

SUMMER RANGE CREEK RANGE UNIT ECOSYSTEM RESTORATION STRATEGIC PLAN

prepared for:

**British Columbia Ministry
of Forests and Range**

Central Cariboo Forest District

by

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Executive Summary

There has been a recent resurgence in interest on the effects of fire suppression on dry forest types throughout western North America. Major problems have been identified including forest health problems, loss of merchantable volume in overstocked stands, increased risk of catastrophic wildfire, and reduced forage production. The principal cause of these problems has been identified as forest encroachment and forest ingrowth. The Central Cariboo Forest District has conducted grassland burning and slashing projects to control forest encroachment, but never as part of a strategic plan.

An objective of the Cariboo-Chilcotin Land Use Plan was the establishment of a Grassland Benchmark area, which was defined by the Inter-Agency Management Committee (2000) as the area and extent of open grassland on inventory maps prepared between 1962 and 1975. In 2006 the Central Cariboo Forest District was awarded funds with which to conduct an ecosystem restoration pilot project. The goal of this project is to produce an Ecosystem Restoration Strategic Plan to manage the density, distribution and species composition of forests within the Grasslands Benchmark area at the Summer Range Creek Range Unit to more closely reflect fire-based ecosystem (grassland) conditions prior to the introduction of cattle grazing and timber harvest, and the suppression of natural fire. Objectives are: a) minimize the long-term damage to grassland vegetation and soils; b) maintain treated sites in a restored condition; c) maintain or improve forage production; and, d) improve and increase habitat for grassland dependent native plant/animal species and associated plant communities.

The Summer Range Creek Range Unit is located on the west side of the Fraser River, approximately 60 km west of Williams Lake, BC. The range unit consists of about 8,500 ha, of which Private Land and Reserves account for 336 ha. Grassland and open forest within the Grassland Benchmark area total approximately 3,280 ha, or about 40% of the range unit. Forest encroachment was verified on more than 2,000 ha, indicating 63% of the Grassland Benchmark area is in need of treatment. Encroachment has affected 47, 82 and 92% of Treatment Units in the open range, open range/open forest, and open forest classes, respectively.

The Richardson's needlegrass range type is dominant in the Grassland Benchmark area, accounting for nearly 2,200 ha, but the bluebunch wheatgrass and needle-and-thread/prairie junegrass types are also important. These range types are mainly found in open grassland and open forest areas, and correspond to plant communities that are red- and blue-listed in BC. Pinegrass dominates the herbaceous layer in closed forest polygons. Forest harvest, stand-tending, prescribed fire and grazing/browsing management are the most likely methods of restoring these communities. Red- and blue-listed wildlife species that potentially use these plant communities will also benefit from restoration activities.

Restoration treatments can be classed as commercial and non-commercial. Forest products available from commercial treatments include sawlogs, post and rail material, grape stakes, pulpwood, pulp and OSB chips, and hog-fuel. Some harvesting will be required beyond the Grassland Benchmark. Revenue can be used as cost recovery for non-commercial treatments. Non-renewable Forest Licenses may be required to initiate treatments in the Grassland Benchmark area. Incentives to make operations viable include salvage of forest products, and setting stumpage at the upset rate.

Strategic Plans to restore grasslands will require a cooperative approach between government, tenure holders and forest harvest/stand-tending contractors. Dedication of resources to initiate these plans, and the willingness of all participants to move toward an adaptive management philosophy, are the key elements in managing grasslands and forest within the Grassland Benchmark area.

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Table of Contents

Executive Summary.....	ii
Acknowledgements.....	iii
List of Tables.....	vi
List of Figures.....	vi
List of Appendices.....	vi
1.0 Introduction.....	1
1.1 Background.....	1
1.2 Objectives.....	4
2.0 Site Description.....	4
2.1 Landforms and Soils.....	6
2.2 Vegetation.....	8
2.3 Climate.....	8
2.4 Wildlife.....	8
3.0 Methods.....	9
3.1 Stratification.....	9
3.2 Field Reconnaissance.....	9
3.3 Digital Mapping.....	10
4.0 Results.....	10
4.1 Range Unit Description.....	10
4.2 Slope, Aspect and Elevation.....	10
4.3 Landforms and Soils.....	12
4.4 Forest Cover.....	12
4.4.1 Range Unit.....	12
4.4.2 Pastures.....	14
4.5 Forest Encroachment.....	15
4.6 Vegetation.....	15
4.6.1 Open Grassland.....	15
4.6.2 Open Forest.....	19
4.6.3 Closed Forest.....	19
4.6.4 Invasive Plants.....	19
4.7 Forest Health.....	19
4.8 Wildlife.....	20
5.0 Management Plan.....	20
5.1 Stratification.....	20
5.2 Priority Areas for Restoration.....	20
5.2.1 Open Grassland.....	20
5.2.2 Open Forest.....	22
5.2.3 Closed Forest.....	23
5.3 Commercial Harvesting Treatments.....	23
5.4 Forest Products.....	23
5.5 Treatment Prescriptions.....	26
5.6 Harvest and Access Disturbance.....	26
5.7 Non-Commercial Treatments.....	27
5.8 Forest Health.....	27
5.9 Invasive Plants.....	28
5.10 Livestock and Ungulate Management.....	28

6.0 Pre-and Post Operational Monitoring.....	29
6.1 Maintenance Treatments.....	29
6.2 Range Survey.....	29
6.3 Invasive Plants.....	31
6.4 Wildlife.....	31
7.0 Summary and Recommendations.....	31
8.0 Literature Cited.....	33
9.0 Appendices.....	36

List of Tables

Table 1. Pastures at the Summer Range Creek Range Unit.....	11
Table 2. Pre-treatment forest cover classes at the Summer Range Creek Range Unit	13
Table 3. Forest encroachment in permanent range areas at the Summer Range Creek Range Unit.....	16
Table 4. Range types at the Summer Range Creek Range Unit.....	17
Table 5. Treatment Units at the Summer Range Creek Range Unit.....	21
Table 6. Treatments and treatment priorities at the Summer Range Creek Range Unit	24
Table 7. Projected treatment revenues and expenses at the Summer Range Creek Range Unit	25
Table 8. Post-treatment forest cover classes at the Summer Range Creek Range Unit...	30

List of Figures

Figure 1. Summer Range Creek Range Unit.....	5
Figure 2. Soils at the Summer Range Creek Range Unit.....	7

List of Appendices

Appendix 1. Plant species.....	37
Appendix 2. Animal species.....	43
Appendix 3. Plant communities at the Summer Range Creek Range Unit in September, 2008.....	44
Appendix 4. Polygon areas at Summer Range Creek Range Unit in September, 2008	78
Appendix 5. Photo-points.....	96
Appendix 6. Summer Range Creek Range Unit – Pre-treatment forest cover (1:20,000)	
Appendix 7. Summer Range Creek Range Unit – Post-treatment forest cover (1:20,000)	

1.0 Introduction

While interest in the effects of fire suppression in dry-forest types is currently high, the problem is not a new one. Nearly 90 years ago the spread of forests into grasslands was a recognized problem in southern British Columbia (Whitford and Craig 1918 as cited in Strang and Parminter 1980). Tisdale (1950), in a review of livestock grazing on forest lands in the Interior of British Columbia, identified the invasion of open or semi-open areas by tree growth as a common phenomenon over much of the Interior. He noted the reduction in grazing capacity and usefulness as early range, which accompanied forest encroachment in these areas.

While various Ecosystem Restoration efforts have been made in the Cariboo-Chilcotin over the past 20 years, most have been ad-hoc. The Williams Lake Forest District (now the Central Cariboo Forest District) has conducted grassland burning and some slashing projects to control forest encroachment, but never as part of a strategic plan. In 2006 the Central Cariboo Forest District was awarded funds with which to conduct an ecosystem restoration pilot project.

1.1 Background

Although interest is high in parts of British Columbia, where the Ponderosa pine and Interior Douglas-fir forest types exist, until recently little work has been done to characterize the problem in the Chilcotin grasslands of the Central Cariboo Forest District. The exception is a study by Strang and Parminter (1980) near Riske Creek. They attributed forest encroachment to a combination of the absence of fire, absence of grass competition, and subtle micro-site determinants of soil moisture availability.

Fire suppression activities were not organized in the Cariboo Forest Region until 1961 (J. S. Muraro in Strang and Parminter 1980). However, in the fire chronology of Dester Ridge, the area studied by these authors, it was revealed that there had not been a fire of sufficient intensity to cause fire scarring since 1926. Previous to 1926, Strang and Parminter (1980) estimated a fire return interval of 9.8 years. Indeed, Tisdale (1950) noted that heavy grazing had aided forest encroachment in BC by removing fine fuels and reducing herbaceous vegetation competition on some sites, but that much of the encroachment was due to a natural return of trees to areas deforested in the past by repeated fires.

The primary ingrowth species has been identified as Douglas-fir, but lodgepole pine is also important. Additionally, aspen may have increased through suckering in some areas (Strang and Parminter 1980, Kay et al 1994). Range burns, as a method of reducing forest ingrowth and encroachment, have met with some success in the Central Cariboo Forest District, but generally have not been intense enough for a satisfactory kill of tree seedlings (Fred Knezovitch, ret., BC Ministry of Forests, pers. comm.).

Burns have generally been conducted in spring due to concerns with escapement into timbered areas. Hall (1976), working in the Blue Mountains of Oregon on the effects of underburning on ponderosa pine, Douglas-fir, and white fir, found that the absence of underburning resulted in a different primary succession in these forests. While ponderosa pine develops a fire-resistant bark containing a 6 to 14 mm thick dead outer layer at 5 cm

outer diameter at ground level, Douglas-fir bark remains photosynthetically active at up to 10 cm outer diameter at ground level. With the elimination of underburning in the Blue Mountains ponderosa pine are being replaced by Douglas-fir and white fir.

Similarly, in the Chilcotin, a combination of the absence of periodic ground fires and the removal of fine fuels by historic overgrazing has led to the creation of appropriate seedbeds for tree germination (Strang and Parminter 1980). The coincidence of large tree seed crops with the micro-climatic susceptibility of some sites has enabled forest encroachment and forest ingrowth. Tree germination appears to have occurred in “waves” which correspond to heavy seed crop production combined with favourable moisture conditions. Douglas-fir and lodgepole pine are the principal ingrowth and encroachment species. Arno and Gruell (1986), working in Montana, attributed the establishment of large areas of pole-sized Douglas-fir to periods of near-normal or better than normal moisture conditions. They also noted that, historically, periods of Douglas-fir establishment ended with the onset of periods of drought. These waves of conifer regeneration may last 10 to 15 years.

These factors have contributed to a situation where the carrying capacity has decreased with an attendant loss of AUM's. An additional concern is that grazing is increasingly concentrated on non-forested areas with a possible result being altered plant communities, decreasing range condition, and a possible loss of biodiversity.

Forest harvest has been conducted on the Summer Range Creek Range Unit in recent years, and should partially compensate for lost grazing opportunities in the open grassland and open forest. However, these opportunities are temporary. Also, grazing tends to focus on the domestic forage seedlings on roadsides and landings.

Land use planning initiatives began in 1994 and resulted in the creation of the Cariboo-Chilcotin Land Use Plan (CCLUP). The Grazing Enhancement Fund (GEF) was created to compensate agricultural interests that were affected by the land use planning process.

In 1996 a project was initiated under the GEF to document forest encroachment and ingrowth in the Bald Mountain and Becher Prairie range units between 1962 and 1993/95 (Ross 1997). This starting date coincided with the beginning of active fire suppression and calculation of the Annual Allowable Cut (AAC) in the Cariboo Forest Region (Ross Fredell, ret., BC Ministry of Forests, pers. comm.).

General findings on the occurrence of forest ingrowth and encroachment on Bald Mountain and Becher Prairie (Ross 1997) were:

- 1) Forest encroachment is more prevalent than forest ingrowth. There is a continuous forest edge in many places. Ingrowth may have already occurred on most sites.
- 2) North and east exposures are most susceptible.
- 3) Encroachment into small grassland openings in the forest, and narrow “necks” of open grassland extending into areas of open or closed forest is common. Patches of timber have coalesced due to encroachment and ingrowth.

- 4) Encroachment from contiguous areas of closed forest can be from any aspect. The explanation is likely increased shading in these areas. It may even occur from small islands of timber in open grassland.
- 5) Gullies and microtopography create ingrowth and encroachment sites.
- 6) The relationship between litter, grazing and forest ingrowth and encroachment is not definitive. It is possible to have a similar amount of forest encroachment on two different sites which have differing amounts of standing litter.
- 7) Prevailing winds affect tree seed dispersal and soil evapo-transpiration.
- 8) Elevation affects the ingrowth/encroachment species. Douglas-fir is the most prevalent species on Bald Mountain. Lodgepole pine is most prevalent at lower elevations on Becher Prairie, while Douglas-fir occurs mainly on upper elevation sites.

Similar work was conducted on the Junction, Word Creek, Lone Cabin Creek, Dog Creek, Canoe Creek and Meadow Lake range units comparing airphotos from 1961-75 and 1995-7 (Ross 2000). Results indicate that the open grassland class was reduced by between 18 and 51% between the two dates at these range units.

Relationships between forest encroachment and ingrowth and site biophysical factors were further investigated by Bai et al (2000, 2004). Nearly 50,000 ha encompassed by the Becher Prairie, Bald Mountain, Junction, Word Creek, Lone Cabin Creek, Dog Creek, Canoe Creek and Meadow Lake range units were evaluated.

This study found:

- The greatest change in forest cover was between elevations of 700 and 1000 m
- Open grasslands occurred mainly on southern aspects and the shift to treed grassland and open forest was most likely there
- The probability of shift from open grassland to treed or open forest decreased with increasing slope degree
- Closed forest most often occurred on northerly facing slopes and the shift from open forest to closed forest was most likely to occur there

In 1997 the Cariboo-Chilcotin Grassland Strategy Working Group was directed by the Inter-agency Management Committee (IAMC) to prepare a grassland strategy that would serve as a strategic framework for grassland conservation in the Cariboo-Chilcotin.

Specific objectives were to:

- Recommend a Grassland Benchmark area
- Recommend management objectives for the Grassland Benchmark area,
- Evaluate implications of the benchmark on forage production, AUM allocation, biodiversity and timber

The Grassland Benchmark was established and signed off by the IAMC in 2000. The benchmark was established based on the work by Ross (1997, 2000) and Bai et al (2000, 2004), and the area and extent of open grassland on inventory maps prepared between 1962 and 1975 (BC Ministry of Forests 1963, 1975). These inventory maps were the first digital inventory available and were based on interpretation of aerial photography from this time period. While the ecological extent of grasslands does extend beyond the benchmark, it was determined that establishing the extent of the “true” grassland would require a prohibitive expenditure of time, effort and money. Also, it was felt that the potential impact on the timber supply was not consistent with CCLUP objectives.

1.2 Objectives

The goal of this project is to produce an Ecosystem Restoration Strategic Plan to manage the density, distribution and species composition of forests within the CCLUP Grasslands Benchmark at the Summer Range Creek Range Unit to more closely reflect fire-based ecosystem (grassland) conditions prior to the introduction of cattle grazing and timber harvest, and the suppression of natural fire.

Objectives of the Strategic Plan are as follows:

- a) minimize the long-term damage to grassland vegetation and soils;
- b) maintain treated sites in a restored condition;
- c) maintain or improve forage production; and
- d) improve and increase habitat for grassland dependent native plant/animal species and associated plant communities.

2.0 Site Description

The Summer Range Creek Range Unit is located on the west side of the Fraser River, approximately 60 km west of Williams Lake, BC (Figure 1). It encompasses the area to the west of Farwell Creek to the south and west of the junction of the Chilcotin and Fraser Rivers, Gang Ranch is the sole grazing permittee.

Summer Range Creek Range Unit was split into two pastures about 10 years ago to allow for several use options (Chris Armes, pers. comm.). Total use is from the beginning of May to mid-June, with roughly 2,500 head of cow/calves flowing through. The rotation changes every year, as cattle flow through rather than graze the unit for a specific grazing period, so exact dates or AUM's cannot be given.

Typically, cattle are turned out from Gang Ranch private land onto Crown land in April. They are slowly pushed (about 250 head at a time) from the three turnout pastures to Summer Range Creek. The cattle can be pushed along the Fraser River Benches until they hit East pasture where they graze until they are moved to West pasture. Some of the cattle are pushed over Saddle Horse Mountain directly into the West pasture, while other cattle are pushed around through Mary's Flat into the East pasture. In about one-half of the years calves are branded as they move through from the northeast to the southwest.

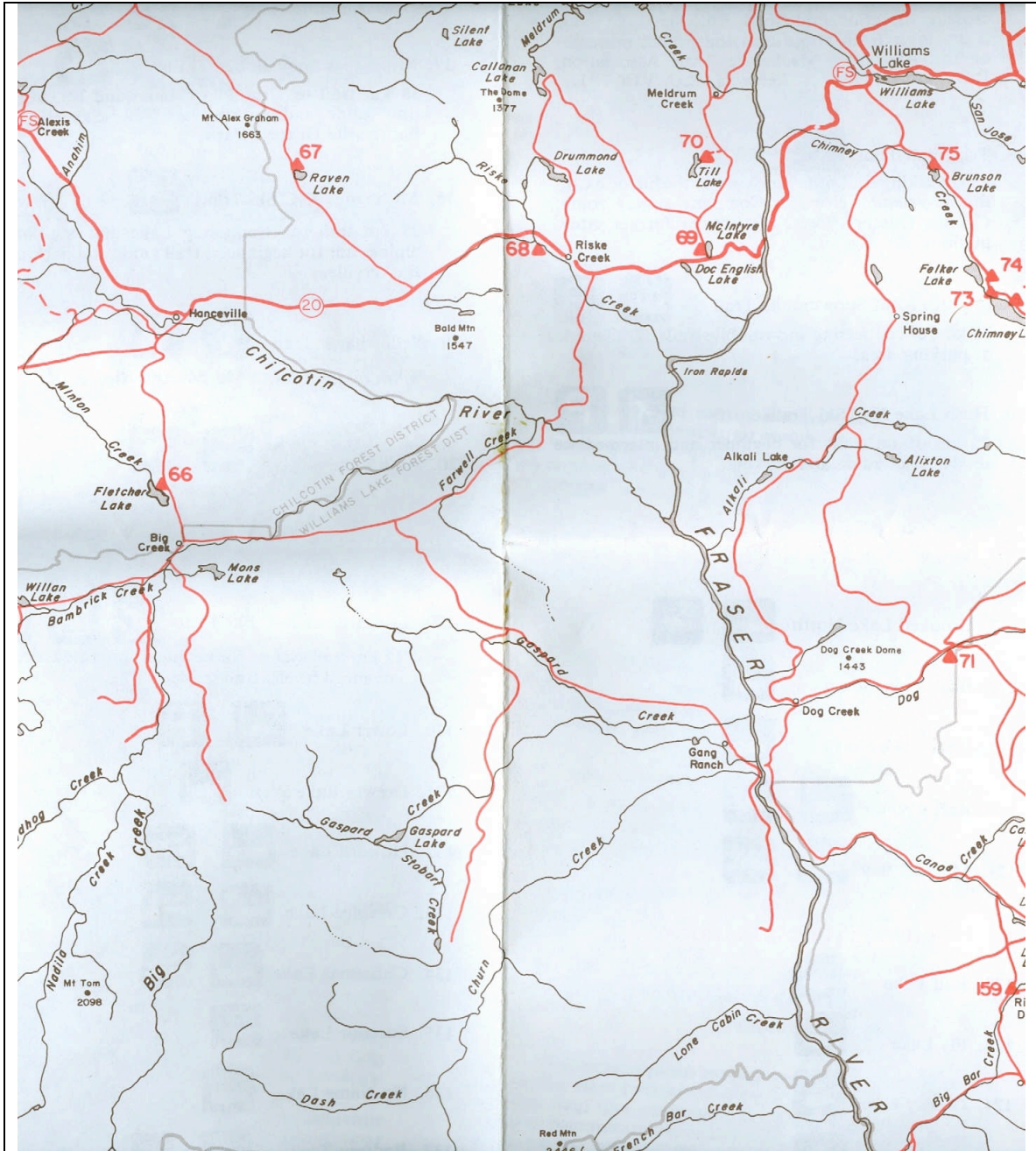


Figure 1. Study Area (1:50,000).

Some cattle are driven directly over Saddle Horse Mountain into West pasture. These are generally the later cattle, as cows are already being moved into West from East by this time (leap frogging). Late calving cows are generally trucked from the home ranch to the West pasture. Occasionally yearlings are hauled into the West pasture.

Timber harvest is the other principal tenured use on Crown land in the Summer Range Creek Range Unit. Forest tenure is held by West Fraser Timber.

2.1 Landforms and Soils

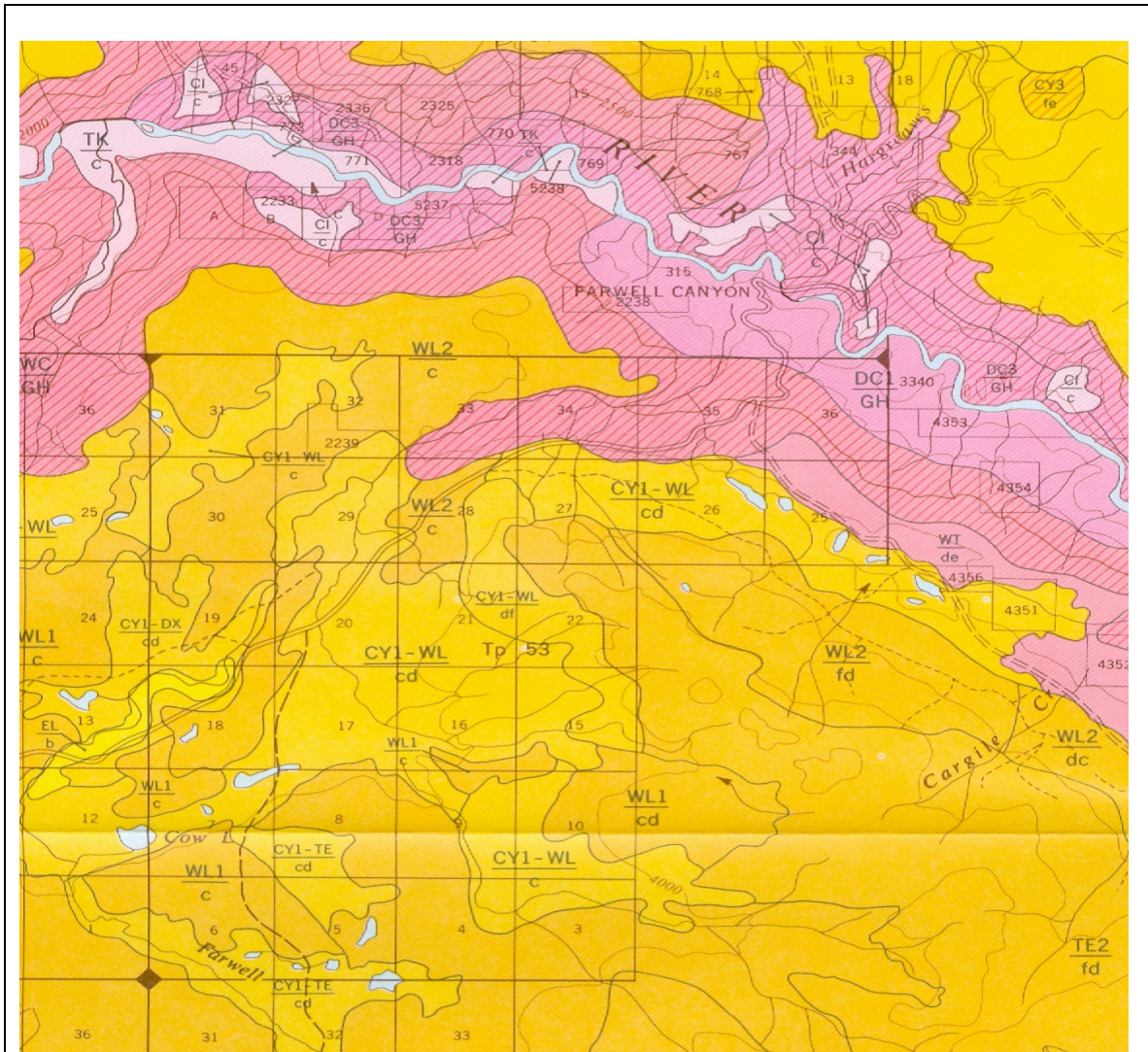
The Summer Range Creek Range Unit lies within the Fraser Plateau East subdivision of the Interior Plateau of British Columbia (Holland 1976). The Fraser Plateau is a rolling, drumlinized till plain dissected by deep valleys and containing some isolated hills (Valentine et al 1978). It slopes from the southwest to the northeast starting at about 1500 m ASL and gradually falling to about 1000 m ASL. The bedrock is comprised of basalt and andesite lava flows with a few intrusions of granodiorite. Limestone and argillite are also found (Valentine et al 1978). As a result of weathering processes, these base rich rocks have produced alkaline soils and subsoils. In depressions the soils are sometimes alkaline and/or saline.

Morainal deposits (glacial till) are the most common surficial material in the study area. Depths vary from a few centimeters to >5 meters. They consist of a heterogeneous mixture of boulders, cobbles, pebbles, sand, silt, and clay (Valentine et al 1987). The undulating topography of morainal areas produces soils with different moisture regimes, depending on slope position. Typically, there are drier soils on crests and progressively moister soils downslope. In depressions there may be organic soils or lakes.

The Chimney and Williams Lake soil associations comprise the majority of the area within the range unit (Figure 2). Small areas of the Drummond, Elliot, Tyee, Whiskey Creek and Withrow soil associations are also found. Withrow and Whiskey Creek soils are associated with the Chilcotin River valley, while the other soils are found within the Fraser Plateau East.

Chimney soils are classified as Orthic Dark Brown Chernozems (grassland soils) and are described as well-drained and moderately pervious with a subhumid moisture regime. They are characterized by an organic-enriched surface horizon (Ah), a slightly weathered subsurface horizon (B), and calcareous parent material (Valentine et al 1987). Chimney soils may be capped with a 2 to 15 cm thick loess veneer.

Williams Lake soils are classified as Orthic Gray Luvisols (forest soils) and are described as having a subsurface rich in clay, calcareous parent material, and a thin surface litter layer. These soils are deep and well-drained, moderately pervious, with a subhumid moisture regime (Valentine et al 1987). There are numerous irregular patches of the forested Williams Lake soil association distributed throughout large expanses of grassland.



Symbol	Soil Association	Parent Material	Texture	Drainage	Soil Classification	Description
CY	Chimney	moraine	l	w	DG, DB Chernozem	Grasslands with 20-60% forested soils
DX	Drummond	moraine	l	w	Eluviated DB Chernozem	Grasslands with 10-15% forest on rolling plateaus
EL	Elliot	fluvial	fsl	r	Carbonated R H Gleysol	Variable parent material in linear depressions
TE	Tyee	moraine	sil	w	Orthic Dystric Brunisol	Level, level areas with 20-40% shallow soils, large boulders
WC	Whiskey Creek	moraine	vfs	w	Orthic Eutric Brunisol	Upper valley slopes, include 10-30% Chimney soils and rock outcrops
WL	Williams Lake	moraine	fsl	mw	Orthic G Luvisol	Forested soils, 15-30% imperfectly drained
WT	Withrow	moraine/eolian	fsl	w	Eluviated E Brunisol	Eolian cap from river terraces to Frazer plateau

Figure 2. Soils at Summer Range Creek Range Unit (1:100,000).

Tyee, Whiskey Creek and Withrow soils are all classified as Brunisolic soils, Drummond soils are Eluviated Dark Brown Chernozems, while Elliot soils are Carbonated Rego Humic Gleysols.

Compound units of Chimney and Williams Lake soils are a common map unit. They represent the ecotone between grasslands and forests on the plateau (Valentine et al 1987). Tyee and Drummond soils are also found in complex units with Chimney soils.

2.2 Vegetation

The range unit is located primarily within the Interior Douglas-fir (IDF) biogeoclimatic zone, with minor inclusions of the Bunchgrass (BG) biogeoclimatic zone (Annas and Coupe 1979, Steen and Coupe 1997). The most common Interior Douglas-fir subzones are the very dry, mild (IDFxm) and the dry, cool Chilcotin variant (IDFdk4), while the Bunchgrass zone is represented by the very dry, warm, Alkali variant (BGxw2).

The IDFxm subzone is located on lower to upper valley slopes associated with the Chilcotin River. The IDFdk4 occurs above the IDFxm, typically occupying low and mid elevation areas of the Fraser plateau in areas that are cooler and drier than the IDFdk3. The BGxw2 subzone is described as upper valley slopes and terraces adjacent to the Fraser and Chilcotin rivers (Annas and Coupe 1979, Steen and Coupe 1997).

Major tree species are Douglas-fir¹, lodgepole pine, trembling aspen, and white spruce. Common shrubs are big sagebrush, rabbitbrush, rose, juniper, bearberry, soopolallie, and bog-birch (Appendix 1). Grasses include bluebunch wheatgrass, sheep fescue, Kentucky bluegrass, needle-and-thread, Richardson's needlegrass, Sandberg bluegrass and pinegrass. Common forbs are goldenrod, shrubby penstemon, timber milkvetch, twinflower, western yarrow, showy aster, heart-leaved arnica and pussytoes. Goatsbeard is a common introduced weedy forb species.

2.3 Climate

The study area is located in the lee of the Coast Mountains. The area's climate is described as a moderate continental climate with cold winters and warm summers. Annual precipitation ranges from 320 to 450 mm (Valentine et al 1987). The frost-free period may be as short as 40 days on some plateau areas. Average precipitation at Big Creek, approximately 45 km southwest of the range unit is 38.9 cm, while at Williams Lake precipitation averages 45.0 cm (Environment Canada 2008).

2.4 Wildlife

The Summer Range Creek Range Unit is rated as having high to low (Class 1W and 4W) capability to support ungulates, in particular mule deer and moose (Canada Land Inventory 1976). Waterfowl capability is rated as high. There are several Ducks Unlimited projects in the area. Carnivores such as black bear use the unit. Red and blue-listed wildlife species that may use the range unit are listed in Appendix 2 (BC Conservation Data Center 2008).

¹Plant species names are after Hitchcock and Cronquist (1973).

3.0 Methods

3.1 Stratification

All Crown land within the boundaries of the Summer Range Creek Range Unit was included in the study area. Areas of private land within range unit boundaries were mapped, but were not surveyed. The survey was organized by pasture.

The range unit was first stratified into Treatment Units (TU) of permanent range within pastures on recent 1:20,000 colour aerial photographs (2005). For this initial stratification, permanent range was assumed to be open range and open forest, and may include some associated riparian and aspen areas bordering wetlands, shallow water or lake features. Those areas classified as permanent range are predominantly within the “grassland matrix” as bounded by the Grassland Benchmark.

Forest canopy closure classes follow forest cover (1:20,000) classes and are defined as: Open Range (OR) 0 to 10%, Open Forest (OF) 11 to 40% and Closed Forest (CF) >40% (BC Ministry of Forests 2007). The OR/OF class is incorporated to account for polygons that are a mosaic of the two types. Water, wetlands and private land are mapped separately. Forest encroachment on grasslands was mapped separately where observed within individual TUs.

Transitory range represents polygons where recent timber harvest has occurred, making forage available for 15 to 20 years. Transitory range polygons were not mapped separately during this inventory. If harvest had been conducted within OR, OR/OF or OF polygons, these areas were included in the polygon. Other features including riparian areas, utility right-of-ways, roadsides and landings, agricultural fields, or rock outcrops were not mapped separately. Initial polygon boundaries were refined by examination of historical airphotos (circa ~1962) and forest cover maps (BC Department of Lands, Forest and Water Resources 1963, 1975), and on soils maps (Valentine et al 1987).

Open range polygons serve as the Grassland Benchmark, however, due to variability in the landscape, TUs also contain open and closed forest polygons. Defining TUs in this way serves to improve operability. Some open and closed forest polygons will be treated along with grassland areas. Other open and closed forest polygons will be retention areas that:

- are associated with riparian or moisture receiving sites, ridge crests or cool aspect slopes
- contain a component of mature or older trees >40cm dbh
- are at least one mature tree height in width (~ 20m)

3.2 Field Reconnaissance

Following the photo-interpretation, a field reconnaissance of the range unit was completed. This consisted of traveling throughout the grassland areas and visiting approximately 30 sites. General site characteristics and vegetation descriptions were recorded for each TU (Appendix 3, 4). Photos and GPS coordinates were also taken at each site (Appendix 5). Polygon boundaries were refined at this time.

Slope, aspect, elevation, landform and soil type were recorded. Forest canopy and the shrub and herbaceous layers were described. The overstory is composed of veteran and dominant trees, and mature trees >12.5 cm dbh (Layer 1 and 2). The regeneration layer consists of all trees up to 1.3 m in height (Layer 5) and those trees >1.3 m in height, but <7.5 cm dbh (Layer 4). The remaining trees comprise the understory (Layer 3 – 7.5 to 12.4 cm dbh). Range condition (Dyksterhuis 1949) is used to describe the seral stage of the herbaceous and shrub plant community's response to past grazing disturbance. Excellent range condition represents ecological "climax" while poor condition corresponds to the lowest seral stage.

3.3 Digital Mapping

The GIS work for this project was done with ESRI ArcGIS Version 9.3 at the ARC/INFO level. Appropriate 1:20,000 TRIM map sheets were downloaded and mylar sheets were used in order to transfer the photo-interpreted line-work. The mylars were then digitized. The line-work was verified and cleaned for overshoots, undershoots, and then matched to the base map. Each Treatment Unit then had its appropriate attribute data entered and area calculated (Appendix 4).

Information is presented in tabular format and is incorporated into the report. A 1:20,000 polygon map was produced depicting current forest cover (pre-treatment) at the Summer Range Creek Range Unit as observed in 2008 (Appendix 6). A second map was produced depicting recommended post-treatment forest cover (Appendix 7).

4.0 Results

4.1 Range Unit Description

The Summer Range Creek Range Unit was surveyed between September 5 and 8, 2008. Detailed TU descriptions are found in Appendix 3 and depicted on maps accompanying this report (Appendix 6 and 7).

The range unit, including Crown land and Private Land within the range unit boundary encompasses 8,510 ha (Table 1). Private Land and Reserves totaled slightly more than 330 ha, so the surveyed area of the range unit equaled approximately 8,200 ha.

4.2 Elevation, Slope and Aspect

Elevation at Summer Range Creek Range Unit ranged between 920 and 1300 m (Appendix 3, 5). The lowest elevation areas were found in the Poison Lakes area of East pasture (TU1-6), while the highest elevations were found in the southern portion of East pasture to the west of Saddle Horse Mountain. Slopes within the grassland matrix were typically <5°, but slopes of 10 to 30+° were encountered, especially in TU 9-15 in East pasture. All aspects were represented, but OR polygons within the Grassland Benchmark area were most commonly found on southeast to southwest aspects (Appendix 3).

Table 1. Pastures at the Summer Range Creek Range Unit.

Pasture	Area (ha)
East	5235
East Riparian	16
West	3206
West Holding	43
West Riparian	10
Total	8510

Note: Private Land (212 ha) and Research Reserves (124 ha) found in East and West pastures are included in the Range Unit total.

4.3 Landforms and Soils

At a landscape level the Summer Range Creek Range Unit is dissected by deep valleys associated with the Chilcotin River, includes the northern portion of a drumlinized till plain, and contains some fluvial deposits (Holland 1976). Saddle Horse Mountain is the most prominent feature in the area. Morainal soils dominate. They exhibit internal drainage, which leads to the creation of enclosed depressions that may contain shallow waterbodies or wet soils with associated organic deposits. Glaciofluvial deposits are occasionally found in shallow valleys and meltwater channels. There are many areas of alkaline soils within the range unit that are variants from the modal soils (Appendix 3).

Soils from the Chimney and Williams Lake soil associations comprise the majority of the range unit. Small areas of the Drummond, Elliot, Whiskey Creek and Withrow soil associations are also found. Chimney soils are grassland soils and are dominant within the range unit's Grassland Benchmark area. They are frequently associated with the Drummond association, soils that are slightly drier than the modal Chimney soil, and with Tyee soils. Chimney soils are represented by grasslands in TU1-4 and TU9-15 in East pasture, and TU1 and TU9-15 in West pasture.

Williams Lake soils are forest soils that are distributed in irregular patches throughout large expanses of grassland. Compound units of Chimney and Williams Lake soils are a common map unit. They represent the ecotone between the grassland and the forest on this portion of the Fraser plateau (Valentine et al 1987).

The principal difference between the Chimney and Williams Lake soils appears to be landscape position. Chimney soils are usually found on drier aspects so chernozemic soil processes have occurred with grassland vegetation predominant. In contrast, Williams Lake soils are frequently found in slightly moister settings, where forest vegetation predominates and luvisolic soil processes are dominant.

Whiskey Creek and Withrow soils are associated with the Chilcotin River valley. Both soils should support grassland vegetation as OR or OF polygons, depending primarily on aspect. The principal difference between these soils is the eolian cap that characterizes the Withrow soils. These soils are found in the northmost portion of East pasture in the vicinity of TU5-10.

Elliot soils are found in a narrow band of fluvial deposits in West pasture along the Riske Creek-Gang Ranch Road (2000 Road). They are characterized by gleysolic soil processes that result in grasslands or graminoid meadow features (McKenzie and Moran 2004). These features usually occur in a mosaic with dry, open forests as in TU2-8 in West pasture. They constitute a relatively small area of the range unit.

4.4 Forest Cover

4.4.1 Range Unit

Closed forest was the largest cover class representing 57% of the range unit, at more than 4,600 ha (Table 2). Permanent range, including OR, OR/OF and OF polygons within the Grassland Benchmark area, accounts for about 3,300 ha (40%) of the range unit. Open range was the largest class comprising nearly 1,800 ha, or 22% of the surveyed area.

Table 2. Pre-treatment forest cover classes at the Summer range Creek Range Unit.

Pasture	Open Range	Open Range/ Open Forest	Open Forest	Closed Forest	Riparian	Water	Private Land	Reserves	Total	Total *
-----ha-----										
East	1472	393	64	2937	29	21	195	124	5235	4915
East Riparian	8	0	0	0	3	5	0	0	16	16
West	304	954	25	1716	130	61	16	0	3206	3190
West Holding	0	43	0	0	0	0	0	0	43	43
West Riparian	10	0	0	0	0	0	0	0	10	10
Total by Class	1794	1390	89	4653	161	86	212	124	8510	8174

* Total minus Private Land and Reserves.

Permanent Range (ha) = (Open Range + Open Range/Open Forest + Open Forest)/Range Unit Total = 3273

Permanent Range (%) = (Open Range + Open Range/Open Forest + Open Forest)/Range Unit Excluding PL = 40

Distribution (%)	Range Unit *	Permanent Range
Open Range	22	55
Open Range/Open Forest	17	42
Open Forest	1	3
Closed Forest	57	0
Riparian	2	0
Water	1	0
Total	100	100

* Range Unit minus the area of Private Land and Reserves.

The open forest class was not well represented at Summer Range Creek at less than 90 ha, or about 1% of the range unit. However, the compound unit, OR/OF covered about 1400 ha. Water and Riparian areas together comprise slightly less than 250 ha, or 3% of the range unit.

4.4.2 Pastures

For ease of data presentation and TU operability the range unit was surveyed by pasture. There are two main pastures in the range unit, East and West, and three smaller pastures within them (Table 1).

East

East is the largest pasture and comprises the north, east and central portions of the range unit (Appendix 6, 7). It is bisected by the Riske Creek-Gang Ranch Road (2000 Road) and includes the 2500 Road through the Poison Lake area, and the Saddle Horse Mountain Road. Grassland areas are associated with the Chilcotin River and Farwell Creek valleys in the north of the pasture, and on the south side of Saddle Horse Mountain in the southwest portion of the pasture. Two research forests are found in East pasture in the vicinity of TU9 and 10 (Appendix 6, 7). Permanent range equals more than 1,900 ha.

East Riparian

East Riparian pasture is found within TU1 in East pasture. This small pasture was created as a result of exclusion fencing at Poison Lake.

West

West pasture is bisected by the Riske Creek-Gang Ranch Road (2000 Road), and includes the 2200 Road, which services the Cow Lake area. Grasslands are associated with Farwell Creek, Cow Lake and several unnamed wetland systems. A Ducks Unlimited water diversion and storage installation is found at Cow Lake. There have been several recent timber harvest entries in this pasture. They are associated with grasslands found in TU7, 8, 11, 12 and 15. There are about 1,300 ha of permanent range.

West Holding

West Holding pasture is found between the Riske Creek-Gang Ranch and Cow Lake roads in West pasture. This small pasture is located on one branch of the Farwell Creek drainage and is designed to sort or temporarily hold livestock. It also includes cabins and a corral system.

West Riparian

West Riparian pasture is found alongside the Riske Creek-Gang Ranch Road in West pasture. This small pasture results from exclusion fencing on one branch of the Farwell Creek drainage.

4.5 Forest Encroachment

Forest encroachment was observed in all pastures and in most TUs during the reconnaissance survey. Of the nearly 3,300 ha of permanent range within the Grassland Benchmark, more than 2,000 ha (63%) is affected by forest encroachment (Table 3).

Although the OR class is the largest class in the permanent range area, both the total area, and the percentage of the class affected by encroachment are higher in the OR/OF. Forest encroachment has occurred on more than 1,100 ha of the OR/OF class, in contrast to nearly 850 ha in the OR class. Approximately 50% of the OR in the range unit has experienced encroachment, but more than 80% of the OR/OF polygons are affected. Less than 90 ha of OF were mapped in the range unit, but encroachment has occurred on 92%.

All TUs in all pastures have been affected, although encroachment levels in East Riparian and West Riparian pastures have been nominal. In many cases treatment units where forest cover is comprised of OR/OF or OF polygons have lost a larger percentage of the Grassland Benchmark area than TUs that are designated as OR (Appendix 3, 4, 6). However, large OR polygons may have lost a greater area to encroachment.

Douglas-fir is the principal encroachment and ingrowth species in East pasture, although it is also found in most TUs in West and West Riparian pastures (Appendix 3). This is likely due to a combination of the effects of higher elevations and northerly aspects in East pasture. In contrast, lodgepole pine is most often the leading encroachment and ingrowth species in West and West Holding pastures. Aspect, elevation and dry soil types are the most likely explanations for this trend.

4.6 Vegetation

Vegetation descriptions were compiled for each TU. The area of each plant community type as described below was derived by surveying all OR, OR/OF and OF polygons within the TU, with the dominant type being assigned to the whole TU. Variation in topography within the TU often results in more than one type being represented in an individual TU, so plant species community descriptions are provided (Appendix 3).

4.6.1 Open Grassland

Open grassland sites in the Summer Range Creek Range Unit can be classified within the biogeoclimatic zones by site moisture characteristics. These types are not necessarily distinct, as they have many species in common, and are apt to intergrade based on subtle variations in topography and microclimate. The driest sites are those dominated by needle-and-thread and bluebunch wheatgrass, mesic sites are dominated by Richardson's needlegrass, while moister sites are usually dominated by pinegrass. Alkaline soils associated with wetlands and riparian areas have a distinctive plant community.

Soil moisture-holding capacity, as determined by soil texture and by small differences in slope and aspect, is quite variable within these units such that five basic grassland types are encountered (Table 4).

Table 3. Forest encroachment in permanent range areas at the Summer Range Creek Range Unit.

Pasture	Open Range (ha)			Open Range/Open Forest (ha)			Open Forest (ha)			Pasture Total
	Total	Treat	No-treat	Total	Treat	No-treat	Total	Treat	No-treat	
East	1472	684	788	393	320	73	64	58	6	1929
East Riparian	8	0	8	0	0	0	0	0	0	8
West	304	160	145	954	777	176	25	24	1	1283
West Holding	0	0	0	43	36	7	0	0	0	43
West Riparian	10	0	10	0	0	0	0	0	0	10
Total by Class	1794	844	950	1390	1133	257	89	82	7	3273

Permanent Range = (Open Range + Open Range/Open Forest + Open Forest) = 3273

Encroachment = 2059

<u>Permanent Range</u>	<u>Encroachment (%)</u>
Total Permanent Range	63
Open Range	47
Open Range/Open Forest	82
Open Forest	92

Table 4. Range types at the Summer Range Creek Range Unit.

	Type 1	Type 2	Type 3	Type 4	Type 5	Not Classified	Total
Pasture	-----ha-----						
East	224	29	544	1162	2937	340	5235
East Riparian	0	11	0	0	0	5	16
West	77	130	198	1009	1716	78	3206
West Holding	43	0	0	0	0	0	43
West Riparian	0	10	0	0	0	0	10
Total by Range Type	343	179	742	2171	4653	422	8509

Type 1 = needle-and-thread/prairie junegrass

Type 2 = inland saltgrass/Nuttall's alkaligrass

Type 3 = bluebunch wheatgrass leading

Type 4 = Richardson's needlegrass leading

Type 5 = pinegrass leading

Not classified = Private Land, Research Reserves and Water.

Type 1: Needle-and-thread/prairie junegrass

The needle-and-thread/prairie junegrass type is found on the driest sites and corresponds to the BGxw2 variant. Primarily, these sites are found on gentle to very gentle slopes and upper slope positions with 180° to 270° aspects, but occasionally occur on steep slopes. Needle-and-thread and prairie junegrass dominate the plant community, but significant amounts of bluebunch wheatgrass, western needlegrass, Kentucky bluegrass and Richardson's needlegrass may also be included. Common forbs include Holboell's rockcress, desert parsley and pussytoes. Shrub cover is predominantly big sagebrush. This type is common in the range unit, but many occurrences were not large enough to map for the purposes of this project. About 340 ha of this type were mapped in East, West and West Holding pastures (Table 4).

Type 2: Inland saltgrass/Nuttall's alkaligrass

A saline-tolerant open grassland community is associated with alkaline soils in wetlands and moist depressions throughout the range unit. The grass and grasslike component of the plant community is dominated by inland saltgrass and Nuttall's alkaligrass with inclusions of sedges, rushes, alkali cordgrass and northern wheatgrass. The most common forbs are silverweed, tufted white prairie aster, strawberry blight and alkali goosefoot. Shrubs include bog-birch and willow species. Many of the associated grass, forb and shrub species are found in the needle-and-thread/prairie junegrass type also. Many examples of this range type were found but they were generally too small to map separately. Mapped areas for Type 2 totaled about 180 ha, and were found in all pastures except West Holding (Table 4).

Type 3: Bluebunch wheatgrass leading

This range type is most commonly associated with IDFxM sites, but also with drier soil phases of the IDFdk4 series. Bluebunch wheatgrass is the dominant species on good to excellent condition range. Needle-and-thread and prairie junegrass are associated on drier sites, while western needlegrass, Kentucky bluegrass, sheep fescue and Richardson's needlegrass are included in mesic sites. Common forbs are balsamroot, stoneseed, rosy pussytoes, old man's whiskers, and sulphur buckwheat. Shrub cover includes common juniper, Rocky Mountain juniper, rabbitbrush, prickly rose, and snowberry. Approximately 740 ha are found in the range unit in East and West pastures (Table 4).

Type 4: Richardson's needlegrass leading

This range type is by far the most common in the Grassland Benchmark area. It is found in OR and OF polygons, generally on mesic sites on ridgetops and on southwest aspect slopes, and is considered to be representative of IDFdk4 sites. This type is dominated by Richardson's needlegrass with inclusions of Columbia needlegrass, timber oatgrass, porcupine grass, sheep fescue, bluebunch wheatgrass, prairie junegrass and pinegrass depending on soil moisture. Forb cover is variable and is at least partially dependant on soil moisture conditions. Drier sites support dune goldenrod, pasture sage and rosy pussytoes. Moist sites will have populations of tiny penstemon, graceful cinquefoil and sticky geranium. Shrubs are similar to those in Type 3. Nearly 2,200 ha were mapped in East and West pastures (Table 4).

Domestic grass species

Domestic grass species were found throughout the Summer Range Creek Range Unit, but no areas of domestic seedings were mapped separately. Crested wheatgrass was the most common domestic grass, but slender wheatgrass, smooth brome grass and orchardgrass were also found. Native grass and forb species are commonly associated. These species most likely originated from seeded roadsides and landings from previous forest harvest, and were subsequently distributed by cattle and wild ungulates.

4.6.2 Open Forest

Typically, open forest vegetation was dominated by Type 4 grasslands, with occasional inclusions of Types 1 and 3. The grass component of Type 4 grasslands in the open forest are as described above, but the assemblage of plant species will vary among sites (Appendix 3).

4.6.3 Closed Forest

Type 5: Pinegrass leading

On sites traditionally dominated by heavier forest cover, such as steeper northeast aspects, a pinegrass leading grassland type is most prevalent. This site is representative of wetter sites in the IDFdk4, and is found in all pastures. Many of the species from Type 3 and 4 are included in drier micro-sites within this type. The composition of this community, as well as its distribution, is largely controlled by soil moisture and light conditions. Forest cover is generally OF or CF. As CF polygons were not surveyed in this project, Type 5 was not mapped separately. In OR, OR/OF or OF polygons it was noted when observed (Appendix 3). However, the pinegrass type can be assumed to be dominant on the more than 4,600 ha of CF polygons in the range unit (Table 4).

4.6.4 Invasive Plants

No Provincial or Regional designated noxious weeds were noted during the course of this reconnaissance level survey. Goatsbeard is the predominant invasive species and was common throughout the range unit with cover often averaging 5% over the TU. (Appendix 3). Other invasive species noted are mainly nuisance species including tarragon, common mullien, mustards, curly-cup gumweed, field peppergrass and lambsquarter. Sulphur cinquefoil was found in West pasture (TU11) (Appendix 3).

The Invasive Alien Plant Program (IAPP) website notes common burdock and Canada thistle on the Farwell Canyon-Gang Ranch Road (2000 Road), and yellow toadflax on the 2200 Road (IAPP 2008).

4.7 Forest Health

Mountain pine beetle (*Dendroctonus ponderosae*) is the predominant forest health agent in the range unit. The majority of lodgepole pine in all layers, except Layer 4 trees <2m in height and Layer 5 trees, were either at the grey or red-attack stage (Appendix 3). In many cases heavy cone crops were in evidence. Cones were usually open, but seed viability is in question. New germinants were not commonly noted on most sites.

Other forest health agents noted during the survey included pitch twig moth (*Petrova spp.*), mistletoe (*Arceuthobium spp.*), western spruce budworm (*Choristoneura occidentalis*) and conks or catface (*Atrophilis piniphila*). Poor form was common in Douglas-fir Layer 4 and 5 trees also, especially on dry aspects. This may be attributable to budworm attack or Douglas-fir needle-cast (*Rhabdocline pseudotsuga*).

Grey-attack Layer 1 to 3 lodgepole pine trees are often found in mixed forests with trembling aspen and/or Douglas-fir (Appendix 3). This is particularly true in small patches of timber in OR/OF and large OR polygons.

Photopoints collected in the current survey reveal that lodgepole pine is present in Layers 1 to 3, but it is consistently at the grey or red-attack stage. In contrast, there is little visual evidence of forest health concerns, caused mainly by the mountain pine beetle, in Layers 4 and 5 (Appendix 5).

4.8 Wildlife

Black bears were the most frequently sighted large mammals during the survey. Mule deer sightings were recorded in several TUs. Waterfowl were observed using the many shallow water/marsh/graminoid meadow systems in the range unit. There is one Duck's Unlimited project in the range unit associated with TU10 in West pasture.

No blue- or red-listed species, that may be present in the range unit, were observed (Appendix 2). There are no designated Wildlife Habitat Areas (WHA) or known occurrences of red or blue-listed species within the range unit (Appendix 2). Detailed wildlife surveys should be conducted as part of the pre- and post-treatment monitoring program.

5.0 Management Plan

5.1 Stratification

Pastures were stratified into TUs at the onset of the reconnaissance survey, based on landforms, topography, forest cover type, fencelines and roads. Stratification in this way will enhance treatment application. Treatment units primarily contain OR, OR/OF and/or OF polygons within the Grassland Benchmark area, but retention areas will occur in most TUs. They are associated with; a) riparian or moisture receiving sites, b) ridge crests or c) cool aspect slopes, that contain a component of mature or older trees >40cm dbh, and are at least one mature tree height in width (~ 20m).

5.2 Priority Areas for Restoration

5.2.1 Open Grassland

Restoring the open range component of the Summer Range Creek Range Unit to the 1962 Grassland Benchmark is a major objective of this plan. The range unit was divided into 33 TUs, for which pre-treatment forest cover indicates 12 are OR, 17 are OR/OF and 4 are OF. Encroachment by TU ranges from 7 to 77% for OR units, between 35 and 95% for OR/OF, and between 89 and 100% for OF (Table 5). Forest encroachment is prevalent on more than 2,000 ha of the nearly 3,300 ha in the Grassland Benchmark area.

Table 5. Treatment Units at Summer Range Creek Range Unit.

	Treatment	Forest	TU Total	No-treatment	Treatment	Treatment	Pasture
Pasture	Unit	Cover	------(ha)-----			(%)	Total
East	1	OR	192	92	99	52	1930
	2	OR/OF	64	13	51	79	
	3	OR/OF	32	5	27	84	
	4	OR/OF	40	17	22	56	
	5	OF	41	5	36	89	
	6	OR/OF	126	21	105	83	
	7	OR/OF	57	12	44	79	
	8	OR	32	13	19	59	
	9	OR/OF	75	5	70	94	
	10	OR	100	23	77	77	
	11	OR	102	63	39	38	
	12	OR	599	334	265	44	
	13	OF	12	0	12	100	
	14	OF	12	1	11	92	
	15	OR	448	263	185	41	
Pasture Total							1930
East Riparian	1	OR	8	8	0	0	8
Pasture Total							
West	1	OR	17	16	1	7	1283
	2	OR/OF	25	9	16	65	
	3	OR/OF	27	10	17	64	
	4	OF	25	1	24	95	
	5	OR/OF	50	32	17	35	
	6	OR/OF	87	8	78	90	
	7	OR/OF	126	32	94	74	
	8	OR/OF	199	10	189	95	
	9	OR	94	56	38	40	
	10	OR	57	34	23	41	
	11	OR/OF	88	33	55	63	
	12	OR/OF	111	14	97	87	
	13	OR/OF	88	13	75	86	
	14	OR/OF	154	16	138	90	
	15	OR	136	39	97	72	
Pasture Total							1283
West Holding	1	OR/OF	43	7	36	84	43
Pasture Total							
West Riparian	1	OR	10	10	0	0	10
Pasture Total							
Permanent Range Total							3274

Observations from studies in other range units in the Central Cariboo Forest District are relevant to conditions at the Summer Range Creek Range Unit (Ross 1997, 2000, 2008a, 2008b). Typically, encroachment into open grasslands occurs on southerly aspects on gentle slopes. This is evident in large OR polygons such as those in TU12 and 15 in East pasture. Forest ingrowth can cause shifts toward open forest in OR/OF (Bai et al 2000, 2004). Examples are found in units such as TU6, 7, 8 and 9 in East pasture, TU1 in West Holding, and TU1, 2 and 3 in West pasture.

There is a continuous forest edge on many sites where ingrowth may have already occurred. Shifts from open forest to closed forest are most likely to occur on northerly facing slopes (Bai et al 2000, 2004). Increased shading in these areas is the common factor leading to increased tree seedling survival at these sites. All large OR polygons in East and West pastures are affected.

Encroachment from contiguous areas of closed forest is common and can be from any aspect. Small grassland openings in the forest, and narrow “necks” of open grassland extending into areas of open or closed forest are most susceptible. This occurrence is common to all TUs that are currently in OR/OF stocking. These include East (TU6, 7, 9) and West (TU3, 6, 7 and 8). In these cases a continuous forest edge develops. Patches of timber have coalesced due to encroachment, and ingrowth and encroachment occurs from small islands of timber in open grassland (West Holding TU1, West TU13 and 14). Gullies and microtopography also create encroachment sites.

Other factors affect the distribution of forest ingrowth in the range unit. Elevation affects the ingrowth/encroachment species with lodgepole pine most prevalent at lower elevations and Douglas-fir at higher elevations (Appendix 3). Prevailing winds impact tree seed dispersal and evapo-transpiration levels in soils. This can be seen in the encroachment patterns found in large OR polygons such as TU1, 12 and 15 in East pasture, and TU9 and 15 in West pasture. Encroachment is mainly located on the perimeter, with fewer encroachment sites in the center of the polygon (Appendix 5).

The relationship between litter and grazing, and forest encroachment and ingrowth is not definitive. It is possible to have a similar amount of forest encroachment on two different sites that have differing amounts of standing litter. For example in West pasture, litter at TU6 was estimated to range between 50 and 95%, while at TU13, litter was as high as 100%. Encroachment covers nearly 100% of both units (Table 5, Appendix 3).

5.2.2 Open Forest

Distinct OF TUs account for a minor area of the encroachment sites, with four TUs that totaled approximately 90 ha. Open forest polygons are typically arrayed in a mosaic with OR polygons as compound OR/OF units. These areas should be treated in conjunction with OR polygons within TUs to improve the efficiency of the operation and to assist in maintaining OR polygons at desired stocking levels.

5.2.3 Closed Forest

Closed forest areas, as mapped in this plan, are generally outside the Grassland Benchmark area. However borders between OR and CF polygons are rarely distinct and grassland plant species commonly range into the forest depending on aspect and slope (Appendix 3). In the interest of ecosystem restoration objectives in many TUs, the forest margin should be included in the treatment areas, along with isolated clumps of timber within OR polygons. This is especially important in attempting to salvage value from red and grey attack lodgepole pine. This practice will also aid in treatment cost recovery.

5.3 Commercial Harvesting Treatments

Priorities and post-treatment stocking have been generated for each TU. Priorities are primarily based on the amount of encroachment, but the nature of treatments required for restoration, and options for cost recovery are also factors (Table 6). Restoration priorities are ranked by the following definitions:

- Priority 1 (High) – encroachment is >60% of the TU
- Priority 2 (Medium) – encroachment is 30 to 60% of the TU
- Priority 3 (Low) – encroachment is <30% of the TU

5.4 Forest Products

Forest products include sawlogs, post and rail material, grape stakes, pulpwood, pulp chips, OSB chips and hog-fuel. These products can be extracted with the potential to off-set the cost of non-commercial treatments. The reconnaissance survey identified locations where these products exist, and suitable treatments to extract them, however, volume estimates for each type are beyond the scope of this report. Available volume partially depends on the intensity of harvest in retention zones, and harvest beyond the Grassland Benchmark into closed forest. Ecosystem Restoration Prescriptions, Harvest and Stand-tending plans should be devised for each TU. Some revenue and expense scenarios are presented in Table 7.

In some cases, ecosystem restoration treatments should be viewed as stand-tending operations on sites that have not had the necessary maintenance. Incentives are required to improve the economics of treating these sites so that outside funding is not required. The most viable incentives are to set stumpage for timber and salvage material at the upset rate, and allow harvest into the forest edge. In this way harvest/stand-tending contractors can find enough volume to make the operation viable. Projected revenues and expenses, based on figures available at the time of this report (January, 2009), demonstrate that with the addition of volume from the encroachment area and the forest margin it is possible to offset costs, and potentially generate net revenue from these TUs (Table 7). Commercial and non-commercial treatments should be linked in a one-pass operation.

The ecosystem restoration program will benefit from the cost recovery. Revenue from forest products harvested in encroachment areas and from the forest edge can potentially pay for treatment of the encroachment area. The use of a Non-Renewable Forest License should be investigated to accomplish these objectives. These actions have found success in the East Kootenay on ecosystem restoration projects on Crown land, Non-government organization (NGO) lands and in Provincial Parks.

Table 6. Treatments and treatment priorities at the Summer Range Creek Range Unit.

Pasture	Treatment Forest Cover Class				Treatment	TU	Pasture
	Unit	Pre-treat	Post-treat	Priority		Total	Total
East	1	OR	OR	2	S, P	191.6	
	2	OR/OF	OR	1	H, S, C	63.9	
	3	OR/OF	OR	1	H, S, C	31.9	
	4	OR/OF	OR	2	H, T, S, C	39.5	
	5	OF	OR	1	H, T, S, C	41.1	
	6	OR/OF	OR/OF	1	H, T, S, C	126.3	
	7	OR/OF	OR	1	S, P	56.5	
	8	OR	OR	2	S, P	31.6	
	9	OR/OF	OR	1	H, T, S, C	75.1	
	10	OR	OR	1	H, T, S, C	99.9	
	11	OR	OR	2	H, S, P	101.5	
	12	OR	OR	2	H, T, S, P	599.1	
	13	OF	OR	1	H, T, S, C	11.9	
	14	OF	OR	1	H, T, S, C	10.9	
	15	OR	OR	2	H, T, S, P	448.1	
Pasture Total							1929
East Riparian	1	OR	OR	3	S, P	8.0	8
Pasture Total							
West	1	OR	OR	3	S	17.2	
	2	OR/OF	OR	1	D, S, C	25.2	
	3	OR/OF	OR	1	D, S, C	26.9	
	4	OF	OR	1	S, C	25.2	
	5	OR/OF	OR	2	D, S, C	49.6	
	6	OR/OF	OR/OF	1	D, S, C	86.5	
	7	OR/OF	OR/OF	1	T, S, C	126.3	
	8	OR/OF	OR/OF	1	T, S, C	198.8	
	9	OR	OR	2	D, S, P	94.3	
	10	OR	OR	2	H, D, S, P	56.7	
	11	OR/OF	OR/OF	1	H, D, S, C	88.1	
	12	OR/OF	OR/OF	1	H, D, S, C	111.1	
	13	OR/OF	OR	1	H, D, T, S, C	87.6	
	14	OR/OF	OR	1	H, D, T, S, C	153.7	
	15	OR	OR	1	H, D, T, S, C	136.0	
Pasture Total							1283
West Holding	1	OR/OF	OR/OF	1	H, D, T, S, C	43.0	43
Pasture Total							
West Riparian	1	OR	OR	3	S	9.6	10
Pasture Total							
Permanent Range Total							3273

Note: Treatment Priority is based on encroachment/ingrowth in the TU: 1=High=>60%; 2=Medium=30-60%; 3=Low=<30%

Table 7. Projected treatment revenues and expenses at the Summer Range Creek Range Unit.

Task	Scenario Assumptions		Volume (m3/ha)	Revenue (\$/ha)	Cost/ha (\$/ha)	Net Revenue
Open Range	1	no merch, slash only				
Revenue						
Harvest		Rev=\$32/m3	0	0		
Pulp/chips		Rev=\$28/m3	0	0		
Total			0	0		
Expenses						
Slashing		hand slash, low density			125	
Layout		Layout, GPS = 30% treatment			50	
Rehabilitation					0	
Total Expenses					175	
Net Revenue						-175
Breakeven						N/A
Open Range	2	merch=10 m3/ha sawlogs; 10 m3 pulp				
Revenue						
Harvest		Rev=\$32/m3	10	320		
Pulp/chips		Rev=\$28/m3	10	280		
Total			20	600		
Expenses			0			
Slashing		hand slash, moderate density			320	
Layout		include layout, GPS, supervision			50	
Cruise		Cost=\$52/plot; 1 plot/4 ha			13	
Harvest		Cost=\$16/m3	10		160	
Trucking		Cost=\$22/m3	10		220	
Rehabilitation		\$100/hr; 5 ha/day			160	
Total Expenses					923	
Net Revenue						-323
Break-even						46
Open Forest	3	merch=30 m3/ha; 30 m3 pulp				
Revenue			0			
Harvest		Rev=\$32/m3	30	960		
Pulp/chips		Rev=\$28/m3	30	840		
Total			60	1800		
Expenses						
Slashing		hand slash, high density			640	
Layout		include layout, GPS, supervision			50	
Cruise		Cost=\$52/plot; 1 plot/4 ha			13	
Harvest		Cost=\$16/m3	30		480	
Trucking		Cost=\$22/m3	30		660	
Rehabilitation		\$100/hr; 5 ha/day			160	
Total Expenses					2003	
Net Revenue						-203
Break-even						33

5.5 Treatment Prescriptions

Treatment options within the grassland matrix will vary according to the nature, type and extent of forest encroachment. In general, prescriptions will harvest or remove all live coniferous trees in Layer 1 within the Grassland Benchmark area except:

- Retain 90 to 100% of veteran trees. These trees are generally >140 years of age. If no veteran trees are present in the grassland matrix, then there is no retention requirement.
- Retain an additional one to four trees >12.5 cm dbh for recruitment purposes. Recruitment trees should ideally be located adjacent to veterans in a retention clump.

In the retention portion of a TU a basal area of 15 to 25 m²/ha, representing the largest 1/3 of the available trees, will be reserved from harvest. The objective with retention zones is to set up the TU so that desired forest stocking can be maintained with prescribed fire. In order to accomplish this objective, retention areas must also be treated in order to prevent crown fires. These areas will be treated by:

- harvesting up to 2/3 of the available Layer 1 and 2 trees
- salvaging grey or red-attack lodgepole pine where viable
- commercial thinning from below (spacing treatments)
- spacing or slashing Layer 3 to 5 trees
- light under-story burning to control Layer 4 and 5 trees

On all portions of each TU, biodiversity, wildlife and riparian values and integrity will be preserved or enhanced by:

- Snag retention - promote by maintaining at least five snags/ha of the largest available trees. All trees with stick nests or signs of recent cavity nesting will be maintained. Ideally, all conifers >35 cm dbh, and deciduous trees >20 cm dbh will be reserved. No-work zones should be used where such trees exist in patches.
- Reserving aspen patches - minimize damage to live aspen to reduce the potential for suckering and to retain high habitat values.
- Riparian buffer zones – maintain shade and habitat values on all wetland, shallow water and lake ecosystems. No-harvest riparian reserves (minimum 10 m) and management zones (minimum 20 m) should be in place around all riparian features. The Riparian Management Zone should equal 30 m.

5.6 Harvest and Access Disturbance

Soils in the Summer Range Creek Range Unit are most commonly loams derived from morainal deposits (Appendix 3). However, texture is variable among soil associations and can range from sandy loam to silty clay loams (Valentine et al 1987). For this reason, treatments must avoid soil disturbance where possible. These actions will minimize soil compaction, soil erosion, soil sterilization, limit run-off, and reduce the potential for invasion by weedy species. Soils are especially susceptible to disturbance if harvesting, trucking and prescribed fire operations are not conducted properly. Some TUs may require archeological surveys.

Specific actions are:

- Do not locate new roads or landings in grassland areas
- Load, unload and maintain equipment on landings only
- Limit the operation of tracked or wheeled equipment to frozen soils
- Do not create bladed trails in harvest blocks or on adjacent grasslands
- Construct fire breaks (where necessary) within forested areas only
- Reserve topsoil separately when constructing temporary roads or fire-guards
- Minimize machine operation in reserve areas
- Pile and burn slash and harvest debris unless the MOFR requires well-distributed slash to facilitate prescribed fire. Restrict piles to approximately 40 m²
- Situate piles so as not to affect residual overstory trees and retention patches
- Minimize burning or heat scorching residual overstory trees and retention patches

5.7 Non-Commercial Treatments

Some TUs will require maintenance treatments only in the form of knockdown, tree falling, slashing, prescribed fire and clean-up burns (Appendix 3, 5). The most efficient approach to ecosystem restoration is a one-pass system where all operations are combined and applied where necessary. Stratification, target results and disturbance cautions are similar to the commercial treatments.

5.8 Forest Health

Forest health strategies for areas such as the Summer Range Creek Range Unit, that have experienced severe forest health consequences as a result of agents like the mountain pine beetle, are limited to salvage and future prevention. It has been documented that lodgepole pine has encroached onto these grasslands, likely as a consequence of heavy, stress-induced cone crops followed by years of above average precipitation (Ross 1997). Older stands from encroachment events that took place 20 to 40 years ago (Layers 3 and 4) are typically at the red-attack stage (Appendix 3, 5). Layer 1 and 2 trees were almost always at the grey-attack stage. In contrast, Layer 4 and 5 trees that are <2 m in height are uniformly green. It is likely that the intensity of the mountain pine beetle epidemic in this range unit will subside in the short-term as suitable host trees have almost been exhausted. However, if these surviving encroachment trees are not treated, there is the potential for the cycle to repeat. The most practical solution to avert future mountain pine beetle infestation is to remove lodgepole pine in all layers from grasslands, and to reduce stocking levels in open forest areas.

Douglas-fir is found throughout the Summer Range Creek Range Unit, but is most common on cooler aspects and at higher elevations (Appendix 3, 5). Various pests were observed for this species also. Trees that are moisture-stressed, such as those encroaching onto grasslands, are more likely to attract forest pests. Strategies to improve the health of Douglas-fir trees begin with removing encroachment from grassland sites. Other measures include reducing forest stocking levels in adjacent CF blocks to open forest standards with partial-cutting techniques, and by not allowing these forests overstock.

Treatment prescriptions should carefully consider and include actions to prevent and deal with future forest health issues by:

- Timing harvest to optimize drying time for slash
- Employing lop and scatter techniques to facilitate fuel drying for prescribed fire
- Establishing burning/bucking diameter limits for Douglas-fir
- Possible use of anti-aggregation pheromones
- Post-treatment monitoring
- Other actions recommended by MOFR forest health staff

5.9 Invasive Plants

Invasive plants noted on the Summer Range Creek Range Unit were most commonly nuisance weeds (Appendix 3). Noxious weed species such as common burdock, yellow toadflax and Canada thistle have been recorded on the IAPP site. Treatment prescriptions should carefully consider and include actions to prevent and deal with potential risk for invasive plants following harvest treatment.

Soil disturbance is the most prominent method of encouraging the spread of invasive plant species. Treatment recommendations to minimize soil disturbance listed above apply here. Other actions include ensuring harvesting equipment is clean before working on a particular site.

Actions to deal with the risk of invasive species should include:

- Consultation with local weed experts
- Following applicable sections of the Invasive Plant Council of BC's recommendations for forest harvesting operations (2007)

5.10 Livestock and Ungulate Management

Forage use by livestock and wild ungulates is impacted by forest encroachment as grazing and browsing pressure is concentrated on an ever-decreasing area of grassland and open forest. In effect, forest encroachment increases stocking rate without a corresponding increase in forage production. This can cause a general loss of the more palatable grasses, forbs and shrubs, short-term proliferation of "increaser" species (sub-dominants in the plant community), with subsequent losses in production and palatability. Ultimately, there is the potential for severe downgrading of the plant community to weedy species with the loss of seed sources, genetic variation and general biodiversity. For large livestock and wild ungulates, this results in reduced carrying capacity, and potential decline in the value of these habitat types as wildlife winter and spring range.

Newly treated areas are attractive to livestock and wild ungulates. Mule deer will use newly logged areas in Douglas-fir blocks almost immediately in winter as they select for arboreal lichens and foliage from upper branches. Mule deer winter diets may contain 60 to 95% Douglas-fir (Dawson et al 1990, Wikeem and Ross 2002). Dawson et al (1990) found that deer preferred forage from trees >40 cm dbh and rarely used foliage from trees <6 cm dbh. Differences in the levels of foliar essential oils such as monoterpenes have been hypothesized to influence foliage palatability in Douglas-fir trees (Radwan 1978). Armleder and Dawson (1992) recommend the retention of large diameter, mature Douglas-fir trees in mule deer winter range areas for thermal cover, snow interception and browse production.

Although deer favour browse for the better part of their diet, they also make extensive use of grasses and forbs. Deer use of grasses averages about 10% over the year, but spring use is much higher (Wikeem and Ross 2002). Open grassland areas tend to green-up before forested areas, so this increases the value of OR polygons as spring range.

Cattle use of newly treated areas is influenced by the nature of the treatments. Access is decreased in areas where high amounts of slash have been left. In contrast, the palatability of grasses and forbs is increased when prescribed fire has been used to reduce litter and needle-cast accumulations.

Grazing management and ecosystem restoration treatments must be managed concurrently. Sufficient litter must be accumulated in order to create a hot enough fire to kill tree seedlings. If the fire is not hot enough only the bottom branches will be killed. The bark and upper growing points will not be injured and the tree will merely be “fire-proofed” for the next burn. Douglas-fir bark remains photosynthetically active at up to 10 cm outer diameter at ground level (Hall 1976).

6.0 Pre-and Post Operational Monitoring

An important objective of an ecosystem restoration plan is to leave sites in a state where prescribed fire will be the principal maintenance treatment. This will reduce site maintenance costs. Recommended post-treatment stocking would result in nearly 2,500 ha in the OR class (Table 8). Most of the TUs (19 of 33) within the Grassland Benchmark area should remain in, or be converted to OR stocking. A further 11 should remain in, or be converted to OR/OF stocking. Therefore, monitoring is essential to ensure forest encroachment does not re-establish in the Grassland Benchmark area, and to decide when to re-treat individual TUs.

6.1 Maintenance Treatments

Managers should plan to treat new conifer regeneration before trees reach 1 m in height to maximize treatment effectiveness. A re-treatment date should be scheduled for each site using the best available information, and be revised as new information becomes available. Forest health and regeneration surveys should be initiated as a component of the pre- and post-treatment monitoring plan.

6.2 Range Survey

There is one range reference area at Cow Lake (West – TU9) in the Summer Range Creek Range Unit, which contains both grazed and ungrazed (exclosure) plots. These plots should be re-sampled periodically. Additional range reference sites should be established in other locations. Rare plant surveys may be considered at this time as well. Additionally, utilization checks should be performed as a part of post-treatment monitoring to discern if livestock distribution and forage use patterns have been affected.

Table 8. Post-treatment forest cover classes at the Summer Range Creek Range Unit.

Pasture	Open Range	Open Range/ Open Forest	Open Forest	Closed Forest	Riparian	Water	Private Land	Reserves	Total	Total *
	-----ha-----									
East	1803	126	0	2937	29	21	195	124	5235	5039
East Riparian	8	0	0	0	3	5	0	0	16	16
West	672	611	0	1716	130	61	16	0	3206	3190
West Holding	0	43	0	0	0	0	0	0	43	43
West Riparian	10	0	0	0	0	0	0	0	10	10
Total by Class	2493	780	0	4653	161	86	212	124	8510	8174

* Total minus Private Land and Reserves.

Permanent Range (ha) = (Open Range + Open Range/Open Forest + Open Forest)/Range Unit Total = 3273
 Permanent Range (%) = (Open Range + Open Range/Open Forest + Open Forest)/Range Unit Excluding PL = 40

Distribution (%)	Range Unit *	Permanent Range
Open Range	30	76
Open Range/Open Forest	10	24
Open Forest	0	0
Closed Forest	57	0
Wetlands	2	0
Water	1	0
	100	100

* Range Unit minus the area of Private Land and Reserves.

6.3 Invasive Plants

Soil disturbance on restoration sites and the potential introduction of new species from roadsides and contaminated equipment are potential concerns with ecosystem restoration activities. Surveys should be initiated as a component of the pre- and post-treatment monitoring plan.

6.4 Wildlife

Surveys for species other than large ungulates should be initiated as a component of the pre- and post-treatment monitoring plan. Long-billed curlew, Lewis' woodpecker, bobolink, flammulated owl, sharp-tailed grouse and badger are some of the species that if present, would be expected to benefit from ecosystem restoration activities.

Sharp-tailed grouse are known to populate the area. Surveys conducted in 1993 note sharp-tailed grouse population increases in the Chilcotin region are mostly associated with clearcut logging of lodgepole pine (Ritcey 1995). Ecosystem restoration activities should increase the suitable habitat area for sharp-tailed grouse.

Recent surveys confirm that long-billed curlews are using grassland areas in the vicinity of the Summer Range Creek Range Unit (Julie Steciw, SAR biologist, BC Ministry of Environment, pers. comm.). Ecosystem restoration activities should increase the suitable habitat area for long-billed curlew.

7.0 Summary and Recommendations

The Summer Range Creek Range Unit encompasses slightly more than 8,500 ha, including Private Land holdings and Research Reserves of about 330 ha. More than 8,200 ha were surveyed as the background for the development of an Ecosystem Restoration Strategic Plan.

Grassland and open forest contained within the Grassland Benchmark area comprise approximately 3,300 ha, or about 40% of the range unit. Forest encroachment was verified on more than 2,000 ha, indicating 63% of the Grassland Benchmark area is in need of ecosystem restoration treatments. Nearly 50% of OR polygons are affected, but encroachment has affected 82 and 92% of TUs in the OR/OF and the OF classes, respectively.

The Richardson's needlegrass leading range type (Type 4) is dominant in the Grassland Benchmark area, accounting for nearly 2,200 ha. The bluebunch wheatgrass leading type (Type 3) was the second most abundant grassland type at nearly 750 ha. The needle-and-thread dominated grassland type (Type 2) is also important, but was only found on about 350 ha. These range types are mainly found in open grassland and open forest areas, and correspond to plant communities that are red- and blue-listed in BC (Appendix 2). Pinegrass (Type 5) dominates the herbaceous layer in closed forest polygons, but plant species from Types 3 and 4 are commonly included, especially along the grassland/forest ecotone.

Activities such as forest harvest, stand-tending, prescribed fire and grazing/browsing management are the most likely methods of restoring these communities. The assortment of red- and blue-listed wildlife species that potentially use these plant communities will also benefit from restoration activities.

Restoration treatments can be classed as commercial and non-commercial. Forest products available as a result of commercial treatments include sawlogs, post and rail material, grape stakes, pulpwood, pulp and OSB chips, and hog-fuel. The economics vary among TUs, but revenue from these products can be used as cost recovery for non-commercial treatments. Some harvesting will be required beyond the Grassland Benchmark. Non-renewable Forest Licenses may be the best vehicle to initiate treatments in the grassland matrix area. Harvest and stand-tending contractors will need incentives in order to make operations viable. These incentives will be provided by allowing operators to salvage forest products, and by setting stumpage at the upset rate.

Ecosystem Restoration Strategic Plans will require a cooperative approach between government, tenure holders and forest harvest/stand-tending contractors. Dedication of resources to initiate these plans, and the willingness of all participants to move toward an adaptive management philosophy, are the key elements in restoring grasslands and managing forests within the Grassland Benchmark.

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9.0 Appendices.

Appendix 1. Plant Species

Latin Name	Common Name
Abies lasiocarpa,ABLA, 4	White fir
Achillea millefolium,ACMI, 2	Western yarrow
Agropyron cristatum,AGCR, 1	Crested wheatgrass
Agropyron spicatum,AGSP, 1	Bluebunch wheatgrass
Agropyron repens,AGRE, 1	Quackgrass
Agropyron trachycaulum,AGTR, 1	Slender wheatgrass
Agrostis alba,AGAL, 1	Redtop
Agrostis scabra,AGSC, 1	Hair bentgrass
Allium cernuum,ALCE, 2	Nodding onion
Amelanchier alnifolia,AMAL, 3	Saskatoon
Anaphalis margaritacea,ANMA, 2	Pearly everlasting
Anemone multifida,ANMU, 2	Pacific anemone
Antennaria dimorpha,ANDI, 2	Low pussytoes
Antennaria microphylla,ANMI, 2	Rosy pussytoes
Antennaria parvifolia,ANPA, 2	Nuttall's pussytoes
Arabis holboellii,ARHO, 2	Holboell's rockcress
Arctium minus,ARMI, 2	Common burdock
Arctostaphylos uva-ursi,ARUV, 3	Bearberry
Arnica cordifolia,ARCO, 2	Orange arnica
Artemesia dranunculus,ARDR, 2	Tarragon
Artemesia frigida,ARFR, 2	Pasture sage
Aster conspicuous,ASCO, 2	Showy aster
Aster foliaceus,ASFO, 2	Leafy aster
Aster pansies,ASPA, 2	Tufted white prairie aster
Astragalus miser,ASMI, 2	Timber milkvetch
Balsamorhiza sagittata,BASA, 2	Balsamroot
Betula glandulosa,BEGL, 3	Bog-birch
Bromus inermis,BRIN, 1	Smooth bromegrass
Calamagrostis rubescens,CARU, 1	Pinegrass
Carex concinnoides,CACO, 1	Northwest sedge
Carex spp.,CARX, 1	Sedge species
Centaurea maculosa,CEMA, 2	Spotted knapweed
Cerastium arvense,CEAR, 2	Chickweed
Chenopodium capitatum,CHCA, 2	Strawberry blight
Chenopodium rubrum,CHRU, 2	Alkali goosefoot
Chrysothamnus nauseosus,CHNA, 3	Rabbitbrush
Cirsium arvense,CIAR, 2	Canada thistle
Cirsium hookerianum,CIHO, 2	Hooker's thistle
Commandra umbellata,COUM, 2	Pale commandra
Danthonia intermedia,DAIN, 1	Timber oatgrass
Distichlis stricta,DIST, 1	Inland saltgrass
Elaeagnus commutata,ELCO, 3	Wolf-willow

Appendix 1. (cont'd)

Latin Name	Common Name
Epilobium angustifolium,EPAN, 2	Fireweed
Erigeron compositus,ERCO, 2	Compound fleabane
Erigeron pumilis,ERPU, 2	Shaggy fleabane
Erigeron speciosus,ERSP, 2	Showy fleabane
Eriogonum umbellatum,ERUM, 2	Sulphur buckwheat
Festuca ovina,FEOV, 1	Sheep fescue
Fragaria virginiana,FRVI, 2	Wild strawberry
Gaillardia aristata,GAAR, 2	Brown-eyed susan
Gallium boreale,GABO, 2	Northern bedstew
Geranium viscosissimum,GEVI, 2	Sticky geranium
Geum triflorum,GETR, 2	Old man's whiskers
Grindellia squarrosa,GRSQ, 2	Curly-cup gumweed
Hedysarum sulphurescens,HESU, 2	Yellow hedysarum
Heuchra cylindrica,HECY, 2	Alumroot
Hordeum jubatum,HOJU, 1	Foxtail barley
Juncus balticus,JUBA, 1	Baltic rush
Juniper communis,JUCO, 3	Common juniper
Juniper scopulorum,JUSC, 3	Rocky Mountain juniper
Koeleria cristata,KOCR, 1	Prairie junegrass
Lathyrus ochroleucus,LAOI, 2	Creamy peavine
Lepidium densiflorum,LEDE, 2	Field peppergrass
Linaria vulgaris,LIVU, 2	Yellow toadflax
Linnaea borealis,LIBO, 2	Twinflower
Linum perenne,LIPE, 2	False flax
Lithospermum ruderae,LIRU, 2	Stoneseed
Lomatium macrocarpum,LOMA, 2	Large-fruited desert parsley
Lomatium triternatum,LOTR, 2	Nine-leafed lomatium
Medicago sativa,MESA, 2	Alfalfa
Melilotus alba,MEAL, 2	White sweet-clover
Monarda fistulosa,MOFI, 2	Monarda
Penstemon confertus,PECO, 2	Tiny penstemon
Penstemon fruticosa,PEFR, 2	Shrubby penstemon
Phleum pratense,PHPR, 1	Timothy
Picea spp.,PISP, 3	Spruce
Pinus contorta,PICO, 3	Lodgepole pine
Pinus ponderosa,PIPO, 3	Ponderosa pine
Plantago patagonica,PLPA, 2	Narrow-leafed plantain
Poa junctifolia,POJU, 1	Alkali bluegrass
Poa pratensis,POPR, 1	Kentucky bluegrass
Poa sandbergii,POSA, 1	Sandberg bluegrass
Polygonum persicaria,POPE, 2	Spotted ladythumb
Populus balsamifera,POBA, 3	Cottonwood

Appendix 1. (cont'd)

Latin Name	Common Name
Populus tremuloides,POTR, 3	Trembling aspen
Potentilla anserina,POAN, 2	Silverweed
Potentilla fruticosa,POFR, 3	Shrubby cinquefoil
Potentilla gracilis,POGR, 2	Graceful cinquefoil
Potentilla hippiana,POHI, 2	Woolly cinquefoil
Potentilla norvegica,PONO, 2	Norway cinquefoil
Potentilla recta,PORE, 2	Sulphur cinquefoil
Prunus virginiana,PRVI, 3	Chokecherry
Pseudotsuga menziesii,PSME, 3	Douglas-fir
Puccinellia nuttallianum, PUNU, 1	Nuttall's alkaligrass
Rhianthus minor,RHMI, 2	Yellow rattle
Rosa acicularis,ROAC, 3	Prickly rose
Rosa spp.,ROSA, 3	Rose species
Rosa woodsii,ROWO, 3	Prairie rose
Salix spp.,SALX, 3	Willow species
Scirpus lacustris,SCLA, 1	Great bulrush
Shepherdia canadensis,SHCA, 3	Soopolallie
Solidago spathulata,SOSP, 2	Dune goldenrod
Sonchas arvense,SOAR, 2	Prickly sow-thistle
Stipa columbiana,STCL, 1	Columbia needlegrass
Stipa comata,STCO, 1	Needle-and-thread
Stipa occidentalis,STOC, 1	Western needlegrass
Stipa richardsonii,STRI, 1	Richardson's needlegrass
Stipa spartea,STSP, 1	Porcupine grass
Symphoricarpus albus,SYAL, 3	Snowberry
Taraxacum officinale,TAOF, 2	Dandelion
Tragopogon pratense,TRPR, 2	Goatsbeard
Trifolium hybridum,TRHY, 2	Alsike clover
Trifolium repens,TRRE, 2	White clover
Vicia americana,VIAM, 2	American vetch

Appendix 1. cont'd		
Scientific Name	Common Name	Status
<i>Allium geyeri</i> var. <i>tenerum</i>	Geyer's onion	Blue
<i>Arabis holboellii</i> var. <i>pinetorum</i>	Holboell's rockcress	Blue
<i>Arabis sparsiflora</i>	sickle-pod rockcress	Red
<i>Arnica chamissonis</i> ssp. <i>incana</i>	meadow arnica	Blue
<i>Atriplex argentea</i> ssp. <i>argentea</i>	silvery orache	Red
<i>Atriplex truncata</i>	wedgescale orache	Red
<i>Carex heleonastes</i>	Hudson Bay sedge	Blue
<i>Carex hystrix</i>	porcupine sedge	Blue
<i>Carex simulata</i>	short-beaked fen sedge	Blue
<i>Carex sprengelii</i>	Sprengel's sedge	Red
<i>Chamaerhodos erecta</i> ssp. <i>nuttallii</i>	American chamaerhodos	Blue
<i>Entosthodon rubiginosus</i>	rusty cord-moss	Red
<i>Epilobium ciliatum</i> ssp. <i>watsonii</i>	purple-leaved willowherb	Blue
<i>Glyceria pulchella</i>	slender mannagrass	Blue
<i>Hesperostipa spartea</i>	Porcupinegrass	Red
<i>Myotis thysanodes</i>	Fringed Myotis	Blue
<i>Pellaea gastonyi</i>	Gastony's cliff-brake	Blue
<i>Pinus albicaulis</i>	whitebark pine	Blue
<i>Poa fendleriana</i> ssp. <i>fendleriana</i>	mutton grass	Red
<i>Polygonum polygaloides</i> ssp. <i>kelloggii</i>	Kellogg's knotweed	Blue
<i>Potentilla nivea</i> var. <i>pentaphylla</i>	five-leaved cinquefoil	Blue
<i>Pyrola elliptica</i>	white wintergreen	Blue
<i>Ranunculus pedatifidus</i> ssp. <i>affinis</i>	birdfoot buttercup	Blue
<i>Salix boothii</i>	Booth's willow	Blue
<i>Salix serissima</i>	autumn willow	Blue
<i>Scolochloa festucacea</i>	rivergrass	Red
<i>Silene drummondii</i> var. <i>drummondii</i>	Drummond's campion	Blue
<i>Stuckenia vaginata</i>	sheathing pondweed	Blue

Appendix 1. (con't)	Plant Communities		
Scientific Name	Common Name	Sub-zone	Status
<i>Achnatherum richardsonii</i> Herbaceous Vegetation	spreading needlegrass Herbaceous Vegetation	BGxw2/00 IDFdk1a/93 IDFdk4/00 IDFxm/00	Blue
<i>Artemisia campestris</i> / <i>Hesperostipa curisetia</i>	northern wormwood / short-awned porcupinegrass	IDFxm/00	Red
<i>Carex atherodes</i> Fen - Marsh	awned sedge Fen - Marsh	BGxw2/Wm03 IDFdk3/Wm03 IDFdk4/Wm03 IDFxm/Wm03	Red
<i>Carex lasiocarpa</i> / <i>Drepanocladus aduncus</i>	slender sedge / common hook-moss	BWBSdk1/Wf05 IDFdk3/Wf05 IDFdk4/Wf05 IDFdm2/Wf05	Blue
<i>Deschampsia cespitosa</i> Community	tufted hairgrass Community	IDFdk1/Gs04 IDFdk2/Gs04 IDFdk3/Gs04 IDFdk4/Gs04 IDFdm1/Gs04 IDFdm2/Gs04 IDFdw/Gs04	Blue
<i>Eleocharis palustris</i> Herbaceous Vegetation	common spike-rush	BGxw2/Wm04	Blue
<i>Equisetum fluviatile</i> - <i>Carex utriculata</i>	swamp horsetail - beaked sedge	BGxh2/Wm02	Blue
<i>Juncus balticus</i> - <i>Carex praegracilis</i>	Baltic rush - field sedge	BG/Gs03 IDFdk1/Gs03 IDFdk2/Gs03 IDFdk3/Gs03 IDFdk3/W3 IDFdk4/Gs03 IDFdm1/Gs03 IDFdm2/Gs03 IDFdw/Gs03 PP/Gs03	Blue
<i>Picea engelmannii</i> x <i>glauca</i> / <i>Pleurozium schreberi</i> - <i>Brachythecium</i> spp.	hybrid white spruce / red-stemmed feathermoss - ragged-mosses	IDFdk4/09	Blue
<i>Picea engelmannii</i> x <i>glauca</i> / <i>Rosa acicularis</i> / <i>Aralia nudicaulis</i>	hybrid white spruce / prickly rose / wild sarsaparilla	IDFdk3/08	Blue
<i>Picea engelmannii</i> x <i>glauca</i> / <i>Rosa acicularis</i> / <i>Carex concinna</i>	hybrid white spruce / prickly rose / low northern sedge	IDFdk3/07	Blue
<i>Picea engelmannii</i> x <i>glauca</i> / <i>Rosa acicularis</i> / <i>Petasites frigidus</i> var. <i>palmatus</i>	hybrid white spruce / prickly rose / palmate coltsfoot	IDFxm/08 IDFxm/07	Red
<i>Populus tremuloides</i> / <i>Achnatherum richardsonii</i> - <i>Geum triflorum</i>	trembling aspen / spreading needlegrass - old man's whiskers	BGxw2/00 IDFxm/00	Red
<i>Pseudoroegneria spicata</i> - <i>Balsamorhiza sagittata</i>	bluebunch wheatgrass - arrowleaf balsamroot	IDFh1a/93 IDFxm/00 PPdh1/03 PPxh1/00K	Red
<i>Pseudoroegneria spicata</i> - <i>Koeleria macrantha</i>	bluebunch wheatgrass - junegrass	BGxh1/00 BGxh3/00 BGxw1/01 BGxw2/01 IDFdk1a/92 IDFdk3/00 IDFdm1/02 IDFun/00 IDFh2a/00 IDFh2a/92 IDFxm/00	Red

Appendix 1. (con't)	Plant Communities		
Scientific Name	Common Name	Sub-zone	Status
<i>Pseudotsuga menziesii</i> / <i>Juniperus communis</i> / <i>Cladonia</i> spp.	Douglas-fir / common juniper / clad lichens	IDFxm/03	Red
<i>Pseudotsuga menziesii</i> / <i>Juniperus scopulorum</i> / <i>Arctostaphylos uva-ursi</i>	Douglas-fir - Rocky Mountain juniper / kinnikinnick	IDFdK3/02	Red
<i>Pseudotsuga menziesii</i> / <i>Juniperus scopulorum</i> / <i>Artemisia frigida</i>	Douglas-fir - Rocky Mountain juniper / prairie sagewort	IDFdK4/03 IDFdK4/04 IDFxm/04	Blue
<i>Pseudotsuga menziesii</i> / <i>Juniperus scopulorum</i> / <i>Penstemon fruticosus</i>	Douglas-fir - Rocky Mountain juniper / shrubby penstemon	IDFdK3/03 IDFdK4/02 IDFxm/02	Blue
<i>Pseudotsuga menziesii</i> / <i>Juniperus scopulorum</i> / <i>Pseudoroegneria spicata</i>	Douglas-fir - Rocky Mountain juniper / bluebunch wheatgrass	IDFxm/01	Blue
<i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> - <i>Calamagrostis rubescens</i>	Douglas-fir - ponderosa pine / bluebunch wheatgrass - pinegrass	IDFdK2/02 IDFdm1/03 IDFxm1/03 IDFxm2/04 IDFxm/02	Blue
<i>Pseudotsuga menziesii</i> / <i>Pleurozium schreberi</i> - <i>Hylocomium splendens</i>	Douglas-fir / red-stemmed feathermoss - step moss	IDFdK3/05 IDFdK4/07 IDFxm/05 IDFxm/06 SBSdk/04	Blue
<i>Pseudotsuga menziesii</i> / <i>Pseudoroegneria spicata</i> - <i>Achnatherum occidentale</i>	Douglas-fir / bluebunch wheatgrass - stiff needlegrass	IDFdK3/04	Blue
<i>Pseudotsuga menziesii</i> / <i>Pseudoroegneria spicata</i> - <i>Calamagrostis rubescens</i>	Douglas-fir / bluebunch wheatgrass - pinegrass	IDFdK4/05	Blue
<i>Pseudotsuga menziesii</i> / <i>Rosa acicularis</i> / <i>Aralia nudicaulis</i>	Douglas-fir / prickly rose / wild sarsaparilla	IDFxm/07	Red
<i>Puccinellia nuttalliana</i> - <i>Hordeum jubatum</i>	Nuttall's alkaligrass - foxtail barley	IDFdK1/Gs02 IDFdK2/Gs02 IDFdK3/Gs02 IDFdK4/Gs02	Red
<i>Salix maccalliana</i> / <i>Carex utriculata</i>	MacCalla's willow / beaked sedge	IDFdK3/Ws05 IDFdK4/Ws05	Blue
<i>Salix</i> spp. / <i>Carex sartwelli</i>	tall willows / Sartwell's sedge	IDFdK3/W6	Blue
<i>Schoenoplectus acutus</i> Deep Marsh	hard-stemmed bulrush Deep Marsh	IDFdK3/W14	Blue
<i>Sporobolus cryptandrus</i> - <i>Hesperostipa comata</i>	sand dropseed - needle-and-thread grass	BGxm3/00 BGxm2/00 IDFxm/00 IDFxm/00	Red
<i>Triglochin maritima</i> Marsh	seaside arrow-grass Marsh	IDFdK3 MSxv SBPSxc	Red
<i>Typha latifolia</i> Marsh	common cattail Marsh	IDFdK3/Wm05 IDFdm2/Wm05 PPxm1/Wm05	Blue

Appendix 2. Animal species.		
Scientific Name	Common Name	Status
<i>Acipenser transmontanus</i> pop. 6	White Sturgeon (Middle Fraser River Population)	Red
<i>Aechmophorus occidentalis</i>	Western Grebe	Red
<i>Ardea herodias herodias</i>	Great Blue heron, <i>herodias</i> subspecies	Blue
<i>Asio flammeus</i>	Short-eared Owl	Blue
<i>Bartramia longicauda</i>	Upland Sandpiper	Red
<i>Botaurus lentiginosus</i>	American Bittern	Blue
<i>Corynorhinus townsendii</i>	Townsend's Big-eared Bat	Blue
<i>Dolichonyx oryzivorus</i>	Bobolink	Blue
<i>Euderma maculatum</i>	Spotted Bat	Blue
<i>Falco mexicanus</i>	Prairie Falcon	Red
<i>Falco peregrinus anatum</i>	Peregrine Falcon, <i>anatum</i> subspecies	Red
<i>Grus canadensis</i>	Sandhill Crane	Blue
<i>Gulo gulo luscus</i>	Wolverine, <i>luscus</i> subspecies	Blue
<i>Hirundo rustica</i>	Barn Swallow	Blue
<i>Magnipelta mycophaga</i>	Magnum Mantleslug	Blue
<i>Martes pennanti</i>	Fisher	Blue
<i>Melanerpes lewis</i>	Lewis's Woodpecker	Red
<i>Myotis ciliolabrum</i>	Western Small-footed Myotis	Blue
<i>Myotis thysanodes</i>	Fringed Myotis	Blue
<i>Numenius americanus</i>	Long-billed Curlew	Blue
<i>Otus flammeolus</i>	Flammulated Owl	Blue
<i>Ovis canadensis</i>	Bighorn Sheep	Blue
<i>Salvelinus confluentus</i>	Bull Trout	Blue
<i>Taxidea taxus</i>	Badger	Red
<i>Tympanuchus phasianellus columbianus</i>	Sharp-tailed Grouse, <i>columbianus</i> subspecies	Blue
<i>Ursus arctos</i>	Grizzly Bear	Blue

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
East	990	O/S	Douglas-fir	1-5	rabbitbrush	<1	needle-and-thread	5-25	rosy pussytoes	1-25
	60		Trembling aspen	1-5	common juniper	<1	prairie junegrass	1-10	pasture sage	1-5
TU1	0-10				saskatoon	<1	Kentucky bluegrass	1-10	tarragon	<1
		U/S	Douglas-fir	1-10	wolf-willow	<1	bluebunch wheatgrass	<1	false flax	<1
OR			Trembling aspen	1-5			Baltic rush	<1	Holboell's rockcress	<1
							sedge species	<1	goatsbeard	<1
BCC05069		R/G	Douglas-fir	1-10					Norway cinquefoil	<1
159			Trembling aspen	1-2					t. white prairie aster	<1
									dune goldenrod	<1
WP: 224									stoneseed	<1
									pale commandra	<1
Type 1									old man's whiskers	<1
									cc gumweed	<1
									desert parsley	<1
									alfalfa	<1

NOTES: Landform/Soil: moraine/silt loam. Litt: 50-75, Soil: 5-25, Bryo: 5-25, Range Cond: P-F.

Volcanic rock, alkaline soils

At in clumps, Fd regen from N and S margins and from fingers of timber.

Sloughs are all dry.

RECOMMENDATIONS: Slash Douglas-fir in Layers 3, 4, 5.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
East	980	O/S	Douglas-fir	1-25 rabbitbrush	<1 Kentucky bluegrass	5-50 rosy pussytoes
	310		Trembling aspen	1-2 common juniper	<1 R. needlegrass	1-10 pasture sage
TU2	0-5				prairie junegrass	1-10 tarragon
		U/S	Douglas-fir	1-25	needle-and-thread	1-10 tiny penstemon
OR/OF			Trembling aspen	1-2	timber oatgrass	1-2 dune goldenrod
					bluebunch wheatgrass	<1 goatsbeard
BCC05069		R/G	Douglas-fir	1-25	slender wheatgrass	<1 showy fleabane
159			Trembling aspen	<1		false flax
						desert parsley
WP: 225						alfalfa
						field peppergrass
Type 3						Russian thistle
						cc gumweed

NOTES: Landform/Soil: moraine/silt loam. Litt: 95-100, Soil: 0-5, Bryo: 0-5, Range Cond: F.

This end of the pasture has not recently been grazed as heavily as the W and central portions.

Should be bluebunch wheatgrass-leading, but has gone to Kentucky bluegrass.

Fd encroachment on grasslands, with rabbitbrush persisting in forested areas.

RECOMMENDATIONS: Slash Douglas-fir in Layers 3, 4, 5. Harvest Fd. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
East	920	O/S	Douglas-fir	1-5 snowberry	1-2 needle-and-thread	1-25 rosy pussytoes
	110			common juniper	<1 R. needlegrass	1-25 tarragon
TU3	0-5	U/S	Douglas-fir	1-5 saskatoon	<1 prairie junegrass	1-10 dune goldenrod
				prickly rose	<1 timber oatgrass	1-2 pale commandra
OR/OF		R/G	Douglas-fir	1-25 bearberry	<1 pinegrass	1-2 false flax
					slender wheatgrass	1-2 goatsbeard
BCC05069					smooth brome	1-2 monarda
159						stoneseed
						sticky geranium

WP: 226

Type 1

NOTES: Landform/Soil: moraine/silt loam. Litt: 50-95, Soil: 0-10, Bryo: 0-5, Range Cond: F-G.

Rock outcrops.

Fd - L1 are mostly in scattered clumps, L5 - good flushing in 2008, but very few needles from 2007.

Fd - L3-5 are associated with clumps, or along margin.

Richardson's needlegrass begins at forest margin with snowberry and rose, pinegrass ends at forest margin.

RECOMMENDATIONS: Slash L4&5 Fd. Harvest OF patches to ~ 100 sph. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
East	1020	O/S	Douglas-fir	1-10 snowberry	1-5 Kentucky bluegrass	25-50 rosy pussytoes
	235		Trembling aspen	1-10 common juniper	1-2 R. needlegrass	1-5 pale commandra
TU4	0-5			saskatoon	<1 prairie junegrass	1-5 pasture sage
		U/S	Douglas-fir	1-5 prickly rose	<1 timber oatgrass	1-5 Pacific anemone
OR/OF				soopolallie	<1 C. needlegrass	1-5 dune goldenrod
BCC05074		R/G	Douglas-fir	1-25		goatsbeard
						chickweed
10						desert parsley

WP: 227

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 50-75, Soil: 0-5, Bryo: 0-5, Range Cond: F.

Small unit with grasslands and associated sloughs.

Encroachment all over unit, but concentrated on the S side and E end.

RECOMMENDATIONS: Slash L4 and 5 Fd, especially on E and S. Harvest Fd L2 and 3 back to vets on N side. - Join with TU5.

Retain At. Space Fd L2 and 3, clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
East	1010 90	O/S	Douglas-fir	5-25 snowberry bearberry	1-25 pinegrass 1-2 R. needlegrass	1-10 wild strawberry 1-10 dune goldenrod
TU5	0-10	U/S	Douglas-fir	5-25 prickly rose soopolallie	<1 C. needlegrass <1 Kentucky bluegrass	1-10 western yarrow 1-5 showy fleabane
OF		R/G	Douglas-fir	5-50	bluebunch wheatgrass northwest sedge	1-5 showy aster 1-2 pearly everlasting
BCC05074						balsamroot
10						monarda
WP: 228						northern bedstraw
						stoneseed

Type 4

NOTES: Landform/Soil: moraine, lacustrine/silt loam. Litt: 50-95, Soil: 1-5, Bryo: 1-5, Range Cond: G-E.

Breaks above the Chilcotin R. - starts at OF goes to OR with decrease in elevation.

Fd - groves of L1 and vets usually ingrown with L3-5 in between.

Edges have logged Fd vets going back to the 1960's.

RECOMMENDATIONS: Retain groves of vets, harvest L1 & 2, thin L2 to 4, slash L3-5 Fd, especially on E and S. Join with TU4.

Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
East	1010	O/S	Douglas-fir	1-10 snowberry	1-5 Kentucky bluegrass	5-50 rosy pussytoes
	020/200		Trembling aspen	1-10 prickly rose	1-5 R. needlegrass	5-25 pale commandra
TU6	5-20			common juniper	<1 C. needlegrass	1-10 goatsbeard
		U/S	Douglas-fir	1-25 Rocky M. juniper	<1 bluebunch wheatgrass	1-10 showy fleabane
OR/OF			Trembling aspen	1-10 rabbitbrush	<1 prairie junegrass	1-5 northern bedstraw
					redtop	<1 timber milkvetch
BCC05069		R/G	Douglas-fir	1-50		western yarrow
156			Trembling aspen	1-5		dune goldenrod
						sulphur buckwheat
WP: 229						chickweed
						balsamroot
Type 4						old man's whiskers
						alumroot
						nine-leafed lomatium

NOTES: Landform/Soil: moraine, lacustrine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: F-G.

Rock outcrops in OR areas.

Hilly OR/OF unit with one dominant ridge.

Groves of At with L2 Fd and L3-5, very few Fd vets.

Good forage production, not much forage use.

Very dry plant communities on outcrops.

Potential mule deer winter range.

RECOMMENDATIONS: Slash, space and harvest leaving on a few OF patches centered around Fd vets and large L1.

Remove all trees in OR patches. Clean-up burn.

POST-TREATMENT STOCKING: OR/OF.

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
East	1020	O/S	Douglas-fir	1-10	snowberry	1-5	Kentucky bluegrass	5-25	sulphur buckwheat	<1
	40		Trembling aspen	1-2	prickly rose	1-2	R. needlegrass	5-25	rosy pussytoes	<1
TU7	0-5				common juniper	<1	C. needlegrass	1-5	alumroot	<1
		U/S	Douglas-fir	1-10	rabbitbrush	<1	bluebunch wheatgrass	1-5	desert parsley	<1
OR/OF			Trembling aspen	1-5			prairie junegrass	1-2	nodding onion	<1
									Holboell's rockcress	<1
BCC05043		R/G	Douglas-fir	1-25					field peppergrass	<1
84			Trembling aspen	1-5					dune goldenrod	<1
									chickweed	<1
WP: 230									pasture sage	<1
									tarragon	<1
Type 4									false flax	<1
									old man's whiskers	<1

NOTES: Landform/Soil: moraine, lacustrine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: G-E.

Unit on W side of Riske Creek-Gang Ranch Road (2000 Road) @ km 28-29.

At in patches.

Fd well-distributed on margins, especially N and W sides.

RECOMMENDATIONS: Slash all Fd L3-5, retain vets and L1-2. Prescribed fire.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs	Grasses			Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
East	1030	O/S	Douglas-fir	1-5	rabbitbrush	1-10	Kentucky bluegrass	5-25	goatsbeard	<1
	110-340				snowberry	<1	western needlegrass	5-25	pasture sage	<1
TU8	0-20	U/S	Douglas-fir	1-5	prickly rose	<1	bluebunch wheatgrass	1-5	desert parsley	<1
							prairie junegrass	1-5	tarragon	<1
OR		R/G	Douglas-fir	1-25					false flax	<1
									rosy pussytoes	<1
BCC05043									alfalfa	<1
84									shaggy fleabane	<1
									graceful cinquefoil	<1
WP: 231									timber milkvetch	<1
									balsamroot	<1
Type 3									northern bedstraw	<1
									chickweed	<1
									Pacific anemone	<1

NOTES: Landform/Soil: moraine, lacustrine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: G-E.

Unit on E side of Riske Creek-Gang Ranch Road (2000 Road) @ km 28-29.

Fd encroachment from the forest edge on southeast - heaviest in south and west.

Vegetation is very sparse in places - close to water sources.

Includes riparian area around sloughs (R6).

RECOMMENDATIONS: Slash all Fd L3-5, retain vets and L1-2. Prescribed fire.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
East	1060	O/S	Douglas-fir	1-10	prickly rose	1-5	R. needlegrass	1-25	goatsbeard	1-5
	330		Trembling aspen	1-2	snowberry	1-5	Kentucky bluegrass	1-25	sticky geranium	<1
TU9	0-10				Rocky M. juniper	<1	bluebunch wheatgrass	1-5	pale commandra	<1
		U/S	Douglas-fir	1-25	chokecherry	<1	slender wheatgrass	1-5	old man's whiskers	<1
OR/OF			Trembling aspen	1-10			needle-and-thread	1-2		
BCC05069		R/G	Douglas-fir	1-25						
155			Trembling aspen	1-10						
			Lodgepole pine	<1						

WP: 232

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 95-100, Soil: 0-5, Bryo: 0-5, Range Cond: F-G.

Lots of Fd ingrowth and encroachment in all layers.

Some PI here, but all L3 and 4 dead, L5 surviving.

RECOMMENDATIONS: Slash all Fd L3-5 and PI L5. Retain Fd vets and L1-2 - clump remaining trees around them.

Harvest margin, thin Fd L2 and 3. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
East	1060	O/S	Douglas-fir	1-5 rabbitbrush	1-5 R. needlegrass	5-25 sticky geranium
	340			prickly rose	1-5 Kentucky bluegrass	1-10 goatsbeard
TU10	0-10	U/S	Douglas-fir	1-5 common juniper	1-2 prairie junegrass	1-10 old man's whiskers
					timber oatgrass	1-10 pasture sage
OR		R/G	Douglas-fir	1-15	bluebunch wheatgrass	1-5 graceful cinquefoil
			Lodgepole pine	1-2		silverweed
BCC05069						stoneseed
155						pale commandra
						Pacific anemone
WP: 233						dune goldenrod

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 95-100, Soil: 0-5, Bryo: 0-5, Range Cond: G-E.

PI on the W side of unit - all L1-4 are dead, L5 only survivors.

Fd - encroachment all over the unit.

Not much Fd volume - mostly spacing and slashing treatments.

RECOMMENDATIONS: Slash all Fd L3-5 and PI L5. Retain Fd vets and larger L1 - clump remaining trees around them.

Harvest on forest margin, thin Fd L2-3. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs		Grasses		Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
East	1040-1080	O/S	Douglas-fir	1-5	common juniper	<1	R. needlegrass	5-25	northern bedstraw	<1
	230				prickly rose	<1	Kentucky bluegrass	1-15	goatsbeard	<1
TU11	5-20	U/S	Douglas-fir	1-5	snowberry	<1	prairie junegrass	1-5	rosy pussytoes	<1
							bluebunch wheatgrass	1-5	chickweed	<1
OR		R/G	Douglas-fir	1-25			C. needlegrass	1-2	stoneseed	<1
							western needlegrass	1-2	alumroot	<1
BCC05069									yellow hedysarum	<1
155									pasture sage	<1
									false flax	<1
WP: 234									showy fleabane	<1
									dune goldenrod	<1
Type 4									balsamroot	<1
									sulphur buckwheat	<1

NOTES: Landform/Soil: moraine/silt loam. Litt: 95-100, Soil: 1-5, Bryo: 1-5, Range Cond: G.

Not many trees in center - mostly on margins.

Fd - ingrowth and encroachment mainly on W end and on N side.

Some forage use by cattle.

RECOMMENDATIONS: Slash all Fd L3-5 and PI L5. Retain Fd vets and L1-2 - clump remaining trees around them.

Harvest margin, prescribed fire.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs		Grasses		Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
East	1240	O/S	Douglas-fir	1-5	common juniper	<1	Kentucky bluegrass	5-25	alfalfa	1-5
	220		Trembling aspen	1-2	prickly rose	<1	R. needlegrass	1-10	goatsbeard	1-2
TU12	0-10				rabbitbrush	<1	crested wheatgrass	1-5	timber milkvetch	<1
		U/S	Douglas-fir	1-5	willow	<1	timber oatgrass	1-2	stoneseed	<1
OR			Trembling aspen	<1	soopolallie	<1	Sandberg bluegrass	1-2	silverweed	<1
					wolf-willow	<1			pasture sage	<1
BCC05069		R/G	Douglas-fir	1-5					Holboell's rockcress	<1
155			Trembling aspen	<1					shaggy fleabane	<1
			Lodgepole pine	<1					compound fleabane	<1
WP: 235									western yarrow	<1
									chickweed	<1
Type 4									northern bedstraw	<1
									rosy pussytoes	<1

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 1-25, Bryo: 1-10, Range Cond: P-F.

Large OR unit with groves of AT, Fd and PI.

PI - overstory is dead, some understory trees still green - very few L4 or L5. L4 and 5 - poor form if >0.5 m - all browsed.

Fd - L4 and 5 have very few needles remaining from 2007 growth, but good flush in 2008. Many have been browsed.

Encroachment is mainly associated with the margin or from groves of trees in center.

Moose browsing on willows.

Many grasshoppers.

RECOMMENDATIONS: Slash or burn Fd and PI L5.

Slash all Fd L3-5. Retain Fd vets and larger L1 - clump remaining trees around them.

Harvest on margins and in clumps contained within TU boundaries. Thin Fd L2 and 3 on margins. Prescribed fire.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
East	1300	O/S	Douglas-fir	1-25	prickly rose	1-2	R. needlegrass	5-25	northern bedstraw	1-5
	230				common juniper	<1	Kentucky bluegrass	5-25	western yarrow	<1
TU13	0-10	U/S	Douglas-fir	1-25			C. needlegrass	1-5	pasture sage	<1
							prairie junegrass	1-2	rosy pussytoes	<1
OF		R/G	Douglas-fir	1-25			timothy	<1	showy fleabane	<1
									alumroot	<1
BCC05069									stoneseed	<1
155									goatsbeard	<1
									sticky geranium	<1
WP: 236									balsamroot	<1
									nodding onion	<1
Type 4									chickweed	<1
									timber milkvetch	<1
									monarda	<1

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: G-E.

Small unit with a few Fd vets and L1 - the rest of the trees are ingrowth and encroachment.

Some cattle grazing - a few pairs in now.

RECOMMENDATIONS: Slash all Fd L2-5 between clumps. Retain Fd vets and larger L1 - clump remaining trees around them.

Harvest between TU13 and 14 retaining low OF stocking levels. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs		Grasses		Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
East	1330	O/S	Douglas-fir	<1	snowberry	1-2	R. needlegrass	5-25	rosy pussytoes	1-10
	20				prickly rose	1-2	Kentucky bluegrass	1-10	balsamroot	<1
TU14	10	U/S	Douglas-fir	1-25			bluebunch wheatgrass	1-10	sulphur buckwheat	<1
			Lodgepole pine	<1			western needlegrass	1-2	chickweed	<1
OF							C. needlegrass	1-2	pale commandra	<1
		R/G	Douglas-fir	1-5					pasture sage	<1
BCC05069			Lodgepole pine	<1					timber milkvetch	<1
155									northern bedstraw	<1
									stoneseed	<1
WP: 237									showy fleabane	<1
									dune goldenrod	<1
Type 4									wild strawberry	<1
									graceful cinquefoil	<1

NOTES: Landform/Soil: till/rock, moraine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: F.

Several rock outcrops. Riparian area (not described) in CF below.

Whole hillside is ingrowth and encroachment - all surrounding area in neighbouring range unit (Saddle Horse Mountain).

Fd - very few vets, lots of L1 at 20-30 cm dbh, more L2 and 3, few L4 and 5.

PI - L 1-2 all dead, L3 and 4 all green or red-attack, a few surviving L4 and 5 still green.

RECOMMENDATIONS: Slash all Fd L2-5 between clumps. Retain Fd vets and L1-2 - clump remaining trees around them.

Nice vets and large L1 Fd in forest to the W. Establish a 30cm dbh leave limit.

Harvest between TU13 and 14 retaining low OF stocking levels. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site	Elev Aspect	Forest Cover	Trees	Shrubs	Grasses	Forbs				
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover		
East	1340-1360	O/S	Douglas-fir	1-2	prickly rose	<1	Kentucky bluegrass	5-25	showy fleabane	1-2
	200				saskatoon	<1	bluebunch wheatgrass	1-10	old man's whiskers	1-2
TU15	0-5	U/S	Douglas-fir	1-2	snowberry	<1	prairie junegrass	1-5	western yarrow	<1
							C. needlegrass	1-5	sticky geranium	<1
OR		R/G	Douglas-fir	1-2			R. needlegrass	1-5	goatsbeard	<1
			Trembling aspen	<1			timber oatgrass	<1	stoneseed	<1
BCC05069			Lodgepole pine	<1					Pacific anemone	<1
155										

WP: 238

Type 3

NOTES: Landform/Soil: moraine/silt loam. Litt: 95-100, Soil: 1-5, Bryo: 1-25, Range Cond: F-G.

Large OR unit with many enclosed CF clumps of At, Fd and PI.

Most PI L1-4 are dead, L5 green. Large blocks of PI to S of unit are dead. L5 PI are sparse.

Fd - very little encroachment on OR - mostly found in shady spots - necks of grassland etc.

Adjacent forest to the N has had all volume in vets, L1 and 2 removed.

Harvest on margins where feasible, thin Fd and PI on margins. Prescribed fire.

RECOMMENDATIONS: Slash Fd and PI encroachment on margins and necks of OR. Cleanup PI.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
East Riparian	985-1000	O/S	Trembling aspen	1-5	willow	<1	Kentucky bluegrass	5-25	silverweed	1-25
							slender wheatgrass	5-25	t. white prairie aster	1-5
		U/S	Trembling aspen	1-5			foxtail barley	1-10	strawberry blight	1-2
TU1							Nuttall's alkaligrass	1-5	alkali goosefoot	<1
		R/G	Trembling aspen	<1			inland saltgrass	1-5	sowthistle	<1
OR			Douglas-fir	<1						

BCC05069

155

Type 2

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-25, Range Cond: F-G.

Sites are very alkaline.

Water levels variable.

Riparian areas are usually a combination of shallow water and graminoid meadows.

RECOMMENDATIONS: remove Fd encroachment on uplands.

Prescribed fire.

POST-TREATMENT STOCKING: OR

PRIORITY: low

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs		Grasses		Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
West	1080	O/S	Douglas-fir	<1	prickly rose	<1	Kentucky bluegrass	25-50	goatsbeard	<1
	240		Trembling aspen	<1	bearberry	<1	R. needlegrass	1-10	timber milkvetch	<1
TU1	0-2						bluebunch wheatgrass	1-2	graceful cinquefoil	<1
		U/S	Douglas-fir	<1					white clover	<1
OR			Trembling aspen	<1					alfalfa	<1
									alsike clover	<1
BCC05074		R/G	Douglas-fir	<1					sticky geranium	<1
10			Trembling aspen	<1					dandelion	<1

WP: 239

Type 3

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-100, Soil: 0-10, Bryo: 0-5, Range Cond: P-F.

Grazing management should encourage lower forage utilization levels.

A few dead PI - no L4 or 5.

Some Fd encroachment on margins.

RECOMMENDATIONS: Slash Fd L5 on margin.

POST-TREATMENT STOCKING: OR

PRIORITY: low

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
West	1000 330	O/S	Douglas-fir	1-2	prickly rose snowberry	<1 <1	Kentucky bluegrass R. needlegrass	5-25 1-10	goatsbeard western yarrow	1-5 1-5
TU2	0-2	U/S	Lodgepole pine Douglas-fir	1-10 1-2			slender wheatgrass western needlegrass C. needlegrass	1-5 1-5 1-2	timber milkvetch silverweed dandelion	<1 <1 <1
OR/OF		R/G	Lodgepole pine	1-10			timber oatgrass	<1		
BCC05069			Douglas-fir	1-2			prairie junegrass	<1		
155			Trembling aspen	<1						

WP: 241

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-10, Range Cond: P-F.

Two blocks - block to the N was disc-trenched and planted - PI here is 90% alive; PI on OR is 90% dead.

PI - encroachment on margin in a band ~ 50-200 m wide - 1st 50 m is red/dead L1-3, next 100 m is L3, L4 green attack.

Slash back through blocks and join.

RECOMMENDATIONS: Convert both blocks to OR by removing all PI and poor form Fd.

Take cut back into the CF about 200 m. Salvage PI. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs		Grasses		Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
West	1020	O/S	Douglas-fir	1-2	prickly rose	<1	Kentucky bluegrass	5-25	rosy pussytoes	1-2
	140			bearberry	<1	needle-and-thread	1-10	silverweed	1-2	
TU3	0-10	U/S	Lodgepole pine	1-10	willow	<1	prairie junegrass	1-5	goatsbeard	<1
			Douglas-fir	<1	common juniper	<1	Sandberg bluegrass	1-5	old man's whiskers	<1
OR/OF		R/G	Lodgepole pine	1-25			bluebunch wheatgrass	<1	pasture sage	<1
			Douglas-fir	<1				timber milkvetch	<1	
BCC05069	153								false flax	<1
									yellow hedysarum	<1

WP: 242

Type 1

NOTES: Landform/Soil: glaciofluvial/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: P-F.

Long, narrow unit along 2000 Road.

Hummocky unit with current scars.

Alkaline soils - likely enough to repel encroachment.

PI - common in this unit, but all L1-2 area dead. Pitch tubes on L3 green attack.

Most PI L4, 5 are planted - planted and naturals both affected.

Willow in wet microsites.

RECOMMENDATIONS: Remove all PI r/g throughout, salvage PI o/s - retain At and Fd.

Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
West	1040	O/S	Douglas-fir	1-5 snowberry	1-5 R. needlegrass	5-25 goatsbeard
	70		Trembling aspen	<1 bearberry	1-5 Kentucky bluegrass	5-25 pasture sage
TU4	15			prickly rose	1-2 bluebunch wheatgrass	1-10 silverweed
		U/S	Lodgepole pine	5-25 common juniper	1-2 prairie junegrass	1-5
OF			Trembling aspen	1-5 Rocky M. juniper	<1	
			Douglas-fir	<1		
BCC05074						
	17	R/G	Lodgepole pine	1-25		
			Trembling aspen	1-25		
WP: 243			Douglas-fir	<1		

Type 4

NOTES: Landform/Soil: glaciofluvial/silt loam. Litt: 50-95, Soil: 1-25, Bryo: 1-25, Range Cond: P-G.

Formerly OR/OF that was logged, disc-trenched and planted to PI.

PI - mostly planted with a few naturals. Dates to late 1980's.

Similar to TU3, except planted like block to the N of the TU.

Mountain pine beetle, pitch twig moth, cassandra - trees chlorotic, some browsing.

Many poor form PI in L4 and 5.

RECOMMENDATIONS: Slash PI in all layers and poor form Fd r/g.

Salvage PI. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
West	1100 140-180	O/S	Douglas-fir	1-5	prickly rose snowberry	<1	Kentucky bluegrass needle-and-thread	5-25 1-5	silverweed goatsbeard	1-2 <1
TU5	0-5	U/S	Trembling aspen Douglas-fir	1-5 <1			alkali bluegrass Sandberg bluegrass sedge species	1-5 1-2 1-2	rosy pussytoes Holboell's rockcress pasture sage	<1 <1 <1
OR/OF										
BCC0503574 17		R/G	Lodgepole pine Trembling aspen Douglas-fir	1-5 1-5 <1						

WP: 244

Type 1

NOTES: Landform/Soil: moraine, glaciofluvial/silt loam. Litt: 75-95, Soil: 1-10, Bryo: 1-10, Range Cond: P-F.

Very hummocky and very alkaline.

PI - planted in pockets ~ 20 years ago.

RECOMMENDATIONS: Salvage and cleanup on PI L1-3, slash L4, 5 PI. Reserve all At and good form Fd.

Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
West	1120	O/S	Spruce	1-5	prickly rose	1-10	Kentucky bluegrass	5-25	silverweed	1-2
	140		Douglas-fir	1-2	bearberry	1-2	R. needlegrass	1-10	goatsbeard	1-2
TU6	0-5		Trembling aspen	1-2	snowberry	1-2	bluebunch wheatgrass	1-5	western yarrow	<1
					common juniper	<1	prairie junegrass	1-2	old man's whiskers	<1
OR/OF		U/S	Lodgepole pine	1-10	soopolallie	<1	Sandberg bluegrass	1-2	Pacific anemone	<1
			Douglas-fir	1-2	wolf-willow	<1			rosy pussytoes	<1
BCC05074			Trembling aspen	1-2					showy fleabane	<1
17										
		R/G	Lodgepole pine	1-10						
WP: 246			Trembling aspen	1-2						
			Douglas-fir	<1						
Type 3										

NOTES: Landform/Soil: moraine, fluvial/silt loam. Litt: 50-75, Soil: 1-25, Bryo: 1-5, Range Cond: P-F.

Very hummocky and very alkaline.

Complex or OR, OF and R.PI - L1, 2, 3 dead, L4, 5 green.

Some planting in this TU.

Very little volume.

Lots of forage use in this TU.

RECOMMENDATIONS: Cleanup on PI L1-3, slash all PI L4 and 5.

Retain Sw, Fd and At in clumps - slash all voids.

Salvage PI. Clean-up burn.

POST-TREATMENT STOCKING: OR/OF

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
West	1100	O/S	Trembling aspen	1-10	bearberry	1-5	R. needlegrass	5-25	goatsbeard	1-5
	140/320		Douglas-fir	1-5	prickly rose	1-2	Kentucky bluegrass	1-10	old man's whiskers	1-5
TU7	0-5				common juniper	1-2	prairie junegrass	1-5	showy fleabane	<1
		U/S	Lodgepole pine	1-25	soopolallie	<1	bluebunch wheatgrass	1-5	western yarrow	<1
OR/OF			Trembling aspen	1-25	willow	<1	slender wheatgrass	<1	Pacific anemone	<1
			Douglas-fir	1-2	Rocky M. juniper	<1			wild strawberry	<1
BCC05074										
	17	R/G	Lodgepole pine	1-50						
			Trembling aspen	1-2						
WP: 247			Douglas-fir	<1						
			Spruce	<1						
Type 4										

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: G-E.

Hummocky with all aspects represented.

OR/OF mosaic with R - logged.

Some forage use in OF.

PI - all L1-3 dead, L4 red attack, very few L5 trees.

Richardson's needlegrass in OF, bluebunch wheatgrass in OR - OR grazed.

RECOMMENDATIONS: Complete job by slashing remaining Fd r/g and u/s trees.

Thin L2, 3 PI. Salvage PI. Clean-up burn.

POST-TREATMENT STOCKING: OR/OF

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
West	1100	O/S	Douglas-fir	1-10	prickly rose	1-5	R. needlegrass	5-25	goatsbeard	1-5
	140		Trembling aspen	1-2	bearberry	1-5	Kentucky bluegrass	1-10	silverweed	1-2
TU8	0-10		Spruce	<1	snowberry	1-5	prairie junegrass	1-5	northern bedstraw	<1
					willow	1-5	foxtail barley	1-5	timber milkvetch	<1
OR/OF		U/S	Trembling aspen	1-25	Rocky M. juniper	<1	bluebunch wheatgrass	1-2	western yarrow	<1
			Douglas-fir	1-5			slender wheatgrass	1-2	alsike clover	<1
BCC05074			Lodgepole pine	1-5					American vetch	<1
17			Spruce	<1					showy fleabane	<1
									pasture sage	<1
WP: 248		R/G	Lodgepole pine	1-5					creamy peavine	<1
			Trembling aspen	1-5						
Type 4			Douglas-fir	<1						

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-5, Range Cond: F-G.

All aspects represented, hummocky, OR and R in the center of the unit alkaline.

Logged.

PI - L1-3 dead, L4 mostly green attack.

RECOMMENDATIONS: Remove all PI except good form r/g.

Thin L2-4 Fd, slash L5. Retain At and Fd in clumps.

Clean-up burn.

POST-TREATMENT STOCKING: OR/OF

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site	Elev Aspect	Forest Cover	Trees	Shrubs	Grasses	Forbs				
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover		
West	1030	O/S	Douglas-fir	1-5	common juniper	<1	Kentucky bluegrass	5-25	goatsbeard	1-5
	080/300				rabbitbrush	<1	R. needlegrass	1-5	silverweed	1-2
TU9	0-10	U/S	Douglas-fir	1-5			needle-and-thread	1-5	chickweed	<1
							prairie junegrass	1-5	old man's whiskers	<1
OR		R/G	Douglas-fir	1-5			bluebunch wheatgrass	<1	false flax	<1
									rosy pussytoes	<1
BCC05074									timber milkvetch	<1
17									tarragon	<1
									stoneseed	<1

WP: 249

Type 3

NOTES: Landform/Soil: moraine/silt loam. Litt: 25-75, Soil: 0-25, Bryo: 0-25, Range Cond: P-F.

TU contains Cow Lake and Cow Lake grazing exclosure.

Goatsbeard up to 5% cover outside exclosure, >10% inside.

Excess forage use at this site.

Not much encroachment here except Fd and PI on E end, SW and separate piece S of the lake.

Several blocks of CF that are dominated by PI should be removed. Salvage where possible.

Prescribed fire.

Most of the PI, except L4 and 5 are dead.

RECOMMENDATIONS: Slash PI r/g and u/s trees.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
West	1040	O/S	Douglas-fir	1-5	Rocky M. juniper	<1	R. needlegrass	5-25	alfalfa	1-5
	210		Trembling aspen	<1	common juniper	<1	Kentucky bluegrass	5-25	rosy pussytoes	1-2
TU10	0-10						needle-and-thread	1-10	pasture sage	<1
		U/S	Lodgepole pine	1-5			Sandberg bluegrass	1-5	chickweed	<1
OR			Trembling aspen	1-2			prairie junegrass	1-2	goatsbeard	<1
			Douglas-fir	<1			bluebunch wheatgrass	<1	tarragon	<1
BCC05074									old man's whiskers	<1
	17	R/G	Douglas-fir	1-5					silverweed	<1
			Trembling aspen	1-2					compound fleabane	<1
WP: 250			Lodgepole pine	<1					yellow hedysarum	<1

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 50-95, Soil: 1-25, Bryo: 0-5, Range Cond: P-F.

Cow Lake (on maps) with Ducks Unlimited project at this site.

Alkaline site.

Ditch spoil spread on surface to N of lake.

Very heavily grazed to N of lake. Best RC is by the timberline.

Dry site with dead PI L1-3 on margin - edges need cleanup.

No volume on site - harvest into timber required.

Most work is on the N and W margins.

RECOMMENDATIONS: Remove everything on the edge - cleanup and salvage.

Harvest L1 and 2 Fd where applicable. Slash Fd and PI L4 and 5 - space or slash L3.

Prescribed fire.

POST-TREATMENT STOCKING: OR

PRIORITY: medium

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
West	1230	O/S	Douglas-fir	1-5 bearberry	1-10 pinegrass	0-25 northern bedstraw
	280		Trembling aspen	1-2 snowberry	1-5 Kentucky bluegrass	1-25 fireweed
TU11	0-20			willow	1-2 R. needlegrass	1-10 timber milkvetch
		U/S	Lodgepole pine	1-25 soopolallie	<1 C. needlegrass	1-10 leafy aster
OR/OF			Douglas-fir	1-10 prickly rose	<1 prairie junegrass	1-5 wild strawberry
			Trembling aspen	1-2	bentgrass	<1 Pacific anemone
BCC05074					northwest sedge	<1 sulphur cinquefoil
77		R/G	Lodgepole pine	1-25		old man's whiskers
			Trembling aspen	1-5		stoneseed
WP: 251			Douglas-fir	1-2		American vetch

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 95-100, Soil: 0-10, Bryo: 0-10, Range Cond: F-E.

Alkaline soils.

Mosaic of OR and OF with associated R.

Logged - PI dominated forest - most L1 and 2 taken - remained is dead. Forest coming back as ~99% PI L4 and 5.

Scattered Fd vets and L1 - most are > 30cm.

Grassland areas all have encroachment - dead PI L1-3 and green L4 and 5 on margins.

Harvest Fd where possible, but not much available volume - mainly salvage and cleanup here.

RECOMMENDATIONS: Clean up margins on grasslands, and remove all encroachment. Forest - space to ~ 100sph.

Clean-up burn.

POST-TREATMENT STOCKING: OR/OF

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs		Grasses		Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
West	1240	O/S	Douglas-fir	1-2	bearberry	1-25	Kentucky bluegrass	1-25	northern bedstraw	<1
	90		Trembling aspen	<1	snowberry	<1	R. needlegrass	1-25	silverweed	<1
TU12	0-2				soopolallie	<1	pinegrass	1-25	goatsbeard	<1
		U/S	Lodgepole pine	1-10			C. needlegrass	1-5	old man's whiskers	<1
OR/OF			Trembling aspen	1-2			sheep fescue	1-5	showy aster	<1
							northwest sedge	1-2	stoneseed	<1
BCC05074							bluebunch wheatgrass	<1	Holboell's rockcress	<1
77		R/G	Lodgepole pine	1-50			timber oatgrass	<1	wild strawberry	<1
			Trembling aspen	1-5					leafy aster	<1
WP: 252			Douglas-fir	<1					tiny penstemon	<1
			Spruce	<1					western yarrow	<1
Type 4									timber milkvetch	<1
									pasture sage	<1

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-100, Soil: 1-5, Bryo: 1-5, Range Cond: F-E.

Mostly OF with a few OR areas. Should be mostly lightly stocked OF.

Harvested in the 1980's. Most reserve patches from that date are dead.

Herbaceous and shrub layer is dominated by grassland plant species.

RECOMMENDATIONS: Reserve all At and Sw. Salvage L1-2 PI, slash L3, space L4 and L5.

Harvest Fd where available, especially on margins. Cleans-up burn.

POST-TREATMENT STOCKING: OR/OF

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site	Elev Aspect	Forest Cover	Trees Species	Shrubs Cover	Grasses Species	Forbs Species	Cover			
Airphoto	Slope	Class	Species	Species	Species	Species	Cover			
West	1110	O/S	Douglas-fir	5-25	snowberry	1-10	R. needlegrass	5-25	rosy pussytoes	1-5
	110/290				prickly rose	1-2	needle-and-thread	0-25	silverweed	<1
TU13	0-10	U/S	Douglas-fir	5-25	common juniper	1-2	pinegrass	0-25	western yarrow	<1
			Lodgepole pine	5-25	soopolallie	<1	Kentucky bluegrass	1-10	northern bedstraw	<1
OR/OF			Trembling aspen	1-5			western needlegrass	1-10	timber milkvetch	<1
							bluebunch wheatgrass	1-2	dune goldenroad	<1
BCC05074		R/G	Lodgepole pine	1-25					goatsbeard	<1
16			Douglas-fir	1-10					stoneseed	<1
			Spruce	1-5					nodding onion	<1
WP: 253			Trembling aspen	1-5					old man's whiskers	<1
									false flax	<1
Type 4										

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-100, Soil: 0-10, Bryo: 0-5, Range Cond: G-E.

Mosaic of OR, OF, CF and R. OF and CF generally found in gullies.

There has been no harvesting here. The whole forest is ingrown. PI is dominant on OR areas.

Grassland plant communities in all areas except swales in OF.

OR sites have the most PI, but only L4 and 5 area still green.

Fd - some vets, lots of L1, fewer L2-4, few L5. Many L3, 4, and 5 area dead.

At - most are located near water. Reserve all.

RECOMMENDATIONS: Harvest Fd - leave vets and L1 > 30 cm, space only leaving good form trees. Target <75 sph in all layers.

PI - remove all - salvage L1 and 2, slash and burn L3-5.

OF areas should be stocked to <120 sph.

Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
West	1240-1290 090/200	O/S	Douglas-fir	1-25 snowberry prickly rose	1-5 R. needlegrass 1-2 bluebunch wheatgrass	5-25 goatsbeard 5-10 northern bedstraw
TU14	5-20	U/S	Douglas-fir	1-25 rabbitbrush common juniper	<1 Kentucky bluegrass <1 needle-and-thread	1-10 pale commandra 1-10 false flax
OR/OF		R/G	Douglas-fir	1-10 soopolallie	<1 prairie junegrass	1-5 pasture sage
BCC05074			Lodgepole pine	1-5	sheep fescue	1-2 stoneseed
16						chickweed
WP: 254						stonecrop
Type 4						rosy pussytoes
						timber milkvetch
						silverweed
						Pacific anemone
						compound fleabane
						nodding onion
						showy fleabane
						dune goldenrod

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 0-5, Bryo: 0-10, Range Cond: G-E.

Mule deer winter range site.

Fd - branches to the ground on L1-5, vets are fire-scarred. OF not logged - ingrown since last fire.

Fd - encroachment common on all grassland areas. Very poor quality on lower sites in L2-5 trees - budworm.

PI - L1-3 red or dead, L4 and 5 green. No PI encroachment above 1280 m or on W aspect.

RECOMMENDATIONS: Harvest OF portion - reserve Fd vets and some L1 >30cm dbh - space to light OF stocking (75-100 sph).

Slash OR completely reserve only Fd vets in 1-2 ha patches. Retain all At. Remove PI in all layers – salvage where possible.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Cover Species
West	1270	O/S	Douglas-fir	1-2 prickly rose	<1 R. needlegrass	5-25 western yarrow
	180		Trembling aspen	1-2 bearberry	<1 Kentucky bluegrass	5-25 northern bedstraw
TU15	0-10				C. needlegrass	1-5 timber milkvetch
		U/S	Lodgepole pine	1-5	timber oatgrass	1-5 Pacific anemone
OR			Trembling aspen	<1	foxtail barley	<1 rosy pussytoes
			Douglas-fir	<1		goatsbeard
BCC05074						old man's whiskers
77, 79		R/G	Lodgepole pine	1-25		
			Trembling aspen	1-5		
WP: 255			Douglas-fir	1-5		

Type 4

NOTES: Landform/Soil: moraine/silt loam. Litt: 95-100, Soil: 0-5, Bryo: 0-5, Range Cond: F-E.

Two ponds with water in this unit. Riparian plant communities associated.

Some slashing in OR and harvest in adjacent forest.

Harvested PI to N - all site prep'd. Left too many Fd, especially in lower layers.

Most OR area near lakes has been grazed to Kentucky bluegrass dominated plant community.

Bands of willow associated with R communities.

RECOMMENDATIONS: Take forest edge back to where there is volume - cleanup required. Salvage PI.

Complete the slashing project on PI (take all) and remove about 1/2 of the Fd in L4 and 5.

Reserve At and Fd vets and some L1 and 2 for replacements.

Do not site prep. Clean-up burn.

POST-TREATMENT STOCKING: OR

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover Species	Grasses Cover Species	Forbs Species	Cover
West	1000-1300	O/S	Trembling aspen	1-25 willow species	<1 Kentucky bluegrass	5-25 silverweed	1-25
R1-8		U/S	Trembling aspen	1-25	<1 slender wheatgrass	5-25 t. white prairie aster	1-5
R		R/G	Trembling aspen	1-25	foxtail barley	1-25 strawberry blight	1-2
BCC05069					Nuttall's alkaligrass	1-10 alkali goosefoot	<1
153					redtop	1-10 sowthistle	<1
BCC05074					inland saltgrass	1-5 spotted ladysthumb	<1
17, 77, 79					great bulrush	1-5 alsike clover	<1
					sedge species	1-5	
					bentgrass	<1	

Type 2

NOTES: Landform/Soil: moraine/silt loam. Litt: 75-95, Soil: 1-5, Bryo: 1-25, Range Cond: F-G.

Sites are very alkaline.

Water levels variable.

Riparian areas are usually a combination of shallow water and graminoid meadows.

RECOMMENDATIONS: Remove Fd and PI r/g on uplands where applicable.

POST-TREATMENT STOCKING: OR

PRIORITY: low

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture Site Airphoto	Elev Aspect Slope	Forest Cover Class	Trees Species	Shrubs Cover	Species	Grasses Cover	Species	Forbs Cover	Species	Cover
West Holding	1080 60 0-10	O/S U/S	Douglas-fir Trembling aspen	1-10 1-10	prickly rose snowberry	<1 1-10	Kentucky bluegrass western needlegrass Sandberg bluegrass	5-25 1-10 1-5	goatsbeard stoneseed Pacific anemone	1-5 1-2 <1
TU1			Douglas-fir Lodgepole pine	1-5 <1		needle-and-thread bluebunch wheatgrass	1-5 <1		old man's whiskers wild strawberry	<1 <1
OR/OF									pale commandra dune goldenrod	<1 <1
BCC05069		R/G	Douglas-fir Lodgepole pine	1-10 1-10					silverweed	<1
155			Trembling aspen	1-5						

WP: 240

Type 1

NOTES: Landform/Soil: moraine/silt loam. Litt: 50-95, Soil: 0-10, Bryo: 0-10, Range Cond: P-F.

Mosaic of OR and OF with heavy ingrowth and encroachment.

Farwell Creek flows through unit.

Includes corrals and chutes.

Used as horse pasture - fed here also.

Lots of historical and recent grazing.

Many patches of dead L1-3 Pl.

RECOMMENDATIONS: Harvest Fd, salvage and slash Pl o/s, u/s and r/g trees.

Clean-up burn.

POST-TREATMENT STOCKING: OR/OF

PRIORITY: high

Appendix 3. Polygons and plant communities at the Summer Range Creek Range Unit in September, 2008.

Pasture	Elev	Forest								
Site	Aspect	Cover	Trees	Shrubs		Grasses		Forbs		
Airphoto	Slope	Class	Species	Cover	Species	Cover	Species	Cover	Species	Cover
West	1100	O/S	Douglas-fir	<1	prickly rose	<1	quackgrass	25-50	goatsbeard	1-10
Riparian	180		Spruce	<1	willow	<1	Kentucky bluegrass	1-25	pasture sage	1-2
	0-10						bluebunch wheatgrass	1-5	silverweed	1-2
TU1		U/S	Trembling aspen	1-2			prairie junegrass	1-5	western yarrow	<1
			Douglas-fir	<1			timber oatgrass	1-5	timber milkvetch	<1
OR							slender wheatgrass	1-5		
		R/G	Douglas-fir	1-2						
BCC05074			Spruce	<1						
17			Trembling aspen	<1						
			Lodgepole pine	<1						
Type 3										

NOTES: Landform/Soil: moraine, dune, fluvial/silt loam. Litt: 50-75, Soil: 0-5, Bryo: 5-25, Range Cond: F-G.

Upland and riparian areas within fence.

Upland recovering - well vegetated.

RECOMMENDATIONS: Slash r/g.

POST-TREATMENT STOCKING: OR

PRIORITY: low

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	286	01		OR	OR	Yes	76.3				
East	235	01		OR	OR	Yes	19.2				
East	242	01		OR	OR	Yes	3.8				
									99.3		
East	341	01		OR	OR			91.5			
East	224	01		OR	OR			0.8			
									92.3		
TU1 Total											191.6
East	202	02		OR/OF	OR	Yes	49.2				
East	191	02		OR/OF	OR	Yes	1.4				
									50.6		
East	218	02		OR/OF	OR			6.0			
East	200	02		OR/OF	OR			5.8			
East	203	02		OR/OF	OR			1.6			
									13.3		
TU2 Total											63.9
East	209	03		OR/OF	OR	Yes	26.9				
									26.9		
East	195	03		OR/OF	OR			5.0			
									5.0		
TU3 Total											31.9

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	125	04		OR/OF	OR	Yes	13.1				
East	61	04		OR/OF	OR	Yes	8.0				
East	126	04		OR/OF	OR	Yes	1.3				
									22.3		
East	343	04		OR/OF	OR			17.2			
									17.2		
TU4 Total											39.5
East	124	05		OF	OR	Yes	36.4				
									36.4		
East	118	05		OF	OR			3.4			
East	92	05		OF	OR			1.3			
									4.7		
TU5 Total											41.1
East	282	06		OR/OF	OR/OF	Yes	105.4				
									105.4		
East	278	06		OR/OF	OR/OF			4.6			
East	259	06		OR/OF	OR/OF			3.2			
East	249	06		OR/OF	OR/OF			3.0			
East	263	06		OR/OF	OR/OF			2.4			
East	255	06		OR/OF	OR/OF			2.1			
East	277	06		OR/OF	OR/OF			2.1			
East	269	06		OR/OF	OR/OF			1.8			
East	270	06		OR/OF	OR/OF			1.6			
									20.9		
TU6 Total											126.3

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	290	07		OR/OF	OR	Yes	44.4		44.4		
East	289	07		OR/OF	OR			12.1	12.1		
TU7 Total											56.5
East	273	08		OR	OR	Yes	16.7				
East	276	08		OR	OR	Yes	1.9		18.6		
East	284	08		OR	OR			13.1	13.1		
TU8 Total											31.6
East	261	09		OR/OF	OR	Yes	70.3		70.3		
East	253	09		OR/OF	OR			3.1			
East	250	09		OR/OF	OR			1.7	4.8		
TU9 Total											75.1

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	274	10		OR	OR	Yes	42.1				
East	237	10		OR	OR	Yes	22.2				
East	215	10		OR	OR	Yes	7.2				
East	257	10		OR	OR	Yes	5.9				
									77.3		
East	239	10		OR	OR			10.3			
East	257	10		OR	OR			5.6			
East	228	10		OR	OR			3.7			
East	262	10		OR	OR			1.5			
East	219	10		OR	OR			1.5			
									22.6		
TU10 Total											99.9
East	211	11		OR	OR	Yes	27.0				
East	229	11		OR	OR	Yes	11.7				
									38.7		
East	214	11		OR	OR			62.8			
									62.8		
TU11 Total											101.5

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	164	12		OR	OR	Yes	140.2				
East	182	12		OR	OR	Yes	31.5				
East	159	12		OR	OR	Yes	22.2				
East	196	12		OR	OR	Yes	16.9				
East	142	12		OR	OR	Yes	15.0				
East	344	12		OR	OR	Yes	8.0				
East	221	12		OR	OR	Yes	6.9				
East	177	12		OR	OR	Yes	5.2				
East	194	12		OR	OR	Yes	4.8				
East	210	12		OR	OR	Yes	4.2				
East	147	12		OR	OR	Yes	3.9				
East	206	12		OR	OR	Yes	2.4				
East	197	12		OR	OR	Yes	2.3				
East	169	12		OR	OR	Yes	1.0				
East	348	12		OR	OR	Yes	0.9				
									265.4		
East	222	12		OR	OR			332.7			
East	204	12		OR	OR			1.0			
									333.7		
TU12 Total											599.1
East	163	13		OF	OR	Yes	11.9				
									11.9		
TU13 Total											11.9

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	123	14		OF	OR	Yes	9.9		9.9		
East	111	14		OF	OR			1.0	1.0		
TU14 Total											10.9
East	27	15		OR	OR	Yes	72.6				
East	107	15		OR	OR	Yes	52.0				
East	28	15		OR	OR	Yes	14.2				
East	44	15		OR	OR	Yes	11.6				
East	89	15		OR	OR	Yes	8.9				
East	25	15		OR	OR	Yes	8.6				
East	34	15		OR	OR	Yes	6.4				
East	37	15		OR	OR	Yes	3.2				
East	96	15		OR	OR	Yes	2.9				
East	87	15		OR	OR	Yes	2.6				
East	23	15		OR	OR	Yes	1.1				
East	21	15		OR	OR	Yes	0.9				
										185.0	
East	103	15		OR	OR			263.1	263.1		
TU15 Total											448.1

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	201 990	2	CF	CF			3.5		3.5		
East	95 990	4	CF	CF			2.2		2.2		
East	271 990	6	CF	CF			5.6				
East	281 990	6	CF	CF			2.7				
									8.3		
East	272 990	10	CF	CF			39.5		39.5		
East	132 990	12	CF	CF			22.1				
East	153 990	12	CF	CF			2.3				
East	154 990	12	CF	CF			7.0				
East	172 990	12	CF	CF			3.0				
East	183 990	12	CF	CF			8.4				
East	188 990	12	CF	CF			11.9				
East	208 990	12	CF	CF			2.2				
East	227 990	12	CF	CF			14.7				
									71.8		
East	36 990	15	CF	CF			24.8				
									24.8		
East	117 990		CF	CF			69.8				
East	233 990		CF	CF			12.5				
East	243 990		CF	CF			42.8				
East	291 990		CF	CF			674.4				
East	299 990		CF	CF			397.9				
East	323 990		CF	CF			781.1				
East	342 990		CF	CF			808.5				
									2787.1		
East CF Total										2897.7	

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Enchr (ha)	Non-enchr (ha)	Subtotal Area (ha)	Unit Total	Total
East	230	997		RR	RR				40.5		
East	364	997		RR	RR				83.6		
East RR Total											124.0
East	174	998		Private	Private				63.3		
East	217	998		Private	Private				132.1		
East PL Total											195.4
East	58	999		Water	Water				0.2		
East	94	999		Water	Water				1.3		
East	109	999		Water	Water				0.4		
East	110	999		Water	Water				0.7		
East	171	999		Water	Water				1.3		
East	184	999		Water	Water				0.9		
East	189	999		Water	Water				0.2		
East	190	999		Water	Water				0.7		
East	193	999		Water	Water				1.9		
East	198	999		Water	Water				2.1		
East	213	999		Water	Water				4.5		
East	226	999		Water	Water				1.8		
East	234	999		Water	Water				1.2		
East	236	999		Water	Water				0.6		
East	251	999		Water	Water				1.9		
East	254	999		Water	Water				0.6		
East	256	999		Water	Water				0.3		
East	266	999		Water	Water				0.1		
East W Total											20.6

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
East	275	R1		Riparian	Riparian				3.1		
East	252	R2		Riparian	Riparian				10.7		
East	231	R3		Riparian	Riparian				7.9		
East	199	R4		Riparian	Riparian				2.8		
East	120	R5		Riparian	Riparian				2.8		
East	279	R6		Riparian	Riparian				1.2		
East R Total										28.5	
East Pasture Total											5234.7
East Riparian	267	01		OR	OR			8.0			
									8.0		
East Riparian	258	999		Water	Water				4.6		
East Riparian	346	R1		Riparian	Riparian				3.4		
East Riparian Total											16.1
West	149	01		OR	OR	Yes	1.2				
									1.2		
West	178	01		OR	OR			12.1			
West	175	01		OR	OR			3.9			
									16.0		
TU1 Total											17.2

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	180	02		OR/OF	OR	Yes	7.5				
West	179	02		OR/OF	OR	Yes	4.6				
West	186	02		OR/OF	OR	Yes	4.3				
									16.4		
West	167	02		OR/OF	OR			7.2			
West	181	02		OR/OF	OR			1.6			
									8.8		
TU2 Total											25.2
West	168	03		OR/OF	OR	Yes	12.7				
West	354	03		OR/OF	OR	Yes	3.6				
West	131	03		OR/OF	OR	Yes	0.9				
									17.3		
West	337	03		OR/OF	OR			9.6			
									9.6		
TU3 Total											26.9
West	121	04		OF	OR	Yes	24.0				
									24.0		
West	85	04		OF	OR			1.3			
									1.3		
TU4 Total											25.2

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	334	05		OR/OF	OR	Yes	7.1				
West	157	05		OR/OF	OR	Yes	6.9				
West	119	05		OR/OF	OR	Yes	3.2				
									17.2		
West	161	05		OR/OF	OR			14.1			
West	335	05		OR/OF	OR			6.5			
West	352	05		OR/OF	OR			4.9			
West	84	05		OR/OF	OR			4.0			
West	151	05		OR/OF	OR			2.9			
									32.4		
TU5 Total											49.6
West	71	06		OR/OF	OR/OF	Yes	78.2				
									78.2		
West	45	06		OR/OF	OR/OF			2.2			
West	66	06		OR/OF	OR/OF			2.0			
West	50	06		OR/OF	OR/OF			1.8			
West	33	06		OR/OF	OR/OF			1.5			
West	42	06		OR/OF	OR/OF			0.8			
									8.3		
TU6 Total											86.5

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	143	07		OR/OF	OR/OF	Yes	94.0		94.0		
West	138	07		OR/OF	OR/OF			14.9			
West	331	07		OR/OF	OR/OF			12.3			
West	160	07		OR/OF	OR/OF			5.0			
									32.3		
TU7 Total											126.3
West	173	08		OR/OF	OR/OF	Yes	189.0		189.0		
West	113	08		OR/OF	OR/OF			9.7			
									9.7		
TU8 Total											198.8
West	70	09		OR	OR	Yes	13.4				
West	130	09		OR	OR	Yes	9.6				
West	155	09		OR	OR	Yes	9.0				
West	93	09		OR	OR	Yes	3.6				
West	105	09		OR	OR	Yes	2.4				
									38.0		
West	145	09		OR	OR			55.4			
West	351	09		OR	OR			0.9			
									56.4		
TU9 Total											94.3

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	64	10		OR	OR	Yes	10.4				
West	68	10		OR	OR	Yes	6.4				
West	55	10		OR	OR	Yes	5.7				
West	48	10		OR	OR	Yes	0.7				
									23.2		
West	56	10		OR	OR			33.6			
									33.6		
TU10 Total											56.7
West	322	11		OR/OF	OR/OF	Yes	46.1				
West	17	11		OR/OF	OR/OF	Yes	9.3				
									55.4		
West	20	11		OR/OF	OR/OF			32.7			
									32.7		
TU11 Total											88.1
West	10	12		OR/OF	OR/OF	Yes	96.8				
									96.8		
West	7	12		OR/OF	OR/OF			9.9			
West	13	12		OR/OF	OR/OF			3.5			
West	2	12		OR/OF	OR/OF			0.9			
									14.3		
TU12 Total											111.1

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	140	13		OR/OF	OR	Yes	75.0		75.0		
West	81	13		OR/OF	OR			5.7			
West	98	13		OR/OF	OR			4.1			
West	99	13		OR/OF	OR			1.5			
West	90	13		OR/OF	OR			1.3			
									12.6		
TU13 Total											87.6
West	49	14		OR/OF	OR	Yes	136.9				
West	38	14		OR/OF	OR	Yes	1.1				
									138.0		
West	26	14		OR/OF	OR			6.8			
West	327	14		OR/OF	OR			3.6			
West	47	14		OR/OF	OR			2.2			
West	24	14		OR/OF	OR			1.9			
West	41	14		OR/OF	OR			0.8			
West	29	14		OR/OF	OR			0.4			
									15.7		
TU14 Total											153.7

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Area (ha)	Subtotal	Unit	Total
West	18	15		OR	OR	Yes	29.5					
West	16	15		OR	OR	Yes	28.5					
West	152	15		OR	OR	Yes	24.0					
West	6	15		OR	OR	Yes	15.4					
										97.3		
West	324	15		OR	OR			22.3				
West	19	15		OR	OR			7.9				
West	3	15		OR	OR			4.1				
West	4	15		OR	OR			3.3				
West	1	15		OR	OR			1.1				
										38.6		
TU15 Total												136.0

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	144	990	3	CF	CF		3.9				
West	165	990	3	CF	CF		7.4				
									11.2		
West	63	990	9	CF	CF		2.6				
West	69	990	9	CF	CF		4.2				
West	100	990	9	CF	CF		2.1				
									8.8		
West	321	990	12	CF	CF		26.9				
									26.9		
West	43	990	14	CF	CF		17.6				
									17.6		
West	22	990		CF	CF		20.0				
West	60	990		CF	CF		12.6				
West	74	990		CF	CF		28.9				
West	77	990		CF	CF		6.1				
West	86	990		CF	CF		73.7				
West	134	990		CF	CF		39.2				
West	207	990		CF	CF		87.2				
West	338	990		CF	CF		12.2				
West	339	990		CF	CF		1371.6				
									1651.5		
										1716.1	
West	129	998		Private	Private						16.3

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	5	999		Water	Water				1.5		
West	8	999		Water	Water				6.5		
West	9	999		Water	Water				0.6		
West	11	999		Water	Water				1.9		
West	12	999		Water	Water				0.4		
West	30	999		Water	Water				0.1		
West	31	999		Water	Water				0.6		
West	40	999		Water	Water				14.7		
West	51	999		Water	Water				0.7		
West	52	999		Water	Water				0.8		
West	72	999		Water	Water				9.2		
West	73	999		Water	Water				0.4		
West	75	999		Water	Water				0.1		
West	78	999		Water	Water				1.1		
West	79	999		Water	Water				0.1		
West	82	999		Water	Water				0.3		
West	83	999		Water	Water				0.1		
West	91	999		Water	Water				0.4		
West	97	999		Water	Water				1.0		
West	127	999		Water	Water				0.4		
West	133	999		Water	Water				18.3		
West	150	999		Water	Water				0.4		
West	328	999		Water	Water				1.5		
West W Total										61.2	

Appendix 4. Polygon areas at the Summer Range Creek Range Unit in September, 2008.

Pasture	Ply_ID	TU_ID	TU	Pre-Treat	Post_Treat	Encroach	Encr (ha)	Non-encr (ha)	Subtotal Area (ha)	Unit Total	Total
West	166	R1		Riparian	Riparian				31.8		
West	128	R2		Riparian	Riparian				2.5		
West	139	R2		Riparian	Riparian				8.0		
West	336	R3		Riparian	Riparian				7.6		
West	146	R4		Riparian	Riparian				9.1		
West	333	R4		Riparian	Riparian				10.7		
West	39	R5		Riparian	Riparian				5.8		
West	53	R5		Riparian	Riparian				3.8		
West	35	R6		Riparian	Riparian				7.4		
West	349	R7		Riparian	Riparian				2.1		
West	14	R8		Riparian	Riparian				40.7		
West Pasture Total										129.5	3206.4
West Holding	340	01		OR/OF	OR/OF	Yes	36.0		36.0		
West Holding	325	01		OR/OF	OR/OF			7.0	7.0		
West Holding Total											43.0
West Riparian	332	01		OR	OR				9.6		
West Riparian Total											9.6
Range Unit Total											8509.7