 (0.10-0.20)	0.37 (0.25-0.49)
Sy2	NFA33	0.10 (0.01-0.12)	0.25 (0.02-0.30)
Sy2	NFC13	0.15 (0.10-0.20)	0.37 (0.25-0.49)

NFA01 Plains Rough Fescue - Western Porcupine Grass (n=44)

(Festuca hallii - Stipa curtiseta)

This is the reference plant community for Loamy 1 range sites, occurring on plains and mid- to lower-slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. This community is found throughout the Northern Fescue, but is most common in northern portions of the subregion. Plains rough fescue is the dominant grass under light to moderate grazing pressure, but will decline in abundance and vigour under moderate to heavy grazing or other disturbance pressure - replaced by western porcupine grass, upland sedges or Kentucky bluegrass. Plains Rough Fescue is poorly adapted to spring grazing, and will compete more effectively with introduced grasses if grazing occurs during the dormant season. Bare soil = 3% (0-14%), litter = 80% (40-100%), moss and lichen = 7% (0-27).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-9.0	61
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	3.0	0.0-9.0	63
Forb			
PRAIRIE CROCUS *(Anemone patens)*	1.0	0.0-4.0	43
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-7.0	37
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-5.0	54
THREE-FLOWERED AVENS *(Geum triflorum)*	1.0	0.0-14.0	26
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	0.0-13.0	91
Graminoid			
INTERMEDIATE OAT GRASS *(Danthonia intermedia)*	1.0	0.0-6.0	28
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-8.0	52
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	2.0	0.0-7.0	87
SEDGE SPECIES *(Carex)*	6.0	0.0-17.0	95
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	12.0	3.0-30.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	52.0	33.0-80.0	100

Environmental Variables

Elevation (range): 856 (747-930) M

Slope (%): 0 - 30.99

Aspect: Northerly, Southerly, Level, Westerly, Easterly

Topographic Position: Midslope, Lower slope, level

Soil Variables

Soil Drainage: Moderately well drained, Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=3

	Mean	Min	Max
Unspecified	1196	1121	1345
Total	**1196**		

Ecologically Sustainable Stocking Rate

0.81 (0.74-1.14) AUM/Ha or 0.33 (0.30-0.46) AUM/Ac

NFA02 Plains Rough Fescue - Kentucky Bluegrass (n=46)

(Festuca hallii - Poa pratensis)

This is a late seral grassland community, successional to NFA1 (Loamy 1), associated with Loamy range sites on plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Heavy grazing or other disturbance pressure, or season-long grazing will eliminate plains rough fescue from the community. This community has a significant component of Kentucky bluegrass. To maintain a low cover of Kentucky bluegrass, a light to moderate stocking rate is recommended. Plains rough fescue is best adapted to dormant season grazing, and spring grazing of this community will result in reduced rough fescue cover and increase Kentucky bluegrass cover over time. Kentucky bluegrass, once established, is persistent, and rest from grazing or other disturbance pressure may help to improve vigour and cover of rough fescue, but will not eliminate Kentucky bluegrass. Bare soil = 2% (0-15%), litter = 81% (36-100%), moss and lichen = 7% (0-27%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-5.0	60
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	2.0	0.0-9.0	63
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-4.0	61
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-12.0	24
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-11.0	56
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	1.0	0.0-6.0	52
THREE-FLOWERED AVENS *(Geum triflorum)*	1.0	0.0-10.0	41
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	0.0-12.0	87
Graminoid			
AWNED WHEAT GRASS *(Agropyron subsecundum)*	1.0	0.0-10.0	52
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-11.0	37
KENTUCKY BLUEGRASS *(Poa pratensis)*	1.0	1.0-5.0	100
SEDGE SPECIES *(Carex)*	5.0	0.0-17.0	89
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	9.0	0.0-29.0	94
PLAINS ROUGH FESCUE *(Festuca hallii)*	49.0	20.0-79.0	100

Environmental Variables

Elevation (range): 824 (785-863) M

Slope (%): 0 - 30.99

Aspect: Southerly, Level, Northerly, Westerly, Easterly

Topographic Position: Midslope, Lower slope, Level

Soil Variables

Soil Drainage: Moderately well drained, Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=4

	Mean	**Min**	**Max**
Unspecified	1541	1233	1793
Total	**1541**		

Ecologically Sustainable Stocking Rate

0.81 (0.74-1.14) AUM/Ha or 0.33 (0.30-0.46) AUM/Ac

NFA03 Kentucky Bluegrass - Plains Rough Fescue (n=33)

(Poa pratensis - Festuca hallii)

This is an early- to mid-seral plant community, successional to NFA01 (Loamy 1), occurring on level plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Heavy grazing or other disturbance pressure, or repeated spring grazing has reduced the vigour and cover of rough fescue, and Kentucky bluegrass has invaded the site to become a co-dominant or dominant species. Reduction in grazing or disturbance pressure, or changes in timing of grazing (eg. dormant season grazing) will assist rough fescue recovery, and may result in a minor reduction in Kentucky bluegrass cover, but will not eliminate Kentucky bluegrass on heavily invaded sites. With reduced disturbance pressure, reduced stocking rate, or improved timing of grazing, this community may recover to an NFA02 community. Bare soil = 2% (0-14%), litter = 85% (54-100), moss and lichen = 4% (1-13%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-8.0	72
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	4.0	0.0-8.0	76
Forb			
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-8.0	36
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-5.0	61
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	1.0	0.0-9.0	61
COMMON YARROW *(Achillea millefolium)*	2.0	0.0-5.0	67
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	2.0	0.0-8.0	70
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	0.0-16.0	85
Graminoid			
AWNED WHEAT GRASS *(Agropyron subsecundum)*	2.0	0.0-9.0	82
JUNE GRASS *(Koeleria macrantha)*	2.0	0.0-9.0	55
SEDGE SPECIES *(Carex)*	4.0	0.0-12.0	91
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	8.0	0.0-19.0	94
KENTUCKY BLUEGRASS *(Poa pratensis)*	10.0	5.0-22.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	49.0	20.0-79.0	100

Environmental Variables

Elevation (range): 837 (765-879) M

Slope (%): 0.5 – 45.99

Aspect: Level, Northerly, Southerly, Westerly, Easterly

Topographic Position: Level, Midslope

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=9

	Mean	Min	Max
Unspecified	1800	1233	2242
Total	**1800**		

Ecologically Sustainable Stocking Rate

0.81 (0.74-1.14) AUM/Ha or 0.33 (0.30-0.46) AUM/Ac

NFA07 Western Porcupine Grass - Plains Rough Fescue (n=28)

(Stipa curtiseta - Festuca hallii)

This is the reference plant community for Loamy 2 ecological range sites, occurring on hill crests and steep upper slopes. Soils are dominated by the eroded phase of dark brown chernozems, which have a thinner A horizon than soils at mid- and lower slope positions. This community is similar to the more mesic NFA01, but under drier conditions western porcupine grass is co-dominant with plains rough fescue. With increased grazing or other disturbance pressures, or early season grazing, plains rough fescue declines in cover, replaced by upland sedges or western porcupine grass. Bare soil = 6% (0-11%), litter = 56% (35-93%), moss and lichen = 12 (1-35%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 2
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-5.0	54
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-8.0	42
Forb			
PRAIRIE CROCUS *(Anemone patens)*	1.0	0.0-6.0	57
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-6.0	46
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	1.0	0.0-5.0	36
THREE-FLOWERED AVENS *(Geum triflorum)*	1.0	0.0-15.0	18
TUFTED FLEABANE *(Erigeron caespitosus)*	2.0	0.0-10.0	43
PASTURE SAGEWORT *(Artemisia frigida)*	7.0	0.0-21.0	93
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	2.0	0.0-7.0	61
WESTERN WHEAT GRASS *(Agropyron smithii)*	2.0	0.0-15.0	71
BLUE GRAMA *(Bouteloua gracilis)*	2.0	0.0-12.0	57
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	2.0	0.0-7.0	86
JUNE GRASS *(Koeleria macrantha)*	4.0	0.0-13.0	79
SEDGE SPECIES *(Carex)*	6.0	0.0-14.0	96
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	20.0	9.0-29.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	22.0	10.0-33.0	100

Environmental Variables

Elevation (range): 921 (867-970) M

Slope (%): 0 - 45.99

Aspect: Level, Westerly, Southerly,

Topographic Position: Upper Slope, Midslope, Crest

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=1

	Mean	**Min**	**Max**
Unspecified	1065	1065	1065
Total	**1065**		

Ecologically Sustainable Stocking Rate

0.75 (0.62-0.87) AUM/Ha or 0.30 (0.25-0.35) AUM/Ac

NFA08 Sedge-Plains Rough Fescue - Western Porcupine Grass (n=51)

(Carex spp. - Festuca hallii-Stipa curtiseta)

This is a mid-seral plant community, successional to NFA07 (Loamy 2), occurring on hill crests and steep upper slopes. Soils are dominated by the eroded phase of dark brown chernozems, which have a thinner A horizon than soils at mid- and lower slope positions. Moderate to heavy grazing or other disturbance pressures, or repeated spring grazing have reduced cover of plains rough fescue and western porcupine grass so they are co-dominant with upland sedges. Kentucky bluegrass is a minor component of this community, but occurs at lower cover than on invaded Loamy 1 sites due to drier site conditions. Continued high disturbance, high stocking rates, or repeated spring grazing will result in further decline of plains rough fescue and western porcupine grass. Bare soil = 2% (0-12%), litter = 74% (34-98%), moss and lichen = 23% (2-66%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 2
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-4.0	33
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-6.0	37
Forb			
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-11.0	43
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-11.0	53
THREE-FLOWERED AVENS *(Geum triflorum)*	1.0	0.0-17.0	20
LOW GOLDENROD *(Solidago missouriensis)*	1.0	0.0-4.0	65
PRAIRIE CROCUS *(Anemone patens)*	2.0	0.0-10.0	78
TUFTED FLEABANE *(Erigeron caespitosus)*	2.0	0.0-16.0	49
PASTURE SAGEWORT *(Artemisia frigida)*	12.0	2.0-25.0	100
Graminoid			
NEEDLE-AND-THREAD *(Stipa comata)*	1.0	0.0-17.0	10
BLUE GRAMA *(Bouteloua gracilis)*	2.0	0.0-10.0	65
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	2.0	0.0-13.0	94
JUNE GRASS *(Koeleria macrantha)*	2.0	0.0-10.0	80
WESTERN WHEAT GRASS *(Agropyron smithii)*	4.0	0.0-17.0	67
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	12.0	2.0-25.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	21.0	1.0-42.0	100
SEDGE SPECIES *(Carex)*	21.0	4.0-48.0	100

Environmental Variables

Elevation (range): 1211 (740-2340) M

Slope (%): 0.5 - 30.99

Aspect: Southerly, Westerly

Topographic Position: Crest, Upper Slope, Midslope

Soil Variables

Soil Drainage: Rapidly drained, Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: EOR, NUT, PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=2

	Mean	**Min**	**Max**
Unspecified	897	673	1121
Total	**897**		

Ecologically Sustainable Stocking Rate

0.69 (0.52-0.87) AUM/Ha or 0.28 (0.21-0.35) AUM/Ac

NFA09 Blue Grama - Sedge (n=29)

(Bouteloua gracilis - Carex spp.)

This is an early-seral plant community, successional to NFA07 (Loamy 2), occurring on hill crests and steep upper slopes. Soils are dominated by the eroded phase of dark brown chernozems, which have a thinner A horizon than soils at mid- and lower slope positions. Heavy grazing or other heavy disturbance pressures have led to a community dominated by low grasses such as blue grama and upland sedges, with a reduced component of western porcupine grass. Moss and lichen cover, and bare ground are relatively high (30% and 7%, respectively). With rest, reduced stocking rate, or improved livestock distribution tall grass cover will recover. Bare soil = 2% (0-8%), litter = 48% (30-78%), moss and lichen = 17% (1-43%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 2
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-4.0	55
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	2.0	0.0-7.0	52
Forb			
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-4.0	24
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-5.0	31
TUFTED FLEABANE *(Erigeron caespitosus)*	1.0	0.0-4.0	21
PASTURE SAGEWORT *(Artemisia frigida)*	8.0	0.0-26.0	97
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-11.0	41
PLAINS MUHLY *(Muhlenbergia cuspidata)*	1.0	0.0-9.0	21
WESTERN WHEAT GRASS *(Agropyron smithii)*	3.0	0.0-12.0	51
JUNE GRASS *(Koeleria macrantha)*	6.0	0.0-24.0	86
PLAINS ROUGH FESCUE *(Festuca hallii)*	7.0	0.0-25.0	86
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	12.0	1.0-20.0	100
SEDGE SPECIES *(Carex)*	12.0	1.0-22.0	100
BLUE GRAMA *(Bouteloua gracilis)*	21.0	5.0-50.0	100

Environmental Variables

Elevation (range): 747 (737-766) M

Slope (%): 0.5 – 45.99

Aspect: Westerly, Southerly

Topographic Position: Crest, Upper Slope, Midslope

Soil Variables

Soil Drainage: Rapidly drained, Well drained, Moderately well drained

Soil Subgroup: REGOSOL ORTHIC, DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, NUT, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.52 (0.42-0.62) AUM/Ha or 0.21 (0.17-0.25) AUM/Ac

NFA10 Plains Rough Fescue - Sedge (n=10)

(Festuca hallii - Carex spp.)

This is a late seral to reference plant community on Blowout 1 ecological range sites, developing on dark brown solods and solodized solonetzes. The presence of a relatively thick (>20cm) A horizon allows taller grasses such as rough fescue and western porcupine grass to dominate the community. Under moderate grazing pressure, rough fescue declines in abundance and is replaced by upland sedges and western porcupine grass. Blowouts may be characterised by a mosaic of Blowout 1 communities where topsoil is relatively deep and Blowout 2 communities in eroded pits. In situations where Blowout 1 and Blowout 2 sites occur together, select the site type and community that best represents the majority of the site, and adjust the stocking rate upwards or downwards to accommodate for patches with higher or lower productivity than the selected community. Bare soil = 0% (0-1%), litter = 42% (35-49%), moss and lichen = 5% (1-9%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-2.0	30
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-2.0	50
Forb			
UNDIFFERENTIATED ANEMONE *(Anemone)*	1.0	0.0-5.0	50
UNDIFFERENTIATED MILK VETCH *(Astragalus)*	1.0	0.0-3.0	40
GOLDEN BEAN *(Thermopsis rhombifolia)*	1.0	0.0-3.0	50
COMMON YARROW *(Achillea millefolium)*	2.0	0.0-8.0	90
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-6.0	90
NORTHERN BEDSTRAW *(Galium boreale)*	2.0	0.0-5.0	50
Graminoid			
BLUE GRAMA *(Bouteloua gracilis)*	1.0	0.0-5.0	30
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	1.0	0.0-4.0	70
JUNE GRASS *(Koeleria macrantha)*	5.0	0.0-9.0	90
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	6.0	0.0-12.0	80
WHEAT GRASS SPECIES *(Agropyron)*	7.0	0.0-10.0	90
SEDGE SPECIES *(Carex)*	11.0	5.0-28.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	25.0	16.0-35.0	100

Environmental Variables

Elevation (range): 769 (743-795) M

Slope (%): 2.5 - 5.99

Aspect: Level

Topographic Position: Level, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup:

Soil Series: ZGW, BFD, FNR, LHD, SUL

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.66 (0.54-0.75) AUM/Ha or 0.26 (0.22-0.30) AUM/Ac

NFA11 Sedge - Plains Rough Fescue (n=6)

(Carex spp. - Festuca hallii)

This is a mid-seral plant community successional to NFA10 (Blowout 1) on dark brown solods and solodized solonetzes with a relatively deep A horizon. Moderate grazing pressure has resulted in reduced plains rough fescue cover and increased cover of upland sedges and western porcupine grass. Reduced stocking rates or rest will allow rough fescue to recover. Blowouts may be characterised by a mosaic of Blowout 1 communities where topsoil is relatively deep and Blowout 2 communities in eroded pits. In situations where both Blowout 1 and Blowout 2 sites occur together, select the site type and community that best represents the majority of the site, and adjust the stocking rate upwards or downwards to accommodate for patches with higher or lower productivity than the selected community. Bare soil = 0% (0-1%), litter = 93% (87-100%), moss and lichen = 17% (10-27%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-3.0	67
CUT-LEAVED ANEMONE *(Anemone multifida)*	1.0	0.0-5.0	17
GOLDEN BEAN *(Thermopsis rhombifolia)*	1.0	0.0-4.0	67
ASTER SPECIES *(Aster)*	1.0	0.0-3.0	33
PRAIRIE CROCUS *(Anemone patens)*	2.0	0.0-9.0	50
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	1.0-5.0	100
Graminoid			
PLAINS ROUGH FESCUE *(Festuca hallii)*	1.0	0.0-4.0	67
NEEDLE-AND-THREAD *(Stipa comata)*	1.0	0.0-4.0	50
BLUE GRAMA *(Bouteloua gracilis)*	2.0	0.0-7.0	67
JUNE GRASS *(Koeleria macrantha)*	2.0	1.0-4.0	100
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	3.0	0.0-9.0	67
SEDGE SPECIES *(Carex)*	9.0	5.0-15.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	10.0	7.0-14.0	100

Environmental Variables

Elevation (range): 770 (685-823) M

Slope (%): 0.5 - 2.49

Aspect: Level

Topographic Position: Level, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup:

Soil Series: SUL, BFD, FST, HKR

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.50 (0.37-0.62) AUM/Ha or 0.20 (0.15-0.25) AUM/Ac

NFA12 Western Wheat Grass - June Grass (n=9)

(Agropyron smithii - Koeleria macrantha)

This is the reference community for Blowout 3 sites, occurring on severely eroded soils of the solonetzic order, characterised by a solonetzic B horizon at the soil surface or under a few centimetres of A horizon. This community is dominated by western wheat grass – which is adapted to tolerate high soil salinity and shrink/swell in the B horizon – along with other low grasses such as June grass and upland sedges. Bare soil and moss and lichen cover can be high, and litter cover is limited. Cover of nostoc soil crusts may also be high. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and early spring use (or use during other periods of saturation) may result in long-term negative soil impacts. Under moderate grazing, cover of western wheat grass and other grasses is reduced and bare soil and moss & lichen cover increase. Bare soil = 4% (0-17%), litter = 20% (7-36%), moss and lichen = 55% (43-77%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 3
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
SILVER SAGEBRUSH *(Artemisia cana)*	1.0	0.0-5.0	56
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-3.0	44
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-5.0	11
WINTER-FAT *(Eurotia lanata)*	1.0	0.0-3.0	56
PRICKLY-PEAR *(Opuntia polyacantha)*	3.0	0.0-7.0	78
PASTURE SAGEWORT *(Artemisia frigida)*	4.0	0.0-10.0	89
Graminoid			
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	1.0	0.0-5.0	22
SEDGE SPECIES *(Carex)*	3.0	0.0-9.0	89
BLUEGRASSES *(Poa)*	7.0	0.0-19.0	89
JUNE GRASS *(Koeleria macrantha)*	9.0	0.0-24.0	89
WESTERN WHEAT GRASS *(Agropyron smithii)*	28.0	17.0-50.0	100

Environmental Variables

Elevation (range): 699 (699-699) M

Slope (%): 0 - 0.49

Aspect: Variable, Level

Topographic Position: Level

Soil Variables

Soil Drainage: Moderately well drained, Well drained

Soil Subgroup: SOLODIZED SOLONETZ DARK BROWN, SOLONETZ DARK BROWN

Soil Series: BFD, HKR, SUL, TLA, ZUN

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.45 (0.30-0.57) AUM/Ha or 0.18 (0.12-0.23) AUM/Ac

NFA15 Awned sedge - Fowl Bluegrass (n=10)

(Carex atherodes - Poa palustris)

This is a late-seral to reference plant community occurring on Subirrigated 1 ecological range sites. These sites are non-saline and usually retain water at the surface for only a brief period in the early spring before the bottom ice seal disappears, and occasionally for several days after heavy rainstorms (Stewart and Kantrud 1971) (National Wetlands Working Group 1997). In light- or no disturbance the community is dominated by awned sedge. Under moderate disturbance fowl bluegrass, foxtail barley and native forbs will increase in cover, and under heavy disturbance conditions invasive species including redtop and Kentucky bluegrass may dominate the site. The degree to which the community will shift from the reference plant community to early seral depends on grazing management and changes in the water table during the growing season. Generally, livestock avoid these sites when there is standing water or a high water table. Grazing pressure and season of use appear to vary with the water table and grazing season. Willow species will usually form a ring around the outside margin of these sites, i.e., transition from wetland to sub-irrigated to overflows. Communities on this site should be assessed for riparian health rather than range health. Bare soil = 3% (0-9%), litter = 61% (10-87%), moss and lichen = 11% (7-17%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Subirrigated 1
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	1.0	0.0-5.0	30
Shrub			
BASKET WILLOW *(Salix petiolaris)*	2.0	0.0-5.0	50
Forb			
WATER SMARTWEED *(Polygonum coccineum)*	2.0	0.0-5.0	50
Graminoid			
SMALL BOTTLE SEDGE *(Carex utriculata)*	1.0	0.0-8.0	10
COMMON TALL MANNA GRASS *(Glyceria grandis)*	1.0	0.0-11.0	10
WOOLLY SEDGE *(Carex lanuginosa)*	2.0	0.0-24.0	10
FOWL MANNA GRASS *(Glyceria striata)*	2.0	0.0-16.0	10
NORTHERN REED GRASS *(Calamagrostis inexpansa)*	5.0	0.0-20.0	60
FOWL BLUEGRASS *(Poa palustris)*	6.0	0.0-18.0	70
AWNED SEDGE *(Carex atherodes)*	70.0	33.0-95.0	100

Environmental Variables

Elevation (range): 677 (677-677) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Depression

Soil Variables

Soil Drainage: Poorly drained, Very poorly drained

Soil Subgroup: HUMIC GLEYSOL ORTHIC, DARK BROWN CHERNOZEM ORTHIC

Soil Series:

Soil Correlation: SCA 4

Range Site Category: Subirrigated

Forage Production (kg/ha) n=1

	Mean	**Min**	**Max**
Unspecified	3923	3923	3923
Total	**3923**		

Ecologically Sustainable Stocking Rate

0.02 (0.02-0.37) AUM/Ha or 0.01 (0.01-0.15) AUM/Ac

NFA16 Sedge - Creeping Spike Rush (n=4)

(Carex spp. - Eleocharis palustris)

This is a late seral to reference plant community for Subirrigated ecological range sites. These are highly productive and most palatable early in the grazing season. These sites are non-saline and usually retain water at the surface for only a brief period in the early spring before the bottom ice seal disappears, and occasionally for several days after heavy rainstorms (Stewart and Kantrud 1971) (National Wetlands Working Group 1997). In light- to no disturbance this community is dominated by creeping spike rush and tall sedges (awned, beaked, and water sedge). Under moderate disturbance fowl bluegrass, foxtail barley and native forbs will increase in cover, and under heavy disturbance invasive species, including redtop and Kentucky bluegrass, may dominate. The degree to which the community will shift from the reference plant community to early seral depends on grazing management and changes in the water table during the growing season. Generally, livestock avoid these sites when there is standing water or a high water table. Grazing pressure and season of use appear to vary with the water table and grazing season. Willow species will usually form a ring around the outside margin of these sites, i.e., transition from wetland to sub-irrigated to overflows. Communities on this site should be assessed for riparian health rather than range health. Bare soil = 3% (0-6%), litter = 70% (42-90%), moss and lichen = 19 (1-41%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Subirrigated 1
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	3.0	0.0-5.0	75
Shrub			
BEAKED WILLOW *(Salix bebbiana)*	3.0	0.0-5.0	75
BASKET WILLOW *(Salix petiolaris)*	3.0	0.0-5.0	75
Forb			
WILD MINT *(Mentha arvensis)*	1.0	0.0-1.0	25
WATER SMARTWEED *(Polygonum coccineum)*	1.0	0.0-1.0	75
SILVERWEED *(Potentilla anserina)*	1.0	0.0-2.0	25
Graminoid			
WIRE RUSH *(Juncus balticus)*	2.0	0.0-8.0	25
FOWL BLUEGRASS *(Poa palustris)*	2.0	0.0-5.0	50
NORTHERN REED GRASS *(Calamagrostis inexpansa)*	3.0	0.0-11.0	50
SMALL BOTTLE SEDGE *(Carex utriculata)*	4.0	0.0-9.0	50
AWNED SEDGE *(Carex atherodes)*	24.0	0.0-56.0	75
CREEPING SPIKE-RUSH *(Eleocharis palustris)*	51.0	12.0-75.0	100

Environmental Variables

Elevation (range):

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Depression

Soil Variables

Soil Drainage: Poorly drained

Soil Subgroup: GLEYSOL ORTHIC

Soil Series:

Soil Correlation: SCA 4

Range Site Category: Subirrigated

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.02 (0.02-0.37) AUM/Ha or 0.01 (0.01-0.15) AUM/Ac

NFA17 Sedge - Western Wheat Grass (n=6)

(Carex spp - Agropyron smithii)

This is an early-seral plant community successional to NFA10 (Blowout 1) on dark brown solods and solodized solonetzes with a relatively deep A horizon. Heavy grazing and/or other disturbance pressures have greatly reduced tall grass cover, and the community is dominated by mid- and low grasses including a minor component of Kentucky bluegrass. Reduced stocking rates or rest will allow tall grasses to recover, but Kentucky bluegrass is an excellent competitor and will persist in the community. Blowouts may be characterised by a mosaic of Blowout 1 communities where topsoil is relatively deep and Blowout 2 communities in eroded pits. In situations where both Blowout 1 and Blowout 2 sites occur together, select the site type and community that best represents the majority of the site, and adjust the stocking rate upwards or downwards to accommodate for patches with higher or lower productivity than the selected community. Bare soil = 6% (0-12%), moss and lichen = 41% (18-67%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Forb			
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-3.0	50
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	1.0	0.0-3.0	67
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	1.0-4.0	100
GUMWEED *(Grindelia squarrosa)*	2.0	1.0-3.0	100
COMMON YARROW *(Achillea millefolium)*	4.0	2.0-8.0	100
Graminoid			
SANDBERG BLUEGRASS *(Poa sandbergii)*	2.0	1.0-3.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	2.0	1.0-7.0	100
ROUGH HAIR GRASS *(Agrostis scabra)*	3.0	0.0-8.0	83
KENTUCKY BLUEGRASS *(Poa pratensis)*	3.0	2.0-5.0	100
JUNE GRASS *(Koeleria macrantha)*	9.0	3.0-16.0	100
EARLY BLUEGRASS *(Poa cusickii)*	10.0	1.0-16.0	100
WESTERN WHEAT GRASS *(Agropyron smithii)*	13.0	9.0-18.0	100
SEDGE SPECIES *(Carex)*	21.0	17.0-29.0	100

Environmental Variables

Elevation (range):

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level

Soil Variables

Soil Drainage:

Soil Subgroup: SOLOD DARK BROWN, SOLODIZED SOLONETZ DARK BROWN

Soil Series: SUL, BFD, HKR

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.37 (0.25-0.49) AUM/Ha or 0.15 (0.10-0.20) AUM/Ac

NFA18 Western Wheat Grass - Plains Rough Fescue - Sedge (n=5)

(Agropyron smithii - Festuca hallii - Carex spp.)

This is the reference community for the Blowout 2 ecological range site, occurring on eroded dark brown solods or solodized solonetzes that have a thin layer of A horizon (<20cm). Due to close proximity of the solonetzic B horizon to soil surface, this site is more restrictive to plant growth than Blowout 1. The community is dominated by western wheat grass - due to adaptation to high soil salinity and shrink/swell in the B horizon - but site conditions are favourable enough to support significant cover of plains rough fescue under low disturbance conditions. With moderate grazing or disturbance pressure western wheat grass and rough fescue cover are reduced, replaced by upland sedges, June grass, and low forbs. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and early spring use (or use during other periods of saturation) may result in long-term negative soil impacts. On unevenly eroded sites, blowouts may be characterised by a mosaic of Blowout 1 communities where topsoil is relatively deep and Blowout 2 communities in eroded pits. In situations where both Blowout 1 and Blowout 2 sites occur together, select the site type and community that best represents the majority of the site, and adjust the stocking rate upwards or downwards to accommodate for patches with higher or lower productivity than the selected community. Bare soil = 0% (0-1%), litter = 74%, moss and lichen = 47% (14-84%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 2
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Forb			
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	1.0	0.0-2.0	80
PASTURE SAGEWORT *(Artemisia frigida)*	1.0	1.0-2.0	100
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	1.0	0.0-2.0	40
GUMWEED *(Grindelia squarrosa)*	1.0	1.0-3.0	100
COMMON YARROW *(Achillea millefolium)*	3.0	2.0-4.0	100
TUFTED WHITE PRAIRIE ASTER *(Aster ericoides)*	3.0	0.0-11.0	60
Graminoid			
BLUE GRAMA *(Bouteloua gracilis)*	2.0	1.0-3.0	100
EARLY BLUEGRASS *(Poa cusickii)*	2.0	0.0-4.0	60
JUNE GRASS *(Koeleria macrantha)*	4.0	1.0-7.0	100
SEDGE SPECIES *(Carex)*	6.0	3.0-9.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	8.0	5.0-11.0	100
WESTERN WHEAT GRASS *(Agropyron smithii)*	18.0	9.0-35.0	100

Environmental Variables

Elevation (range):

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level

Soil Variables

Soil Drainage:

Soil Subgroup: SOLODIZED SOLONETZ DARK BROWN

Soil Series: TLA, HKR

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.44 (0.25-0.62) AUM/Ha or 0.18 (0.10-0.25) AUM/Ac

NFA19 Sedge - Kentucky Bluegrass (n=6)

(Carex spp. - Poa pratensis)

This is a mid-seral community successional to NFA18 (Blowout 2), occurring on eroded dark brown solods or solodized solonetzes that have a thin layer of A horizon (<20cm). Due to close proximity of the solonetzic B horizon to soil surface, this site is more restrictive to plant growth than Blowout 1. Moderate grazing or other disturbance pressures have reduced wheat grass and rough fescue cover, and the community is dominated by sparse cover of upland sedge, western wheat grass, June grass, and other low grasses and forbs. Under heavy grazing or other disturbance pressure, upland sedge cover increases and Kentucky bluegrass may become a significant component of the community. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and early spring use (or use during other periods of saturation) may result in long-term negative soil impacts. On unevenly eroded sites, Blowouts may be characterised by a mosaic of Blowout 1 communities where topsoil is relatively deep and Blowout 2 communities in eroded pits. In situations where both Blowout 1 and Blowout 2 sites occur together, select the site type and community that best represents the majority of the site, and adjust the stocking rate upwards or downwards to accommodate for patches with higher or lower productivity than the selected community. Bare soil = 2% (0-11%), litter = 32% (25-40%), moss and lichen = 14% (1-46%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 2
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Forb			
PASTURE SAGEWORT *(Artemisia frigida)*	1.0	0.0-2.0	83
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-3.0	50
GUMWEED *(Grindelia squarrosa)*	1.0	0.0-4.0	33
COMMON YARROW *(Achillea millefolium)*	7.0	0.0-11.0	83
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-5.0	50
EARLY BLUEGRASS *(Poa cusickii)*	1.0	0.0-8.0	50
ALKALI BLUEGRASS *(Poa juncifolia)*	1.0	0.0-7.0	33
JUNE GRASS *(Koeleria macrantha)*	2.0	0.0-7.0	50
WESTERN WHEAT GRASS *(Agropyron smithii)*	9.0	6.0-12.0	100
KENTUCKY BLUEGRASS *(Poa pratensis)*	15.0	8.0-31.0	100
SEDGE SPECIES *(Carex)*	21.0	11.0-29.0	100

Environmental Variables

Elevation (range): 780 (780-780) M

Slope (%): 0.5 - 2.49

Aspect: Level

Topographic Position: Level

Soil Variables

Soil Drainage: Moderately well drained

Soil Subgroup: SOLODIZED SOLONETZ DARK BROWN

Soil Series: TLA, SUL

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.37 (0.25-0.49) AUM/Ha or 0.15 (0.10-0.20) AUM/Ac

NFA20 Sedge - June Grass - Western Wheat Grass (n=17)

(Carex spp. - Koeleria macrantha - Agropyron smithii)

This is an early-seral community successional to NFA18 (Blowout 2), occurring on eroded dark brown solods or solodized solonetzes that have a thin layer of A horizon (<20cm). Due to close proximity of the solonetzic B horizon to the soil surface, this site is more restrictive to plant growth than Blowout 1. Heavy grazing or other disturbance pressure has resulted in a reduction in native tall grass cover and the site is dominated by upland sedge and Kentucky bluegrass. With rest or reduced stocking rate, wheat grass and plains rough fescue will recover, but once established Kentucky bluegrass will persist. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and early spring use (or use during other periods of saturation) may result in long-term negative soil impacts. On unevenly eroded sites, Blowouts may be characterised by a mosaic of Blowout 1 communities where topsoil is relatively deep and Blowout 2 communities in eroded pits. In situations where both Blowout 1 and Blowout 2 sites occur together, select the site type and community that best represents the majority of the site, and adjust the stocking rate upwards or downwards to accommodate for patches with higher or lower productivity than the selected community. Bare soil = 3% (0-13%), litter = 80% (41-100%), moss and lichen = 5% (0-10%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 2
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Forb			
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-7.0	41
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-3.0	52
NORTHERN BEDSTRAW *(Galium boreale)*	1.0	0.0-5.0	53
GUMWEED *(Grindelia squarrosa)*	1.0	0.0-4.0	47
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-7.0	71
COMMON YARROW *(Achillea millefolium)*	3.0	1.0-10.0	100
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-5.0	35
KENTUCKY BLUEGRASS *(Poa pratensis)*	1.0	0.0-5.0	35
NEEDLE-AND-THREAD *(Stipa comata)*	2.0	0.0-10.0	24
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	2.0	0.0-5.0	58
PLAINS ROUGH FESCUE *(Festuca hallii)*	3.0	0.0-12.0	65
WESTERN WHEAT GRASS *(Agropyron smithii)*	5.0	0.0-16.0	88
JUNE GRASS *(Koeleria macrantha)*	5.0	1.0-9.0	100
SEDGE SPECIES *(Carex)*	8.0	2.0-13.0	100

Environmental Variables

Elevation (range): 812 (781-853) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level

Soil Variables

Soil Drainage: Moderately well drained

Soil Subgroup: SOLODIZED SOLONETZ DARK BROWN

Soil Series: HKR, CUR, SUL, WES, TLA

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.25 (0.02-0.37) AUM/Ha or 0.10 (0.01-0.15) AUM/Ac

NFA21 Western Wheat Grass (n=12)

(Agropyron smithii)

This community is mid- to early-seral community successional to NFA12 (Blowout 3), occurring on severely eroded soils of the solonetzic order, characterised by the solonetzic B horizon at the soil surface or under a few centimetres of A horizon. This community is almost totally dominated by western wheat grass - which is adapted to tolerate high soil salinity and shrink/swell in the B horizon. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and early spring use (or use during other periods of saturation) may result in long-term negative soil impacts. Bare soil and moss and lichen cover are high, and litter cover is very low. Under heavy disturbance grass cover declines and the site becomes sparsely vegetated by cactus, low grasses, and forbs. Bare soil = 33% (0-83%), litter = 13 (9-17%), moss and lichen = 31% (0-91%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 3
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
SILVER SAGEBRUSH *(Artemisia cana)*	1.0	0.0-3.0	58
NUTTALL'S ATRIPLEX *(Atriplex nuttallii)*	3.0	0.0-12.0	75
Forb			
OAK-LEAVED GOOSEFOOT *(Chenopodium salinum)*	1.0	0.0-7.0	33
BRITTLE PRICKLY-PEAR *(Opuntia fragilis)*	1.0	0.0-1.0	42
PRICKLY-PEAR *(Opuntia polyacantha)*	1.0	0.0-2.0	17
COMMON PEPPER-GRASS *(Lepidium densiflorum)*	2.0	0.0-7.0	67
UNDIFFERENTIATED POLYGONUM *(Polygonum)*	4.0	0.0-15.0	58
Graminoid			
ALKALI BLUEGRASS *(Poa juncifolia)*	2.0	0.0-7.0	83
WESTERN WHEAT GRASS *(Agropyron smithii)*	20.0	5.0-32.0	100

Environmental Variables

Elevation (range):

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level

Soil Variables

Soil Drainage:

Soil Subgroup: SOLONETZ DARK BROWN, SOLODIZED SOLONETZ DARK BROWN

Soil Series: TLA, HKR

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.32 (0.12-0.49) AUM/Ha or 0.13 (0..05-0.20) AUM/Ac

NFA22 Prickly Pear / June Grass (n=1)

(Opuntia polycantha / Koeleria macrantha)

This community is an early-seral community successional to NFA12 (Blowout 3 site), occurring on severely eroded soils of the solonetzic order, characterised by the solonetzic B horizon at the soil surface or under a few centimetres of A horizon. Heavy grazing or other disturbance pressure has severely reduced the cover of low grasses and forbs, and the community is sparsely vegetated by prickly pear. Soil exposure is high and litter is nearly absent. Nostoc crusts or moss & lichen cover may be high within this community, but these are easily disturbed by hoof action. This community produces little usable forage and should be considered non-use. Bare soil = 15%, litter = 1%, moss and lichen = 7%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 3
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Forb			
GUMWEED *(Grindelia squarrosa)*	2.3	2.3-2.3	100
BROOMWEED *(Gutierrezia sarothrae)*	3.3	3.3-3.3	100
PRICKLY-PEAR *(Opuntia polyacantha)*	7.3	7.3-7.3	100
Graminoid			
WESTERN WHEAT GRASS *(Agropyron smithii)*	2.7	2.7-2.7	100
SANDBERG BLUEGRASS *(Poa sandbergii)*	4.0	4.0-4.0	100
JUNE GRASS *(Koeleria macrantha)*	4.3	4.3-4.3	100

Environmental Variables

Elevation (range): 800 (800-800) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level

Soil Variables

Soil Drainage:

Soil Subgroup: SOLONETZ DARK BROWN, SOLODIZED SOLONETZ DARK BROWN

Soil Series: TLA, ZSZ, HKR

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0..02 (0.02-0.12) AUM/Ha or 0.01 (0.01-0.05) AUM/Ac

NFA23 Kentucky Bluegrass / Dandelion (n=32)

(Poa pratensis / Taraxacum officinale)

This is an early-seral plant community, successional to NFA01 (Loamy 1) occurring on level plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. This community occurs on re-seeded industrial disturbances that have not successfully recovered key native species. Heavy grazing or other disturbance pressure has resulted in relatively low Kentucky bluegrass cover, and low forbs and weeds are a significant component of this community. With rest or reduced stocking rate, Kentucky bluegrass will recover, and the community will shift to a more productive NFB01 community. Bare soil = 30% (0-53%), litter = 37%, moss and lichen = 8% (1-29%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Shrub			
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-9.0	56
Forb			
UNDIFFERENTIATED SONCHUS *(Sonchus)*	1.0	0.0-7.0	22
COMMON YARROW *(Achillea millefolium)*	3.0	0.0-12.0	88
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	4.0	0.0-31.0	63
CANADA THISTLE *(Cirsium arvense)*	4.0	0.0-20.0	63
VAR VICAAME NARROW-LEAVED VETCH *(Vicia americana var. sparsifolia)*	4.0	0.0-16.0	84
PASTURE SAGEWORT *(Artemisia frigida)*	7.0	0.0-32.0	88
COMMON DANDELION *(Taraxacum officinale)*	14.0	1.0-37.0	100
Graminoid			
CREEPING RED FESCUE *(Festuca rubra)*	1.0	0.0-11.0	34
SLENDER WHEAT GRASS *(Agropyron trachycaulum)*	4.0	0.0-36.0	56
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	13.0	0.0-35.0	97
KENTUCKY BLUEGRASS *(Poa pratensis)*	22.0	6.0-54.0	100

Environmental Variables

Elevation (range):

Slope (%):

Aspect: Variable

Topographic Position: Midslope, Lower Slope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND, PRO

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.62 (0.44-0.81) AUM/Ha or 0.25 (0.18-0.33) AUM/Ac

NFA24 Creeping Red Fescue - Kentucky Bluegrass (n=13)

(Festuca rubra - Poa pratensis)

This is an early-seral plant community, successional to NFA01 (Loamy 1) occurring on level plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. This community likely represents old tame pastures that have been heavily grazed, reducing the cover of tall grasses and legumes. The community is dominated by creeping red fescue, Kentucky bluegrass, and smooth brome. Bare soil = 18% (7-37%), moss and lichen = 1%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Shrub			
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	2.0	0.0-85.0	0
Forb			
COMMON YARROW *(Achillea millefolium)*	4.0	0.0-9.0	85
PASTURE SAGEWORT *(Artemisia frigida)*	4.0	0.0-13.0	85
CANADA THISTLE *(Cirsium arvense)*	5.0	0.0-18.0	69
COMMON DANDELION *(Taraxacum officinale)*	5.0	0.0-12.0	92
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	6.0	0.0-20.0	77
Graminoid			
CANADA BLUEGRASS *(Poa compressa)*	2.0	0.0-11.0	46
SLENDER WHEAT GRASS *(Agropyron trachycaulum)*	3.0	0.0-15.0	62
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	3.0	0.0-9.0	54
AWNLESS BROME *(Bromus inermis)*	10.0	0.0-37.0	85
KENTUCKY BLUEGRASS *(Poa pratensis)*	16.0	3.0-26.0	100
CREEPING RED FESCUE *(Festuca rubra)*	25.0	4.0-65.0	100

Environmental Variables

Elevation (range):

Slope (%):

Aspect: Variable

Topographic Position: Midslope, Lower Slope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.69 (0.49-0.81) AUM/Ha or 0.28 (0.20-0.33) AUM/Ac

NFA25 Western Porcupine Grass - Sedge - Wheat Grass (n=10)

(Stipa curtiseta - Carex spp. - Agropyron spp.)

This is the reference plant community for Loamy 3 ecological range sites, occurring on hill crests and upper- to mid-slopes with south aspect. This community is found towards the south end of the subregion where the Northern Fescue transitions into the Dry Mixedgrass. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Due to drier conditions than Loamy 1 and 2 sites, the reference community is dominated by western porcupine grass with plains rough fescue as a minor component. Under moderate grazing or other disturbance pressure, western porcupine grass cover declines, and the site becomes more sparsely vegetated. Bare soil = 1% (0-2%), litter = 100%, moss and lichen = 14% (1-52%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 3
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRICKLY ROSE *(Rosa acicularis)*	1.0	0.0-4.0	18
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-6.0	18
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-4.0	36
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-2.0	45
LOW GOLDENROD *(Solidago missouriensis)*	1.0	0.0-3.0	27
PASTURE SAGEWORT *(Artemisia frigida)*	6.0	1.0-16.0	100
Graminoid			
WHEAT GRASS SPECIES *(Agropyron)*	1.0	0.0-9.0	27
BLUE GRAMA *(Bouteloua gracilis)*	2.0	0.0-6.0	72
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	2.0	0.0-6.0	54
NEEDLE-AND-THREAD *(Stipa comata)*	3.0	0.0-20.0	45
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	5.0	0.0-15.0	73
JUNE GRASS *(Koeleria macrantha)*	6.0	0.0-12.0	91
PLAINS ROUGH FESCUE *(Festuca hallii)*	7.0	0.0-17.0	63
SEDGE SPECIES *(Carex)*	10.0	1.0-20.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	27.0	17.0-48.0	100

Environmental Variables

Elevation (range): 895 (813-926) M

Slope (%): 0.5 - 2.49

Aspect: Southerly

Topographic Position: Upper Slope, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.74 (0.52-0.89) AUM/Ha or 0.30 (0.21-0.36) AUM/Ac

NFA26 Sedge - Wheatgrass - Western Porcupine Grass (n=4)

(Carex spp. - Agropyron spp. - Stipa curtiseta)

This is a mid-seral plant community, successional to NFA25 (Loamy 3), occurring on hill crests and upper- to mid-slopes with south aspect. This community is found towards the south end of the subregion where the Northern Fescue transitions into the Dry Mixedgrass. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Moderate grazing or other disturbance pressure has reduced western porcupine grass cover and the community is dominated by upland sedge, wheatgrass and western porcupine grass with a minor component of plains rough fescue. With further disturbance tall and mid-grass cover is reduced and the site becomes sparsely vegetated. Bare soil = 1% (0-2%), litter = 65% (35-94%), moss and lichen = 5% (0-10%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 3
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Forb			
PRAIRIE CROCUS *(Anemone patens)*	1.0	0.0-3.0	75
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-4.0	50
BASTARD TOADFLAX *(Comandra umbellata)*	1.0	0.0-1.0	50
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	0.0-7.0	75
GOLDEN BEAN *(Thermopsis rhombifolia)*	5.0	0.0-10.0	75
Graminoid			
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	1.0	0.0-4.0	50
KENTUCKY BLUEGRASS *(Poa pratensis)*	1.0	1.0-3.0	100
JUNE GRASS *(Koeleria macrantha)*	2.0	1.0-5.0	100
NEEDLE-AND-THREAD *(Stipa comata)*	4.0	0.0-10.0	75
PLAINS ROUGH FESCUE *(Festuca hallii)*	5.0	0.0-11.0	50
WHEAT GRASS SPECIES *(Agropyron)*	6.0	0.0-22.0	25
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	8.0	0.0-21.0	75
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	9.0	6.0-15.0	100
SEDGE SPECIES *(Carex)*	26.0	20.0-33.0	100

Environmental Variables

Elevation (range): 823 (787-859) M

Slope (%): 2.5 - 15.99

Aspect: Variable, Southerly

Topographic Position: Crest, Upper Slope, Midslope

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND

Soil Correlation: SCA 4, SCA 1

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.67 (0.52-0.77) AUM/Ha or 0.27 (0.21-0.31) AUM/Ac

NFA27 Western Porcupine Grass - Sedge (n=4)

(Stipa curtiseta - Carex spp.)

This is an early-seral plant community, successional to NFA25 (Loamy 3), occurring on hill crests and upper- to mid-slopes with south aspect. This community is found towards the South end of the subregion where the Northern Fescue transitions into the Dry Mixedgrass. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Heavy grazing or other disturbance pressure has resulted in a sparsely vegetated community dominated by western porcupine grass co-dominant with low grasses such as upland sedges, June grass, and blue grama. With reduced stocking rate or rest, western porcupine grass will recover. Bare soil = 0%, litter = 94% (77-99%), moss and lichen = 7% (1-18%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 3
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
SCARLET MALLOW *(Sphaeralcea coccinea)*	1.0	0.0-1.0	50
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-1.0	25
GOLDEN ASTER *(Heterotheca villosa)*	1.0	0.0-2.0	25
LOW GOLDENROD *(Solidago missouriensis)*	1.0	0.0-2.0	50
PRAIRIE CROCUS *(Anemone patens)*	2.0	0.0-5.0	50
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	0.0-9.0	50
Graminoid			
BLUE GRAMA *(Bouteloua gracilis)*	1.0	0.0-3.0	75
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	1.0	0.0-2.0	75
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-4.0	50
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	2.0	0.0-7.0	75
SEDGE SPECIES *(Carex)*	6.0	5.0-7.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	13.0	9.0-18.0	100

Environmental Variables

Elevation (range): 706 (683-726) M

Slope (%): 0.5 - 2.49

Aspect: Variable

Topographic Position: Level, Upper Slope, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC, DARK BROWN CHERNOZEM REGO

Soil Series: CNN, HND, NUT

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.57 (0.37-0.69) AUM/Ha or 0.23 (0.15-0.28) AUM/Ac

NFA28 Plains Rough Fescue - Western Porcupine Grass (n=5)

(Festuca hallii - Stipa curtiseta)

This is the reference plant community for Sandy 1 ecological range sites, occurring on gently sloping plains, rolling and hummocky landforms, and mid-slope positions. Soils are dominated by dark brown chernozems with moderately coarse texture, especially the soil series Metisko and Dolcy. Under light disturbance, this community is co-dominated by plains rough fescue and western porcupine grass. Under moderate to heavy disturbance rough fescue and western porcupine grass decline in cover, and sites become dominated by upland sedges. Bare soil = 0% (0-1%), moss and lichen = 5% (1-11%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-5.0	40
PRAIRIE ROSE *(Rosa arkansana)*	2.0	1.0-4.0	100
Forb			
PASTURE SAGEWORT *(Artemisia frigida)*	1.0	0.0-3.0	40
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-2.0	80
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-2.0	40
PRAIRIE CROCUS *(Anemone patens)*	2.0	1.0-4.0	0
Graminoid			
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	1.0	1.0-3.0	100
JUNE GRASS *(Koeleria macrantha)*	1.0	1.0-1.0	100
SEDGE SPECIES *(Carex)*	5.0	3.0-8.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	16.0	14.0-18.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	16.0	15.0-18.0	100

Environmental Variables

Elevation (range): 866 (789-920) M

Slope (%): 2.5 - 5.99

Aspect: Westerly, Southerly

Topographic Position: Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND, MET, DCY

Soil Correlation: SCA 4

Range Site Category: Sandy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.69 (0.57-0.81) AUM/Ha or 0.28 (0.23-0.33) AUM/Ac

NFA29 Sedge - Western Porcupine Grass - Plains Rough Fescue (n=5)

(Carex spp. - Stipa curtiseta - Festuca hallii)

This is mid-seral plant community, successional to NFA28 (Sandy 1), occurring on gently sloping plains, rolling and hummocky landforms, and mid-slope positions. Soils are dominated by dark brown chernozems with moderately coarse texture, especially the soil series Metisko and Dolcy. Moderate to heavy disturbance has reduced cover of plains rough fescue and western porcupine grass, and the site is dominated by upland sedges. Reduced stocking rate or rest will allow rough fescue and western porcupine grass to recover. Bare soil = 0% (0-2%), litter = 81% (66-98%), moss and lichen = 17% (0-34%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-1.0	80
PASTURE SAGEWORT *(Artemisia frigida)*	1.0	0.0-3.0	80
NORTHERN BEDSTRAW *(Galium boreale)*	1.0	0.0-3.0	60
LOW GOLDENROD *(Solidago missouriensis)*	1.0	0.0-4.0	60
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	3.0	0.0-7.0	80
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-1.0	40
WESTERN WHEAT GRASS *(Agropyron smithii)*	2.0	1.0-6.0	100
SAND GRASS *(Calamovilfa longifolia)*	2.0	0.0-5.0	60
JUNE GRASS *(Koeleria macrantha)*	2.0	0.0-8.0	80
NEEDLE-AND-THREAD *(Stipa comata)*	3.0	0.0-11.0	80
PLAINS ROUGH FESCUE *(Festuca hallii)*	7.0	0.0-13.0	80
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	8.0	6.0-12.0	100
SEDGE SPECIES *(Carex)*	30.0	22.0-37.0	100

Environmental Variables

Elevation (range): 778 (772-783) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC, REGOSOL ORTHIC

Soil Series: DCY, ERT, HCH, WWT

Soil Correlation: SCA 4

Range Site Category: Sandy, Sand

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.57 (0.44-0.62) AUM/Ha or 0.23 (0.18-0.25) AUM/Ac

NFA30 Sedge - Western Porcupine Grass (n=9)

(Carex spp. - Stipa curtiseta)

This is an early-seral plant community, successional to NFA28 (Sandy 1), occurring on gently sloping plains, rolling and hummocky landforms, and mid-slope positions. Soils are dominated by dark brown chernozems with moderately coarse texture, especially the soil series Metisko and Dolcy. Heavy disturbance has reduced the cover of tall- and mid-grasses, and the site is sparsely vegetated and dominated by upland sedges with a reduced western porcupine grass component. Reduced stocking rate or rest will allow rough fescue and western porcupine grass to recover. Bare soil = 2% (0-10%), litter = 99% (96-100%), moss and lichen = 0% (0-1%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 1
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
SILVERBERRY *(Elaeagnus commutata)*	1.0	0.0-5.0	11
COMMON WILD ROSE *(Rosa woodsii)*	1.0	0.0-4.0	44
Forb			
BASTARD TOADFLAX *(Comandra umbellata)*	1.0	0.0-5.0	33
GOLDEN BEAN *(Thermopsis rhombifolia)*	1.0	0.0-4.0	67
CUT-LEAVED ANEMONE *(Anemone multifida)*	2.0	0.0-4.0	56
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-9.0	67
Graminoid			
WESTERN WHEAT GRASS *(Agropyron smithii)*	1.0	0.0-2.0	33
SAND GRASS *(Calamovilfa longifolia)*	1.0	0.0-9.0	22
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-4.0	33
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	8.0	3.0-11.0	100
SEDGE SPECIES *(Carex)*	9.0	2.0-16.0	100

Environmental Variables

Elevation (range): 714 (675-780) M

Slope (%): 0 - 15.99

Aspect: Variable

Topographic Position: Upper Slope, Lower Slope, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: WWT, CNN, ERT, HCH, MET

Soil Correlation: SCA 4

Range Site Category: Sand, Sandy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.49 (0.37-0.59) AUM/Ha or 0.20 (0.15-0.24) AUM/Ac

NFA31 Sandgrass - Sedge (n=6)

(Calamovilfa longifolia - Carex spp.)

This is the reference plant community for Sandy 2 ecological range sites, occurring on gently sloping plains, hill crests, and upper- and mid-slope positions. Undulating, rolling, hilly, and choppy sandhills landforms are common. Soils are dominated by dark brown chernozems with very coarse texture, especially the Houcher, Edgerton, and Wainwright soil series. Under light to no disturbance the community is dominated by sandgrass and upland sedges. With moderate disturbance sandgrass cover is reduced and upland sedges and low grasses and forbs become dominant. Bare soil = 0%, litter = 95% (85-100%), moss and lichen = 28% (5-51%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 2
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
COMMON WILD ROSE *(Rosa woodsii)*	1.0	0.0-3.0	67
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-4.0	33
Forb			
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-5.0	50
PRAIRIE SELAGINELLA *(Selaginella densa)*	3.0	0.0-12.0	33
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-5.0	67
BLUE GRAMA *(Bouteloua gracilis)*	1.0	0.0-4.0	50
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-5.0	33
NEEDLE-AND-THREAD *(Stipa comata)*	2.0	0.0-4.0	67
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	2.0	0.0-7.0	67
SEDGE SPECIES *(Carex)*	12.0	7.0-18.0	100
SAND GRASS *(Calamovilfa longifolia)*	21.0	14.0-28.0	100

Environmental Variables

Elevation (range): 678 (672-682) M

Slope (%): 0.5 - 9.99

Aspect: Variable

Topographic Position: Level, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: WWT, ERT, HCH, MET

Soil Correlation: SCA 4

Range Site Category: Sandy, Choppy Sandhills, Sand

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.49 (0.37-0.62) AUM/Ha or 0.20 (0.15-0.25) AUM/Ac

NFA32 Sedge - Sandgrass (n=11)

(Carex spp. - Calamovilfa longifolia)

This is a mid-seral plant community, successional to NFA31 (Sandy 2), occurring on gently sloping plains, hill crests, and upper- and mid-slope positions. Undulating, rolling, hilly, and choppy sandhills landforms are common. Soils are dominated by dark brown chernozems with very coarse texture, especially the Houcher, Edgerton, and Wainwright soil series. Moderate disturbance has reduced sandgrass cover, and the community is dominated by upland sedges, sandgrass, and needle & thread grass. Rest or reduced stocking rate will allow sandgrass to recover. Bare soil = 0, litter = 95% (87-100%), moss and lichen = 4% (1-10%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 2
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
COMMON WILD ROSE *(Rosa woodsii)*	1.0	0.0-5.0	55
Forb			
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-5.0	82
PRAIRIE SELAGINELLA *(Selaginella densa)*	2.0	0.0-5.0	73
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-3.0	55
BLUE GRAMA *(Bouteloua gracilis)*	1.0	0.0-2.0	45
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	1.0	0.0-2.0	27
NEEDLE-AND-THREAD *(Stipa comata)*	2.0	0.0-6.0	64
SAND GRASS *(Calamovilfa longifolia)*	5.0	1.0-8.0	100
SEDGE SPECIES *(Carex)*	12.0	6.0-16.0	100

Environmental Variables

Elevation (range): 681 (676-696) M

Slope (%): 0 - 9.99

Aspect: Variable

Topographic Position: Level, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: WWT, ERT, HCH, MET

Soil Correlation: SCA 4

Range Site Category: Sandy, Sand, Choppy Sandhills

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.37 (0.25-0.49) AUM/Ha or 0.15 (0.10-0.20) AUM/Ac

NFA33 Pasture Sage - Sedge (n=15)

(Artemisia frigida - Carex spp.)

This is a mid-seral plant community, successional to NFA31 (Sandy 2), occurring on gently sloping plains, hill crests, and upper- and mid-slope positions. Undulating, rolling, hilly, and choppy sandhills landforms are common. Soils are dominated by dark brown chernozems with very coarse texture, especially the Houcher, Edgerton, and Wainwright soil series. Heavy disturbance has eliminated tall grasses, and the community is sparsely vegetated by pasture sage, upland sedge, and little clubmoss, with a handful of other low grasses and forbs. This community requires rest or significantly reduced stocking rates for tall grasses to recover. The site is still largely covered with litter, but the litter layer is reduced and may be patchy. Bare soil = 1% (0-8%), litter = 88% (70-98%), moss and lichen = 5% (0-20%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 2
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Forb			
GOLDEN ASTER *(Heterotheca villosa)*	1.0	0.0-3.0	60
GOLDEN BEAN *(Thermopsis rhombifolia)*	1.0	0.0-11.0	33
PRAIRIE SELAGINELLA *(Selaginella densa)*	5.0	0.0-15.0	93
PASTURE SAGEWORT *(Artemisia frigida)*	9.0	2.0-20.0	100
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-4.0	40
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-4.0	73
BLUE GRAMA *(Bouteloua gracilis)*	2.0	0.0-6.0	67
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	2.0	0.0-8.0	33
NEEDLE-AND-THREAD *(Stipa comata)*	4.0	0.0-12.0	67
SEDGE SPECIES *(Carex)*	7.0	2.0-11.0	100

Environmental Variables

Elevation (range): 683 (674-700) M

Slope (%): 0.5 - 5.99

Aspect: Variable

Topographic Position: Level, Crest, Upper Slope, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: WWT, MET, HCH, ERT,

Soil Correlation: SCA 4

Range Site Category: Sandy, Sand, Choppy Sandhills

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.25 (0.02-0.30) AUM/Ha or 0.10 (0.01-0.12) AUM/Ac

NFA35 Western Wheat Grass - Bluegrass (n=5)

(Agropyron smithii - Poa spp.)

This is the reference to late-seral community for the Saline Lowlands 1 ecological range site, which occur in depressional areas where soils have high enough salt content to limit plant growth. These sites are dominated by salt-tolerant species including western wheat grass and and alkali bluegrass. This community occurs under light- to no disturbance, and on sites that have not been recently submerged during periods of high water table. With disturbance or recent submergence, western wheat grass cover is lost and species such as alkali grass, saltgrass, or foxtail barley become dominant. It may require several years of dry soils for this community to develop after the site has been submerged, so on recently dry sites NFA36 may also be a reference plant community for the Saline Lowland 1 ecological range site. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and use during periods of wet or saturated soils may result in long-term negative soil impacts. Bare soil = 0% (1-2%), litter = 93%, moss and lichen = 5% (1-20%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Saline Lowlands 1
Ecological Range Site Phase: Grassland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Forb			
GUMWEED *(Grindelia squarrosa)*	1.0	0.0-2.0	20
UNDIFFERENTIATED POLYGONUM *(Polygonum)*	1.0	0.0-4.0	40
COMMON PEPPER-GRASS *(Lepidium densiflorum)*	3.0	0.0-14.0	40
Graminoid			
FOXTAIL BARLEY *(Hordeum jubatum)*	1.0	0.0-3.0	20
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-5.0	20
NUTTALL'S SALT-MEADOW GRASS *(Puccinellia nuttalliana)*	1.0	0.0-1.0	40
BLUEGRASSES *(Poa)*	15.0	3.0-36.0	100
WESTERN WHEAT GRASS *(Agropyron smithii)*	59.0	50.0-72.0	100

Environmental Variables

Elevation (range): 0 (0-0) M

Slope (%): 0 - 0.49

Aspect: Variable

Topographic Position: Depression

Soil Variables

Soil Drainage: Imperfectly drained

Soil Subgroup:

Soil Series: ZUN

Soil Correlation: SCA 4

Range Site Category: Saline Lowland

Forage Production (kg/ha) n=3

	Mean	**Min**	**Max**
Unspecified	1009	1009	1009
Total	**1009**		

Ecologically Sustainable Stocking Rate

0.49 (0.30-0.64) AUM/Ha or 0.20 (0.12-0.26) AUM/Ac

NFA36 Alkali Grass (n=6)

(Puccinellia nuttalliana)

This is a late- to mid-seral plant community, successional to NFA35 (Saline Lowlands 1), occurring in depressional areas where soils have high enough salt content to limit plant growth. These sites are dominated by salt-tolerant species. Under light to moderate disturbance, or following recent submergence during periods of high water table, this community is dominated by alkali grass and foxtail barley with a minor component of saltgrass. With moderate to heavy disturbance, alkali grass cover declines and saltgrass becomes dominant. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and use during periods of wet or saturated soils may result in long-term negative soil impacts. Bare soil = 23% (0-63%), litter = 22% (7-37%), moss and lichen = 1% (0-5%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Saline Lowlands 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Forb			
GUMWEED *(Grindelia squarrosa)*	1.0	0.0-1.0	33
Graminoid			
WIRE RUSH *(Juncus balticus)*	2.0	0.0-11.0	17
SALT GRASS *(Distichlis stricta)*	6.0	0.0-20.0	50
FOXTAIL BARLEY *(Hordeum jubatum)*	8.0	0.0-22.0	83
NUTTALL'S SALT-MEADOW GRASS *(Puccinellia nuttalliana)*	38.0	11.0-64.0	100

Environmental Variables

Elevation (range): 730 (670-821) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Depression

Soil Variables

Soil Drainage: Poorly drained

Soil Subgroup: GLEYSOL REGO

Soil Series: ZGW

Soil Correlation: SCA 4

Range Site Category: Saline Lowland

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.25 (0.02-0.37) AUM/Ha or 0.10 (0.01-0.15) AUM/Ac

NFA37 Salt Grass (n=6)

(Distichlis stricta)

This is a mid- to early-seral plant community, successional to NFA35 (Saline Lowlands 1), occurring in depressional areas where soils have high enough salt content to limit plant growth. These sites are dominated salt-tolerant species. This community occurs under moderate to heavy disturbance and is dominated by saltgrass and foxtail barley with a minor component of alkali grass. This community may succeed to NFA35 or 36 depending on how frequently the site is submerged during periods of high water table (see descriptions for NFA35 and NFA36 for more information). Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and use during periods of wet or saturated soils may result in long-term negative soil impacts. Bare soil = 3% (0-8%), moss and lichen = 2% (0-9%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Saline Lowlands 1
Ecological Range Site Phase: Grassland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Forb			
GUMWEED *(Grindelia squarrosa)*	2.0	0.0-5.0	67
Graminoid			
NUTTALL'S SALT-MEADOW GRASS *(Puccinellia nuttalliana)*	6.0	5.0-8.0	100
FOXTAIL BARLEY *(Hordeum jubatum)*	18.0	3.0-39.0	100
SALT GRASS *(Distichlis stricta)*	38.0	20.0-75.0	100

Environmental Variables

Elevation (range): 748 (682-819) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Depression

Soil Variables

Soil Drainage:

Soil Subgroup: GLEYSOL ORTHIC

Soil Series: ZGL, ZUN

Soil Correlation: SCA 4

Range Site Category: Saline Lowland

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.02 (0.02-0.25) AUM/Ha or 0.01 (0.01-0.10) AUM/Ac

NFA38 Foxtail Barley (n=3)

(Hordeum jubatum)

This is an early- seral plant community, successional to NFA35 (Saline Lowlands 1), occurring in depressional areas where soils have high enough salt content to limit plant growth. These sites are dominated by salt-tolerant species. This is a pioneer community on soils recently exposed after submergence during a period of high water table. However, under moderate to heavy disturbance, this community may also develop on drier sites. On sites that have not been recently submerged, grazing reduces wheat grass (NFA35) or alkali grass (NFA36) cover, and foxtail barley becomes dominant. Soils are highly vulnerable to compaction and deformation by livestock hoof impact while wet, and use during periods of wet or saturated soils may result in long-term negative soil impacts. Bare soil = 0 (0-1%), litter = 10%, moss and lichen = 0%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Saline Lowlands 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Graminoid			
WIRE RUSH *(Juncus balticus)*	1.0	0.0-3.0	33
NUTTALL'S SALT-MEADOW GRASS *(Puccinellia nuttalliana)*	2.0	0.0-7.0	67
FOWL BLUEGRASS *(Poa palustris)*	8.0	0.0-25.0	33
SEDGE SPECIES *(Carex)*	20.0	0.0-60.0	33
FOXTAIL BARLEY *(Hordeum jubatum)*	67.0	50.0-90.0	100

Environmental Variables

Elevation (range): 825 (825-825) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Depression

Soil Variables

Soil Drainage: Poorly drained, Very poorly drained

Soil Subgroup: HUMIC GLEYSOL ORTHIC

Soil Series: ZGW

Soil Correlation: SCA4

Range Site Category: Saline Lowland

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.25 (0.02-0.37) AUM/Ha or 0.10 (0.01-0.15) AUM/Ac

NFB01 Smooth Brome - Kentucky Bluegrass / Dandelion (n=15)

(Bromus inermis - Poa pratensis / Taraxacum officinale)

This is a modified plant community occurring on Loamy 1 ecological range sites. Soils are dominated by dark brown chernozems with medium to moderately fine texture. The community is dominated by smooth brome, Kentucky bluegrass, and dandelion. This community may represent old cultivated pastures that have been heavily grazed, or heavily disturbed native communities that have been invaded by agronomics. Due to the dominance of competitive introduced grasses, NFB01 is unlikely to revert to rough fescue dominance even under reduced stocking rates or rest from grazing or other disturbance pressures. Bare soil = 26% (0-58%), moss and lichen = 14%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Forb			
COMMON YARROW *(Achillea millefolium)*	2.0	0.0-9.0	73
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	2.0	0.0-11.0	60
YELLOW SWEET-CLOVER *(Melilotus officinalis)*	3.0	0.0-16.0	20
UNDIFFERENTIATED MEDICAGO *(Medicago)*	5.0	0.0-28.0	40
PASTURE SAGEWORT *(Artemisia frigida)*	6.0	0.0-21.0	93
ALFALFA *(Medicago sativa)*	6.0	0.0-40.0	33
COMMON DANDELION *(Taraxacum officinale)*	13.0	4.0-31.0	100
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	2.0	0.0-13.0	47
CREEPING RED FESCUE *(Festuca rubra)*	3.0	0.0-15.0	47
CRESTED WHEAT GRASS *(Agropyron pectiniforme)*	6.0	0.0-15.0	73
SIBERIAN WHEAT GRASS *(Agropyron pectiniforme)*	6.0	0.0-15.0	73
KENTUCKY BLUEGRASS *(Poa pratensis)*	13.0	2.0-35.0	100
AWNLESS BROME *(Bromus inermis)*	23.0	14.0-33.0	100

Environmental Variables

Elevation (range): 0 (0-0) M

Slope (%):

Aspect: Variable

Topographic Position: Midslope, Lower Slope, Level

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.99 (0.74-1.23) AUM/Ha or 0.40 (0.30-0.50) AUM/Ac

NFB02 Kentucky Bluegrass (n=7)

(Poa pratensis)

This is a modified plant community occurring on Loamy 1 ecological range sites. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Kentucky bluegrass has very high cover, along with minor components of wheat grass and low forbs. This community represents heavily disturbed native communities that have lost rough fescue and western porcupine grass and been invaded by Kentucky bluegrass. Due to the dominance of competitive introduced grasses, NFB02 is unlikely to revert to rough fescue dominance even under reduced stocking rates or rest. Bare soil = 11% (0-21%), litter = 33% (25-40%), moss and lichen = 0%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Grassland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	1.0	0.0-2.0	29
Forb			
COMMON DANDELION *(Taraxacum officinale)*	1.0	0.0-2.0	57
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-5.0	85
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	3.0	0.0-15.0	29
COMMON YARROW *(Achillea millefolium)*	4.0	0.0-11.0	85
Graminoid			
CREEPING RED FESCUE *(Festuca rubra)*	2.0	0.0-6.0	29
WESTERN WHEAT GRASS *(Agropyron smithii)*	3.0	0.0-11.0	71
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	6.0	0.0-20.0	57
KENTUCKY BLUEGRASS *(Poa pratensis)*	66.0	50.0-78.0	100

Environmental Variables

Elevation (range): 0 (0-0) M

Slope (%): 0 - 2.49

Aspect: Variable

Topographic Position: Midslope, Lower Slope

Soil Variables

Soil Drainage: Moderately well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.99 (0.74-1.23) AUM/Ha or 0.40 (0.30-0.50) AUM/Ac

NFC01 Snowberry / Plains Rough Fescue (n=47)

(Symphoricarpos occidentalis / Festuca hallii)

This is a late-seral shrubland community on Loamy 1 ecological range sites, occurring on gently sloping plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. This community develops from Loamy 1 grassland communities that have been encroached by snowberry. The spread of snowberry into rough fescue grasslands is enhanced by historical fire suppression, and snowberry-dominated communities are common on loamy sites throughout the Northern Fescue. Heavy grazing disturbance or other disturbance pressures may promote a decline in rough fescue and western porcupine grass, leading to Kentucky bluegrass co-dominance or dominance of the understory. However, dense growth of snowberry discourages cattle from utilizing encroached areas, so agronomic invasion may also occur in the absence of disturbance, due to favourable moisture conditions in areas that support shrub growth. Bare soil = 2% (0-8%), litter = 96% (84-100%), moss and lichen = 8% (1-35%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Shrubland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	3.0	0.0-9.0	87
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	14.0	2.0-34.0	100
Forb			
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-6.0	68
SMOOTH ASTER *(Aster laevis)*	1.0	0.0-5.0	36
THREE-FLOWERED AVENS *(Geum triflorum)*	1.0	0.0-11.0	21
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-10.0	81
Graminoid			
AWNED WHEAT GRASS *(Agropyron subsecundum)*	1.0	0.0-10.0	55
HOOKER'S OAT GRASS *(Helictotrichon hookeri)*	1.0	0.0-7.0	44
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-3.0	36
SEDGE SPECIES *(Carex)*	5.0	0.0-17.0	96
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	8.0	0.0-23.0	96
PLAINS ROUGH FESCUE *(Festuca hallii)*	56.0	32.0-79.0	100

Environmental Variables

Elevation (range): 848 (780-888) M

Slope (%): 0.5 - 30.99

Aspect: Variable

Topographic Position: Midslope, Lower slope

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=3

	Mean	Min	Max
Unspecified	1719	1457	2018
Total	**1719**		

Ecologically Sustainable Stocking Rate

0.89 (0.62-1.11) AUM/Ha or 0.36 (0.25-0.45) AUM/Ac

NFC02 Snowberry / Plains Rough Fescue - Kentucky Bluegrass (n=35)

(Symphoricarpos occidentalis / Festuca hallii - Poa pratensis)

This is a late- to mid-seral shrubland community successional to NFC01 (Loamy 1) occurring on gently sloping plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. This community is dominated by snowberry, with an understory dominated by rough fescue, western porcupine grass, and a minor component of Kentucky bluegrass. Under moderate to heavy grazing or other disturbance pressure, rough fescue and western porcupine grass decline in cover, and Kentucky bluegrass cover will increase. Bare soil = 2% (0-11%), litter = 93% (80-100%), moss and lichen = 3% (1-11%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Tree			
ASPEN *(Populus tremuloides)*	1.0	0.0-10.0	37
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	2.0	0.0-8.0	91
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	16.0	6.0-30.0	100
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-5.0	51
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-5.0	40
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	1.0	0.0-6.0	51
PASTURE SAGEWORT *(Artemisia frigida)*	2.0	0.0-15.0	74
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	2.0	0.0-10.0	71
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	1.0	0.0-7.0	31
JUNE GRASS *(Koeleria macrantha)*	1.0	0.0-4.0	37
KENTUCKY BLUEGRASS *(Poa pratensis)*	2.0	1.0-5.0	100
SEDGE SPECIES *(Carex)*	3.0	0.0-11.0	86
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	6.0	0.0-20.0	94
PLAINS ROUGH FESCUE *(Festuca hallii)*	57.0	29.0-80.0	100

Environmental Variables

Elevation (range): 868 (868-868) M

Slope (%): 0.5 - 30.99

Aspect: Variable

Topographic Position: Midslope, Lower Slope

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=1

	Mean	Min	Max
Unspecified	1457	1457	1457
Total	**1457**		

Ecologically Sustainable Stocking Rate

0.89 (0.62-1.11) AUM/Ha or 0.36 (0.25-0.45) AUM/Ac

NFC03 Snowberry / Kentucky Bluegrass - Plains Rough Fescue (n=39)

(Symphoricarpos occidentalis / Poa pratensis - Festuca hallii)

This is a mid- to early-seral shrubland community successional to NFC01 (Loamy 1) occurring on gently sloping plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. This community is dominated by snowberry, with an understory of rough fescue, western porcupine grass, and with a significant component of Kentucky bluegrass. Elevated Kentucky bluegrass cover may be a result of heavy grazing or other disturbance pressure, or due to moisture conditions that favour agronomic invasion on sites moist enough to support shrubs. Bare soil = 2% (0-8%), litter = 82% (53-100%), moss and lichen = 4% (1-18%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Tree			
ASPEN *(Populus tremuloides)*	1.0	0.0-10.0	18
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	2.0	0.0-5.0	82
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	15.0	7.0-28.0	100
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-5.0	56
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-8.0	72
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-8.0	64
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	0.0-15.0	87
Graminoid			
WESTERN WHEAT GRASS *(Agropyron smithii)*	1.0	0.0-7.0	44
AWNED WHEAT GRASS *(Agropyron subsecundum)*	2.0	0.0-7.0	79
JUNE GRASS *(Koeleria macrantha)*	2.0	0.0-10.0	64
SEDGE SPECIES *(Carex)*	6.0	0.0-30.0	95
KENTUCKY BLUEGRASS *(Poa pratensis)*	11.0	5.0-32.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	12.0	0.0-28.0	95
PLAINS ROUGH FESCUE *(Festuca hallii)*	37.0	17.0-59.0	100

Environmental Variables

Elevation (range):

Slope (%):0.5 – 30.99

Aspect: Variable

Topographic Position: Midslope, Level, Lower slope

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=5

	Mean	Min	Max
Unspecified	1592	1121	2018
Total	**1592**		

Ecologically Sustainable Stocking Rate

0.89 (0.62-1.11) AUM/Ha or 0.36 (0.25-0.45) AUM/Ac

NFC06 Snowberry / Plains Rough Fescue - Western Porcupine Grass (n=7)

(Symphoricarpos occidentalis / Festuca hallii - Stipa curtiseta)

This is a late-seral shrubland community for Loamy 2 ecological range sites, occurring on hill crests and steep upper slopes. Soils are dominated by the eroded phase of dark brown chernozems, which have a thinner A horizon than soils at mid- and lower slope positions. This community develops by snowberry encroachment into a community resembling NFA07. The spread of snowberry into rough fescue grasslands is enhanced by historical fire suppression, and snowberry-dominated communities are common on loamy sites throughout the Northern Fescue natural subregion. This community is dominated by snowberry, and plains rough fescue and western porcupine grass are co-dominant in the understory. Disturbance pressure may promote a decline in rough fescue and western porcupine grass, leading to Kentucky bluegrass co-dominance or dominance. Dense growth of snowberry discourages cattle from utilizing encroached areas, so agronomic invasion also may occur in the absence of disturbance due to favourable moisture conditions in areas moist enough to support shrub growth. Bare soil = 7% (3-14%), litter = 71% (61-82%), moss and lichen = 11% (7-15%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 2
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Tree			
ASPEN *(Populus tremuloides)*	1.0	0.0-5.0	14
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-3.0	71
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	14.0	5.0-38.0	100
Forb			
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	1.0	0.0-3.0	29
NORTHERN BEDSTRAW *(Galium boreale)*	1.0	0.0-1.0	57
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	2.0	0.0-7.0	71
PASTURE SAGEWORT *(Artemisia frigida)*	8.0	4.0-15.0	100
Graminoid			
AWNED WHEAT GRASS *(Agropyron subsecundum)*	1.0	0.0-5.0	71
WESTERN WHEAT GRASS *(Agropyron smithii)*	2.0	0.0-4.0	71
JUNE GRASS *(Koeleria macrantha)*	4.0	2.0-7.0	100
BLUE GRAMA *(Bouteloua gracilis)*	7.0	0.0-11.0	86
SEDGE SPECIES *(Carex)*	7.0	1.0-17.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	16.0	0.0-27.0	86
PLAINS ROUGH FESCUE *(Festuca hallii)*	24.0	16.0-42.0	100

Environmental Variables

Elevation (range): 0 (0-0) M

Slope (%): 6 - 30.99

Aspect: Easterly, Southerly

Topographic Position: Crest, Upper Slope, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.79 (0.72-0.82) AUM/Ha or 0.32 (0.29-0.33) AUM/Ac

NFC07 Snowberry / Sedge - Plains Rough Fescue (n=9)

(Symphoricarpos occidentalis / Carex spp. - Festuca Hallii)

This is a late-seral shrubland community for Blowout 1 ecological range sites, occurring on dark brown solods and solodized solonetzes. with a relatively deep A horizon overlying the solonetzic B horizon. The presence of a relatively thick (>30cm) A horizon supports shrub growth, and this community develops from snowberry encroachment of grassland communities on Blowout 1 sites. It is dominated by snowberry, with an understory dominated by upland sedge, rough fescue, and western porcupine grass. Under moderate to heavy grazing and/or other disturbance pressure, rough fescue and western porcupine grass decline, and cover of upland sedge and other low grasses will increase. Bare soil = 1% (0-8%), moss and lichen = 11% (9-14%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Blowout 1
Ecological Range Site Phase: Shrubland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-5.0	33
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	12.0	6.0-16.0	100
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-3.0	56
NORTHERN BEDSTRAW *(Galium boreale)*	1.0	0.0-12.0	44
UNDIFFERENTIATED ANEMONE *(Anemone)*	2.0	0.0-6.0	56
ASTER SPECIES *(Aster)*	2.0	0.0-7.0	56
PASTURE SAGEWORT *(Artemisia frigida)*	3.0	0.0-13.0	67
Graminoid			
WESTERN WHEAT GRASS *(Agropyron smithii)*	1.0	0.0-5.0	22
WHEAT GRASS SPECIES *(Agropyron)*	2.0	0.0-4.0	78
JUNE GRASS *(Koeleria macrantha)*	4.0	1.0-7.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	4.0	0.0-15.0	89
PLAINS ROUGH FESCUE *(Festuca hallii)*	11.6	1.0-23.0	100
SEDGE SPECIES *(Carex)*	13.0	8.0-23.0	100

Environmental Variables

Elevation (range): 849 (794-904) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level, Lower Slope

Soil Variables

Soil Drainage: Moderately well drained, Well drained

Soil Subgroup: SOLODIZED SOLONETZ DARK BROWN

Soil Series: TLA, BFD, HKR

Soil Correlation: SCA 4

Range Site Category: Blowouts/Solonetzic

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.49 (0.37-0.62) AUM/Ha or 0.20 (0.15-0.25) AUM/Ac

NFC08 Snowberry / Aw (n=2)

(Symphoricarpos occidentalis / Populus tremuloides)

This is a mid-seral shrubland community successional to NFC01 (Loamy 1) occurring on gently sloping plains and mid- to lower slopes. Soils are dominated by dark brown chernozems with medium to moderately-fine texture. This community represents the early stage of succession from shrubland to aspen forest, and is dominated by snowberry with a minor component of aspen. The understory is dominated by upland sedge, smooth brome, and slender wheatgrass. Over time, the overstory will become dominated by aspen, and the understory will consist of snowberry and introduced grasses such as smooth brome and Kentucky bluegrass. Bare soil = 0%, litter = 100%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Shrubland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	5.0	5.0-6.0	100
Shrub			
SASKATOON *(Amelanchier alnifolia)*	1.0	0.0-1.0	50
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-1.0	50
NORTHERN GOOSEBERRY *(Ribes oxyacanthoides)*	3.0	0.0-5.0	50
COMMON WILD ROSE *(Rosa woodsii)*	5.0	2.0-7.0	100
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	24.0	24.0-25.0	100
Graminoid			
KENTUCKY BLUEGRASS *(Poa pratensis)*	1.0	1.0-2.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	4.0	0.0-8.0	50
AWNLESS BROME *(Bromus inermis)*	8.0	6.0-9.0	100
SEDGE SPECIES *(Carex)*	21.0	20.0-22.0	100

Environmental Variables

Elevation (range):

Slope (%): 6 - 30.99

Aspect: Northerly

Topographic Position: Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.49 (0.37-0.74) AUM/Ha or 0.20 (0.15-0.30) AUM/Ac

NFC09 Snowberry / Plains Rough Fescue - Blue Grama (n=4)

(Symphoricarpos occidentalis / Festuca hallii - Bouteloua gracilis)

This is a mid-seral shrubland community, successional to NFC06 (Loamy 2), occurring on hill crests and steep upper slopes. Soils are dominated by the eroded phase of dark brown chernozems with medium to moderately-fine texture. The overstory is dominated by snowberry, and moderate grazing has reduced the dominance of rough fescue and western porcupine grass, and increased blue grama cover. A minor component of Kentucky bluegrass is also present in the understory, which is likely to increase under heavier disturbance pressure. Bare soil = 8% (3-12%), litter = 63% (46-82%), moss and lichen = 3% (2-4%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 2
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	2.0	1.0-6.0	100
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	12.0	7.0-19.0	100
Forb			
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	1.0-2.0	100
NORTHERN BEDSTRAW *(Galium boreale)*	1.0	0.0-4.0	50
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	2.0	0.0-5.0	75
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	2.0	0.0-6.0	75
PASTURE SAGEWORT *(Artemisia frigida)*	9.0	8.0-11.0	100
Graminoid			
KENTUCKY BLUEGRASS *(Poa pratensis)*	2.0	0.0-5.0	75
WESTERN WHEAT GRASS *(Agropyron smithii)*	5.0	0.0-9.0	75
SEDGE SPECIES *(Carex)*	5.0	1.0-16.0	100
JUNE GRASS *(Koeleria macrantha)*	7.0	4.0-14.0	100
BLUE GRAMA *(Bouteloua gracilis)*	13.0	4.0-19.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	14.0	10.0-19.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	22.0	12.0-33.0	100

Environmental Variables

Elevation (range):

Slope (%):16 - 45.99

Aspect: Southerly

Topographic Position: Midslope, Upper Slope

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=1

	Mean	Min	Max
Unspecified	1121	1121	1121
Total	**1121**		

Ecologically Sustainable Stocking Rate

0.69 (0.52-0.86) AUM/Ha or 0.28 (0.21-0.35) AUM/Ac

NFC10 Snowberry / Kentucky Bluegrass - Western Porcupine Grass (n=4)

(Symphoricarpos occidentalis / Poa pratensis - Stipa curtiseta)

This is a mid-seral shrubland community on Loamy 3 ecological range sites. This community is found towards the South end of the subregion where the Northern Fescue transitions into the Dry Mixedgrass. Soils are dominated by dark brown chernozems with medium to moderately fine texture. The spread of snowberry into rough fescue grasslands is enhanced by historical fire suppression, and snowberry-dominated communities are common on loamy sites throughout the Northern Fescue natural subregion. This community develops by snowberry encroachment into Loamy 3 grassland communities. It is characterized by snowberry cover with an understory dominated by Kentucky bluegrass, with remnant cover of plains rough fescue and western porcupine grass. High Kentucky bluegrass cover in the understory may be caused by disturbance, or due to favourable moisture conditions for agronomic invasion on sites that support shrub growth. Bare soil = 3% (0-6%), litter = 59% (34-94%), moss and lichen = 10% (1-27%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 3
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	12.0	10.0-17.0	100
Forb			
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-4.0	50
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	2.0	1.0-4.0	100
FIELD MOUSE-EAR CHICKWEED *(Cerastium arvense)*	2.0	0.0-3.0	75
COMMON YARROW *(Achillea millefolium)*	3.0	1.0-7.0	100
PASTURE SAGEWORT *(Artemisia frigida)*	5.0	1.0-9.0	100
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	6.0	1.0-12.0	100
Graminoid			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	4.0	0.0-14.0	50
WESTERN WHEAT GRASS *(Agropyron smithii)*	5.0	0.0-12.0	75
SEDGE SPECIES *(Carex)*	5.0	3.0-11.0	100
JUNE GRASS *(Koeleria macrantha)*	6.0	4.0-11.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	10.0	5.0-14.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	10.0	6.0-13.0	100
KENTUCKY BLUEGRASS *(Poa pratensis)*	30.0	11.0-43.0	100

Environmental Variables

Elevation (range):

Slope (%): 0.5 - 2.49

Aspect: Southerly

Topographic Position: Crest, Upper Slope, Midslope

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=1

	Mean	Min	Max
Unspecified	1793	1793	1793
Total	**1793**		

Ecologically Sustainable Stocking Rate

0.74 (0.62-0.86) AUM/Ha or 0.30 (0.25-0.35) AUM/Ac

NFC11 Silverberry / Western Porcupine Grass - Plains Rough Fescue (n=3)

(Elaeagnus commutata / Stipa curtiseta - Festuca hallii)

This is a late-seral shrubland community occurring on the Sandy 1 ecological range site on gently sloping plains and mid-slope positions. Soils are dominated by dark brown chernozems with moderately coarse texture, especially the soil series Metisko and Dolcy. This community is found on hill crests and north-facing slopes where locally higher moisture promotes shrub growth. Under light to no disturbance the community is dominated by silverberry with western porcupine grass, rough fescue, and upland sedges dominant in the understory. Under moderate to heavy disturbance western porcupine grass and plains rough fescue decline and are replaced by smooth brome and Kentucky bluegrass. Invasion of this community by agronomic species may also occur because moisture conditions on north aspects benefit smooth brome and Kentucky bluegrass establishment. Bare soil = 0%, litter = 65% (30-100%), moss and lichen = 2%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 1
Ecological Range Site Phase: Shrubland

Plant Composition / Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	1.0	0.0-4.0	67
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	5.0	0.0-16.0	33
SILVERBERRY *(Elaeagnus commutata)*	23.0	15.0-30.0	100
Forb			
LOW GOLDENROD *(Solidago missouriensis)*	1.0	0.0-2.0	67
PRAIRIE CROCUS *(Anemone patens)*	2.0	1.0-2.0	100
PASTURE SAGEWORT *(Artemisia frigida)*	4.0	2.0-7.0	100
Graminoid			
JUNE GRASS *(Koeleria macrantha)*	4.0	1.0-10.0	100
NEEDLE-AND-THREAD *(Stipa comata)*	5.0	0.0-15.0	33
SEDGE SPECIES *(Carex)*	6.0	0.0-15.0	67
PLAINS ROUGH FESCUE *(Festuca hallii)*	9.0	0.0-17.0	67
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	21.0	13.0-35.0	100

Environmental Variables

Elevation (range): 718 (718-718) M

Slope (%): 0.5 - 30.99

Aspect: Northerly, Easterly

Topographic Position: Upper Slope, Crest

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: SCD, HND

Soil Correlation: SCA 4

Range Site Category: Sandy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.64 (0.54-0.74) AUM/Ha or 0.26 (0.22-0.30) AUM/Ac

NFC12 Silverberry / Smooth Brome - Kentucky Bluegrass (n=3)

(Elaeagnus commutata / Bromus inermis - Poa pratensis)

This is a mid-seral shrubland community occurring on the Sandy 1 ecological range site on gently sloping plains and mid-slope positions. Plains, rolling, and hummocky landforms are common. Soils are dominated by dark brown chernozems with moderately coarse texture, especially the soil series Metisko and Dolcy. This community is found on hill crests and north-facing slopes where locally higher moisture promotes shrub growth. Under light to no disturbance, the community is dominated by silverberry, with smooth brome and Kentucky bluegrass dominant in the understory. Once established, agronomic species will persist as a component of the community even given rest or reduced stocking rates. Bare soil = 0%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 1
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
PRAIRIE ROSE *(Rosa arkansana)*	10.0	5.0-20.0	100
SILVERBERRY *(Elaeagnus commutata)*	29.0	20.0-40.0	100
Forb			
COMMON YARROW *(Achillea millefolium)*	1.0	0.0-2.0	50
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-1.0	75
HAREBELL *(Campanula rotundifolia)*	1.0	0.0-2.0	50
GOLDEN BEAN *(Thermopsis rhombifolia)*	1.0	0.0-3.0	75
WILD STRAWBERRY *(Fragaria virginiana)*	6.0	0.0-20.0	50
Graminoid			
SEDGE SPECIES *(Carex)*	3.0	0.0-10.0	25
KENTUCKY BLUEGRASS *(Poa pratensis)*	8.0	0.0-20.0	75
AWNLESS BROME *(Bromus inermis)*	23.0	0.0-50.0	75

Environmental Variables

Elevation (range):

Slope (%): 10 - 15.99

Aspect: Easterly

Topographic Position: Midslope, Upper Slope

Soil Variables

Soil Drainage: Rapidly drained, Well drained, Moderately well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: SCD, DCY

Soil Correlation: SCA 4

Range Site Category: Sandy

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.64 (0.54-0.74) AUM/Ha or 0.26 (0.22-0.30) AUM/Ac

NFC13 Snowberry / Sedge - Sandgrass (n=4)

(Symphoricarpos occidentalis / Carex spp. - Calamovilfa longifolia)

This is a mid-seral shrubland community for Sandy 2 ecological range sites, occurring on gently sloping plains, hill crests, and upper- and mid-slope positions. Undulating, rolling, hilly, and choppy sandhills landforms are common. Soils are dominated by dark brown chernozems with very coarse texture, especially the Houcher, Edgerton, and Wainwright soil series. The community develops by snowberry encroachment of Sandy 2 grassland communities. The community is dominated by snowberry, with an understory dominated by upland sedges and a minor component of sandgrass. Moderate disturbance has reduced sandgrass cover. Bare soil = 3% (0-11%), litter = 99% (88-100%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Sandy 2
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
COMMON WILD ROSE *(Rosa woodsii)*	1.0	1.0-3.0	100
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	21.0	12.0-29.0	100
Forb			
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	1.0	0.0-1.0	25
PRAIRIE SELAGINELLA *(Selaginella densa)*	1.0	0.0-2.0	50
LOW GOLDENROD *(Solidago missouriensis)*	1.0	0.0-1.0	50
Graminoid			
NEEDLE-AND-THREAD *(Stipa comata)*	1.0	0.0-2.0	75
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	1.0	0.0-4.0	25
SAND GRASS *(Calamovilfa longifolia)*	3.0	0.0-8.0	75
SEDGE SPECIES *(Carex)*	15.0	11.0-19.0	100

Environmental Variables

Elevation (range): 685 (675-702) M

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Level, Crest

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: WWT, ERT, HCH, MET

Soil Correlation: SCA 4

Range Site Category: Sandy, Sand, Choppy Sandhills

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.37 (0.25-0.49) AUM/Ha or 0.15 (0.10-0.20) AUM/Ac

NFC14 Basket Willow / Sedge (n=9)

(Salix petiolaris / Carex spp.)

This is the reference shrubland community for Overflow 1 ecological range sites, occurring on moisture-receiving lower slope positions adjacent to depressions, wetlands, and streams. Soils are dominated by non-saline chernozems and regosols. Overflow sites are moist enough to be dominated by shrubland or forest cover under light- or no disturbance. This community most commonly occurs on the interface between loamy uplands and depressional wetlands in rolling or hilly terrain. The overstory is dominated by basket willow with a minor component of beaked willow, and the understory is dominated by lowland sedges (such as awned, beaked, and water sedge). This community also contains a minor component of trembling aspen, and over time in the absence of fire and with light to no disturbance succeeds to aspen-dominated forest. Under moderate to heavy disturbance, tall shrubs are heavily browsed and the community shifts to a snowberry dominated community with agronomic grasses such as Kentucky bluegrass and smooth brome dominant in the understory. Bare soil = 1% (0-10%), litter = 71% (51-85%), moss and lichen = 16% (1-51%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Overflow 1
Ecological Range Site Phase: Shrubland

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	4.0	0.0-10.0	89
Shrub			
BEAKED WILLOW *(Salix bebbiana)*	4.0	0.0-10.0	88
BASKET WILLOW *(Salix petiolaris)*	16.0	8.0-30.0	100
Forb			
WILD MINT *(Mentha arvensis)*	1.0	0.0-2.0	44
MARSH HEDGE-NETTLE *(Stachys palustris)*	1.0	0.0-11.0	33
Graminoid			
KENTUCKY BLUEGRASS *(Poa pratensis)*	1.0	0.0-6.0	22
COMMON TALL MANNA GRASS *(Glyceria grandis)*	2.0	0.0-8.0	56
SLOUGH GRASS *(Beckmannia syzigachne)*	3.0	0.0-7.0	56
FOXTAIL BARLEY *(Hordeum jubatum)*	3.0	0.0-12.0	67
FOWL BLUEGRASS *(Poa palustris)*	5.0	0.0-17.0	78
CREEPING SPIKE-RUSH *(Eleocharis palustris)*	6.0	0.0-33.0	22
SEDGE SPECIES *(Carex)*	65.0	44.0-93.0	100

Environmental Variables

Elevation (range):

Slope (%): 0 - 2.49

Aspect: Variable, Level

Topographic Position: Depression

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, ZGW, HND

Soil Correlation: SCA 4

Range Site Category: Overflow

Forage Production (kg/ha) n=3

	Mean	**Min**	**Max**
Unspecified	3550	3363	3923
Total	**3550**		

Ecologically Sustainable Stocking Rate

0.25 (0.12-0.37) AUM/Ha or 0.10 (0.05-0.15) AUM/Ac

NFC15 Snowberry / Kentucky Bluegrass (n=6)

(Symphoricarpos occidentalis / Poa pratensis)

This is a mid- to early-seral shrubland community, successional to NFC14 (Overflow 1), occurring on moisture-receiving lower slope positions adjacent to depressions, wetlands, and streams. Soils are dominated by non-saline chernozems and regosols. Overflow sites are moist enough to be dominated by shrubland or forest cover under light- or no disturbance. This community most commonly occurs on the interface between loamy uplands and depressional wetlands in rolling or hilly terrain. Moderate to heavy disturbance has resulted in a community dominated by snowberry, with an understory dominated by Kentucky bluegrass and smooth brome, with a significant component of low forbs and weeds. Due to gentle topography, proximity to water, and availability of high-quality, palatable forages, livestock may loiter on Overflow 1 sites, causing localised overgrazing. Reduced stocking rate, rest, or distribution management to reduce livestock loitering will allow sedges, willows, and other tall shrubs to recover. Bare soil = 4% (0-13%), litter = 66% (50-81%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Overflow 1
Ecological Range Site Phase: Shrubland

Plant Composition

Canopy Cover (%)

	Mean	Range	Const.
Shrub			
BASKET WILLOW *(Salix petiolaris)*	3.0	0.0-10.0	33
PRAIRIE ROSE *(Rosa arkansana)*	5.0	2.0-8.0	100
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	11.0	5.0-15.0	100
Forb			
WILD STRAWBERRY *(Fragaria virginiana)*	3.0	0.0-15.0	33
UNDIFFERENTIATED SONCHUS *(Sonchus)*	3.0	0.0-12.0	33
CANADA THISTLE *(Cirsium arvense)*	5.0	0.0-8.0	83
COMMON DANDELION *(Taraxacum officinale)*	5.0	0.0-14.0	67
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	7.0	0.0-28.0	83
Graminoid			
AWNLESS BROME *(Bromus inermis)*	6.0	0.0-32.0	50
SEDGE SPECIES *(Carex)*	7.0	0.0-27.0	83
KENTUCKY BLUEGRASS *(Poa pratensis)*	41.0	17.0-64.0	100

Environmental Variables

Elevation (range): 845 (845-845) M

Slope (%): 0.5 - 5.99

Aspect: Level

Topographic Position: Depression

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: HND, ZGW

Soil Correlation: SCA 4

Range Site Category: Overflow

Forage Production (kg/ha) n=0

	Mean	Min	Max
Total	**0**		

Ecologically Sustainable Stocking Rate

0.25 (0.12-0.37) AUM/Ha or 0.10 (0.05-0.15) AUM/Ac

NFD01 Aw / Snowberry / Sedge (n=12)

(Populus tremuloides / Symphoricarpos occidentalis / Carex spp.)

This is a late-seral forested community on Loamy 1 ecological range sites, occurring on upper- to lower north-facing slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Relatively high moisture conditions on north-facing slopes promote tree and shrub growth, and in the absence of periodic fire disturbance, aspen and shrub encroachment into grassland communities eventually succeeds to forested communities. Under light- to no grazing disturbance the overstory is dominated by trembling aspen, with a snowberry understory. Understory grass and forb cover is sparse, and this community does not produce much usable forage. Under light to moderate grazing, Kentucky bluegrass and smooth brome may invade. However, due to favourable moisture conditions on north aspects, agronomic grasses will readily invade in the absence of livestock or other disturbances, provided there is a nearby seed source. Bare soil = 0%, litter = 80% (1-100%), moss and lichen = 2 (1-3%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Forest

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	53.0	23.0-85.0	100
Shrub			
CHOKE CHERRY *(Prunus virginiana)*	1.0	0.0-5.0	41
BASKET WILLOW *(Salix petiolaris)*	1.0	0.0-5.0	17
COMMON WILD ROSE *(Rosa woodsii)*	5.0	0.0-20.0	75
NORTHERN GOOSEBERRY *(Ribes oxyacanthoides)*	6.0	0.0-35.0	83
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	24.0	2.0-32.0	100
Forb			
COMMON DANDELION *(Taraxacum officinale)*	1.0	0.0-3.0	83
Graminoid			
PLAINS ROUGH FESCUE *(Festuca hallii)*	1.0	0.0-3.0	25
AWNLESS BROME *(Bromus inermis)*	3.0	0.0-12.0	75
KENTUCKY BLUEGRASS *(Poa pratensis)*	3.0	0.0-15.0	42
SEDGE SPECIES *(Carex)*	5.0	0.0-21.0	58

Environmental Variables

Elevation (range): 864 (862-866) M

Slope (%):, 0.5 - 30.99

Aspect: Northerly

Topographic Position: Midslope, Upper Slope, Lower Slope

Soil Variables

Soil Drainage: Moderately well drained, Imperfectly drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.25 (0.02-0.49) AUM/Ha or 0.10 (0.01-0.20) AUM/Ac

NFD02 Aw / Snowberry / Kentucky Bluegrass (n=5)

(Populus tremuloides / Symphoricarpos occidentalis / Poa pratensis)

This is a mid- to late-seral forested community, successional to NFD01 (Loamy 1), occurring on upper- to lower north-facing slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Relatively high moisture conditions on north-facing slopes promote tree and shrub growth, and in the absence of periodic fire disturbance, aspen and shrub encroachment into grassland communities will eventually succeed to forest communities. The overstory is dominated by trembling aspen, with an understory dominated by snowberry, Kentucky bluegrass, and smooth brome. Invasion by agronomic grasses may be due to livestock or other disturbance pressures. However, due to favourable moisture conditions on north aspects, agronomic grasses readily invade this community in the absence of livestock disturbance, provided there is a nearby seed source. Bare soil = 0% (0-1%), litter = 93% (80-100%), moss and lichen = 1% (0-1%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Forest

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	29.0	11.0-55.0	0
Shrub			
CHOKE CHERRY *(Prunus virginiana)*	1.0	0.0-3.0	20
COMMON WILD ROSE *(Rosa woodsii)*	1.0	0.0-6.0	20
WILD RED RASPBERRY *(Rubus idaeus)*	4.0	0.0-21.0	20
BEAKED WILLOW *(Salix bebbiana)*	6.0	0.0-30.0	40
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	12.0	4.0-22.0	100
Forb			
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1.0	0.0-3.0	60
WILD STRAWBERRY *(Fragaria virginiana)*	2.0	0.0-6.0	60
CANADA GOLDENROD *(Solidago canadensis)*	2.0	0.0-3.0	80
COMMON DANDELION *(Taraxacum officinale)*	3.0	0.0-11.0	60
Graminoid			
SEDGE SPECIES *(Carex)*	1.0	0.0-5.0	60
AWNED WHEAT GRASS *(Agropyron subsecundum)*	2.0	0.0-8.0	20
PLAINS ROUGH FESCUE *(Festuca hallii)*	5.0	0.0-16.0	60
AWNLESS BROME *(Bromus inermis)*	15.0	0.0-50.0	60
KENTUCKY BLUEGRASS *(Poa pratensis)*	18.0	0.0-43.0	80

Environmental Variables

Elevation (range): 757 (757-757) M

Slope (%): 0.5 - 5.99

Aspect: Northerly

Topographic Position: Midslope, Upper Slope, Lower Slope

Soil Variables

Soil Drainage: Imperfectly drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, SCD, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.62 (0.25-0.74) AUM/Ha or 0.25 (0.10-0.30) AUM/Ac

NFD03 Aw / Snowberry / Plains Rough Fescue (n=2)

(Populus tremuloides / Symphoricarpos occidentalis / Festuca hallii)

This is an early-seral forested community, successional to NFD01 (Loamy 1), occurring on upper to lower north facing slopes. Soils are dominated by dark brown chernozems with medium to moderately fine texture. Relatively high moisture conditions on north-facing slopes promote tree and shrub growth, and in the absence of periodic fire disturbance, aspen and shrub encroachment into grassland communities will eventually succeed to forest communities. This community represents recent aspen encroachment into an NFA01-like community. Trembling aspen cover is limited, and the understory is still dominated by plains rough fescue and western porcupine grass. As aspen canopy cover increases, the understory is shaded and native grass cover declines. Mid- and late-seral aspen communities have limited native grass cover. Bare soil = 7% (5-9%), moss and lichen = 5% (5-6%).

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Loamy 1
Ecological Range Site Phase: Forest

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	15.0	15.0-15.0	100
Shrub			
BASKET WILLOW *(Salix petiolaris)*	3.0	0.0-5.0	50
PRAIRIE ROSE *(Rosa arkansana)*	5.0	1.0-9.0	100
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	6.0	2.0-10.0	100
Forb			
COMMON YARROW *(Achillea millefolium)*	2.0	0.0-4.0	50
SMALL-LEAVED EVERLASTING *(Antennaria parvifolia)*	3.0	1.0-4.0	100
PASTURE SAGEWORT *(Artemisia frigida)*	5.0	5.0-7.0	100
Graminoid			
WESTERN WHEAT GRASS *(Agropyron smithii)*	1.0	0.0-1.0	50
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	6.0	1.0-10.0	100
BLUE GRAMA *(Bouteloua gracilis)*	7.0	1.0-14.0	100
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	20.0	16.0-25.0	100
PLAINS ROUGH FESCUE *(Festuca hallii)*	31.0	29.0-32.0	100

Environmental Variables

Elevation (range):

Slope (%): 0.5 - 15.99

Aspect: Northerly

Topographic Position: Crest, Upper Slope, Midslope

Soil Variables

Soil Drainage:

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: PRO, HND

Soil Correlation: SCA 4

Range Site Category: Loamy

Forage Production (kg/ha) n=0

	Mean	**Min**	**Max**
Total	**0**		

Ecologically Sustainable Stocking Rate

0.81 (0.74-1.14) AUM/Ha or 0.25 (0.15-0.30) AUM/Ac

NFD04 Aw / Basket Willow / Sedge (n=4)

(Populus tremuloides / Salix petiolaris / Carex spp.)

This is a late-seral to reference forest community for the Overflow 1 ecological range site, occurring on moisture-receiving lower slope positions adjacent to depressions, wetlands, and streams. Soils are dominated by non-saline chernozems and regosols. Overflow sites are moist enough to be dominated by shrubland or forest cover under light- or no disturbance. This community most commonly occurs on the interface between loamy uplands and depressional wetlands in rolling or hilly terrain. This community develops from trembling aspen encroachment into Overflow 1 shrubland communities, and under light- or no disturbance, aspen eventually becomes dominant over willows. The understory is dominated by lowland sedges (including awned, beaked, and water sedge), and tall manna grass. With moderate to heavy disturbance, cover of sedges, tall grasses, and tall shrubs is reduced, and the understory becomes dominated by snowberry and agronomic grasses such as Kentucky bluegrass and smooth brome. Bare soil = 3% (0-7%), litter = 84%.

Natural Subregion: Northern Fescue
Ecosection: Northern Fescue

Ecological Range Site: Overflow 1
Ecological Range Site Phase: Forest

Plant Composition	Canopy Cover (%)		
	Mean	**Range**	**Const.**
Tree			
ASPEN *(Populus tremuloides)*	26.0	13.0-53.0	100
Shrub			
COMMON WILD ROSE *(Rosa woodsii)*	3.0	0.0-5.0	75
SNOWBERRY (BUCKBRUSH) *(Symphoricarpos occidentalis)*	4.0	0.0-15.0	50
BEAKED WILLOW *(Salix bebbiana)*	6.0	0.0-15.0	75
BASKET WILLOW *(Salix petiolaris)*	13.0	1.0-20.0	100
Forb			
MARSH HEDGE-NETTLE *(Stachys palustris)*	1.0	0.0-3.0	50
WILD MINT *(Mentha arvensis)*	3.0	0.0-13.0	25
WATER SMARTWEED *(Polygonum coccineum)*	5.0	0.0-12.0	50
Graminoid			
SLOUGH GRASS *(Beckmannia syzigachne)*	1.0	0.0-5.0	25
NORTHERN REED GRASS *(Calamagrostis inexpansa)*	1.0	0.0-3.0	50
FOWL BLUEGRASS *(Poa palustris)*	15.0	9.0-25.0	100
COMMON TALL MANNA GRASS *(Glyceria grandis)*	17.0	0.0-34.0	75
SEDGE SPECIES *(Carex)*	44.0	14.0-82.0	100

Environmental Variables

Elevation (range):

Slope (%): 0 - 0.49

Aspect: Level

Topographic Position: Depression

Soil Variables

Soil Drainage: Well drained

Soil Subgroup: DARK BROWN CHERNOZEM ORTHIC

Soil Series: ZGW, ZUN, HND

Soil Correlation: SCA 4

Range Site Category: Overflow

Forage Production (kg/ha) n=1

	Mean	**Min**	**Max**
Unspecified	3923	3923	3923
Total	**3923**		

Ecologically Sustainable Stocking Rate

0.25 (0.12-0.37) AUM/Ha or 0.10 (0.05-0.15) AUM/Ac

References

Achuff, P.L. 1994. Natural regions, subregions and natural history themes of Alberta. A classification for protected areas management. Alberta Environmental Protection, Edmonton, Alberta. 72 pp

Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, A. Burkinshaw, J. Richman, K. France, C. DeMaere, T. Kupsch, T. France, T. Broadbent, L. Blonski, A. J. Miller. 2016. Rangeland Health Assessment for Grassland, Forest and Tame Pasture. AEP, Rangeland Resource Stewardship Section. ISBN: 978-1- 4601-2785-8

Alberta Environment and Parks (AEP). 2018. Range Inventory Manual for Forest Reserve Allotments and Grazing Leases within Rocky Mountain, Foothills, Parkland, and Grassland Natural Regions. AEP, Rangeland Resource Stewardship Section. ISBN 978-1-4601-3948-6

Alberta Rangeland Health Task Group. 1995. Terms of Reference. Alberta Agriculture Food and Rural Development (Public Lands Division), Alberta Environment (Forest Management Division). Edmonton, AB. 49 pp.

Alberta Soil Information Center (ASIC). 2001. AGRASID 3.0. Agricultural Region of Alberta Soil Inventory Database Version 3.0. Edited by J.A. Brierley, T.C.

Martin, and D.J. Spiess. Agriculture and Agri-Food Canada, Research Branch, and Alberta Agriculture, Food and Rural Development, Conservation and Development Branch. Edmonton, Alberta. Available: http://www.agric.gov.ab.ca/asic.

Beckingham, J., I.G.W. Corns and J.H. Archibald. 1996. Field Guide to Ecosites of West-Central Alberta. Special report 9. Canadian Forest Service. Northwest Region. Northern Forestry Centre.

Brierley, J.A., J. Kwiatkowski, and L.C. Marciak. 1992. Land Systems within the County of Stettler, Alberta. Agriculture Canada, Centre for Land and Biological Resources Research Contribution No. 92-205; Alberta Agriculture, Edmonton, Alberta. 52 pp., 1 map.

Corns, I.G.W. and R.M. Annas. 1986. Field guide to forest ecosystems of West- Central Alberta. Northern Forestry Centre, Canadian Forestry Service, Edmonton, AB. 251 pp.

Daubenmire, R. 1952. Forest vegetation of Northern Idaho and adjacent Washington and its bearing on concepts of vegetation classification. Ecol. Monogr. 22: 31-330.

Environment Canada, 2002. Canadian Climate Normals for the 1971 – 2000 period. Available at www.msc-smc.ec.gc.ca/climate/climatenormals/results.

Gauch, H.G. 1982. Multivariate analysis in community ecology. Cambridge University Press. Cambridge. 298 pp.

Godfrey, J. (Ed.). 1993. Edmonton beneath our feet. A guide to the geology of the Edmonton region. Edmonton Geological Society, Edmonton, Alberta. 150 pp.

Holechek, J.L., R.D. Pieper and C.H.Herbel. 1995. Range management principles and practices.2. Prentic-Hall Inc. engewood Cliff. New Jersey. Chapter 8.

Jackson, P.C. 1981. Geological highway map of Alberta. Canadian Society of Petroleum Geologists, Calgary, Alberta. Edited by R. de Wit. Map and Legend.

Kjearsgaard, A.A. 1988. Reconnaissance Soil Survey of the Oyen Map Sheet – 72M. Alberta Soil Survey Report No. S-76-36. Land Resource Research Center Contribution No. 85-56. Agriculture Canada, Edmonton, Alberta. 49 pp., 2 maps.

MacMillan, R.A., W.L. Nikiforuk, and A.T. Rodvang. 1988. Soil survey of the County of Flagstaff, Alberta. Alberta Soil Survey Report No. 51. Research Branch, Agriculture Canada, and Terrain Sciences Dept., Alberta Research Council, Edmonton, Alberta. 88 pp.

McBride, R.A., J.A. Brierley, and L.C. Marciak. 1995. Municipal District of Starland (No. 47) Land Systems. Agriculture and Agri-Food Canada Centre for Land and Biological Resources Research, Prairie Farm Rehabilitation Administration, and Alberta Agriculture, Food and Rural Development. Edmonton, Alberta. Map and Legend.

Mueggler, W.F. 1988. Aspen community types of the Intermountain Region. USDA. Intermountain Research Station. INT-250. 133 pp.

Mussieux, R., and M. Nelson. 1998. A traveller's guide to geological wonders in Alberta. The Provincial Museum of Alberta, Federation of Alberta Naturalists, Canadian Society of Petroleum Geologists, and Alberta Community Development. Edmonton, Alberta. 254 pp.

National Wetlands Working Group. 1997. The Canadian Wetland Classification System, 2nd Edition. Warner, B.G. and C.D.A Rubec (eds.), Wetland Research Center, Univeristy of Waterloo, Waterloo, ON. 68 pp.

Natural Regions Committee. 2006. Natural Regions and Subregions of Alberta. Compiled by D.J.Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Nikiforuk, L., B. Sawyer, L. Knapik, and M.R. Johnson (Eds). 1994. CAESA soil inventory project procedures manual. Version 2.1. Produced by the CAESA Soil Inventory Project. Agriculture and Agri-Food Canada, Alberta Research Council, and Alberta Agriculture, Food and Rural Development.

Pettapiece, W.W. 1986. Physiographic subdivisions of Alberta, 1:1.5 million. Map and Legend. Land Resource Research Center, Research Branch, Agriculture Canada, Ottawa, Ontario.

Saskatchewan Environment and Resource Management (SERM). 1998. The Ecoregions of Saskatchewan. Published by the Canadian Plains Research Center, University of Regina. Principle Authors D.F. Acton, G.A. Padbury, and C.T. Stushnoff. 205 pp.

SCWG (Soil Classification Working Group). 1998. The Canadian System of Soil Classification, Third Edition. Research Branch, Agriculture and Agri-Food Canada, Publ. 1646. National Research Council of Canada Research Press, Ottawa, Ontario. 187 pp.

Shetsen, I., 1987. Quaternary Geology, Southern Alberta. 1:500,000. Alberta Research Council, Terrain Sciences Dept. Digital version is available for $20.00 from the Alberta Geological Survey, email EUB.AGS-Library@gov.ab.ca.

Stewart, R.E. and H.A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. U.S. Fish and Wildlife Service, Resource Publication 92. Strong, W.L., and K.R. Leggat. 1992. Ecoregions of Alberta. Technical Report T/245. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta. 59 pp. + map.

Thompson, W.H. and P.L. Hansen. 2002. Classification and management of riparian and wetland sites of the Alberta Grassland Natural Region and adjacent subregions. Bitterroot Restoration, Inc. Prepared for the Alberta Riparian Habitat Management Program-Cows and Fish, Lethbridge. 416 pp.

Walker, B.D., and C. Wang. 1994. Benchmark site documentation 05:AB (Provost Alberta). Center for Land and Biological Resources Research, Agriculture a Agri-Food Canada, Edmonton, Alberta. CLBRR Contribution No. 95-03. 22 pp.

Wells, R.E., and W.L. Nikiforuk. 1988. Soil survey of the County of Paintearth, Alberta. Alberta Soil Survey Report No. 49. Terrain Sciences Dept., Alberta Research Council, Edmonton, Alberta. 54 pp. + maps.

Wyatt, F.A., J.D. Newton, W.E. Bowser, and W. Odynsky. 1938. Soil survey of the Sullivan Lake Sheet. Bulletin No. 31. Dept. of Extension, University of Alberta Edmonton, Alberta. 102 pp.

Wyatt, F.A., J.D. Newton, W.E. Bowser, and W. Odynsky. 1944. Soil survey of the Wainwright and Vermillion Sheets. Bulletin No. 42. Dept. of Extension, University of Alberta Edmonton, Alberta. 122 pp.

APPENDIX A

Soil Series of Soil Correlation Area (SCA) 4 Linked to Ecological Range Sites Natural Subregion: Northern Fescue; Dark Brown Soil Zone of East-Central Alberta

Productivity Rating	Ecological/Range Site	Soil or Landscape Description	Soil Series
More herbage due to superior soil moisture	Overflow (Ov)	Fan, apron, channeled or concave (non-saline) landscapes	**BKF**
	Subirrigated (Sb)	Gleyed; imperfectly drained (SWCG 1998)	
	Wetlands (WL)	Gleysols; poorly drained (SWCG 1998)	FBG, FLT, THR, ZGW
Normal vegetation response	Clayey (Cy)	Fine (FI) or very fine (VF) textures (see Figure 4)	DMH
	Loamy (Lo)	Medium (ME) or moderately fine (MF) textures (see Figure 4)	CNN, **DLA**, FST, HAN, HND, KUR, LFE, OVE, PRO, THB
	Sandy (Sy)	Moderately coarse (MC); or very coarse (VC) veneer over medium (ME) (see Figure 4)	DCY, **LHD**, MET, **SUL**
Limited by moisture (or soluble salts adversely affecting plant growth)	Badlands (BdL)	Bedrock exposures >10%, and bedrock generally <1m deep; I4, and I5 landscape models	
	Blowouts (BlO)	Dominant or co-dominant soils in the Solonetzic order (SWCG 1998)	BFD, CUR, FNR, HKR, **LHD**, MIC, **SHR**, **SUL**, **TLA**, VTR, WES
	Choppy Sandhills (CS)	Duned landscape models; very coarse (VC) (see Figure 4)	ERT
	Gravel (Gr)	Gravels at the surface or <30 cm from the surface	SCD
	Limy (Li)	Calcareous or Rego subgroups; or eroded phases (SWCG 1998)	ALT, NUT, MTR, ZER
	Saline Lowlands (SL)	Saline discharge; salt-enriched	**BKF**, GLK
	Sands (Sa)	Very coarse (VC) and not duned (SWCG 1998)	HCH, RIB, WWT
	Shallow to Gravel (SwG)	veneer (30 – 100 cm) over gravels	
	Thin Breaks (TB)	Bedrock generally, 1 - 5 m; bedrock exposures <10%	**DLA**, PTE, **SHR**, **TLA**

Note: For a complete description of soil series attributes refer to the Soil Names file in AGRASID 3.0 (www.agric.gov.ab.ca/asic). Soil series codes in bold occur in more than one ecological/Range Site.