Vegetation Monitoring
of the
Proposed Onion Lake Prescribed Burn,
Churn Creek Protected Area

2010 Pre-burn Baseline Vegetation Description

prepared for

Grasslands Conservation Council of B.C.

and

Cariboo-Chilcotin Ecosystem Restoration Committee

by

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August 25, 2010

INTRODUCTION

BC Parks intends to conduct a prescribed burn in spring 2011 in the Onion Lake area within Churn Creek Protected Area (pers. comm. Tom Hughes, BC Parks, July 2010). The principal objective is to reduce the abundance of *Artemisia tridentata* (Big Sagebrush) and stimulate growth of bunchgrasses.

Current abundance of big sagebrush in the proposed burn area has likely increased compared to historical levels as a result of reductions in the frequency of fires. Analyses of fire scars on trees at similar elevations within the Protected Area suggest that the historic mean fire frequencies were generally less than 15 years. Prescribed fire can partially restore fire as an important ecosystem process within the grasslands of the Protected Area.

Although several prescribed fires have been conducted within the Protected Area since completion of its management plan in 2001, monitoring of effects of these fires on vegetation or other life forms has been minimal and primarily anecdotal. The proposed Onion Lake burn presents an opportunity to initiate on-going monitoring of fire effects. Of special interest are the effects of fire on sagebrush and bunchgrass abundance, vigour of the cryptogamic community, and establishment or spread of alien plants.

In 2010, the Friends of Churn Creek Protected Area Society received funding from the Cariboo-Chilcotin Ecosystems Restoration Steering Committee through the Grasslands Conservation Council of B.C. to initiate, in part, a study to monitor the effects of the proposed 2011 Onion Lake prescribed burn on vegetation. The purpose of this report is to document the establishment of the vegetation monitoring plots and describe the methods that were used for pre-burn baseline descriptions of the vegetation. A brief summary of 2010 baseline vegetation data collected by this study is also included. The data collected by this pre-burn inventory will form the baseline for subsequent post-burn monitoring.

STUDY AREA

The proposed burn area is located within Churn Creek Protected Area, approximately 3 km south of Churn Creek and 1 km west of the Fraser River. The Empire Valley Road forms the eastern boundary and the Iron Gate Road the northern boundary of the proposed burn area (Figure 1). The area includes upper elevations of the BGxh3 and lower elevations of the BGxw2 biogeoclimatic variants, with elevations ranging from approximately 480 to 650 m above msl. Soils are predominantly Brown Chernozems, developed in an aeolian veneer about 30 cm thick overlaying glaciofluvial and glacial till deposits. Low ridge and swale terrain of an apparent periglacial debris flow/erosion complex occupies much of the area.

Figure 1. Location of proposed prescribed burn area and vegetation monitoring transects 1 – 4.

METHODS

Site Selection

Four monitoring sites (macroplots) were selected to represent a range of site conditions within the proposed burn area. Each monitoring site was selected to have relatively uniform slope gradient, slope aspect, surface soils, and vegetation. Macroplot 1 was selected to represent level to gentle (< 15%) slopes with relatively dense big sagebrush (*Artemisia tridentata*). Macroplot 2 was selected to represent level to gentle slopes dominated by grass with little sagebrush. Macroplot 3 was selected to represent steep north aspect slopes and Macroplot 4 was selected to represent steep south aspect slopes. Site features of the four macroplots are described in Table 1. Locations of the four macroplots are shown on Figure 1 (Study Area) and described in Table 2.

Table 1. Site features of macroplots.

Macroplot	Slope Aspect (degrees)	Slope Grade (%)	Elevation (m)	Geological materials	Surface soil texture	Dominant Vegetation
1	2	12	552	Ev/Fg	SiL	Shrub/Lichen
2	40	7	545	Ev/Fg	fSL	Grass/Forb
3	35	48	600	Ev/Mb	SiL	Grass
4	194	40	575	Cv/Mv	SiL	Shrub

Transect and quadrat (microplot) layout

Three monitoring transects, each 30 m long, were established at macroplots 1 – 3. Due to its small area, only two transects were established at Macroplot 4. Transects are parallel and spaced 15 m apart at macroplots 1 – 3 and 10 m apart at Macroplot 4. Within each macroplot, all transects were located on the same bearing. When possible, the bearing was selected to be the cardinal direction most nearly perpendicular to slope aspect. At Macroplot 4, transect bearing

followed the slope contour but was offset from a cardinal direction (Table 2). The bearing between transect start points is 90° to the transect bearing.

Table 2. Locations and bearings of monitoring transects

Macroplot	Transect	Start Location (UTM[1])		Bearing	Length
		Easting	Northing	(degrees)	(m)
1	1	548987	5704415	270	30
1	2	548986	5704428	270	30
1	3	548984	5704445	270	30
2	1	548989	5704611	360	30
2	2	548988	5704611	360	30
2	3	549004	5704611	360	30
3	1	548201	5704581	270	30
3	2	548203	5704569	270	30
3	3	548205	5704554	270	30
4	1	548031	5705026	300	30
4	2	548029	5705019	300	30

[1] 10U; NAD 83

The start and end of each transect was permanently marked by driving into the soil a rebar pin with a blue painted plate (about 10cm x 10cm) welded on top (Figure 2). The transect tape used to locate quadrats (microplots) was hooked to the near edge of the start plate (Figure 2). An

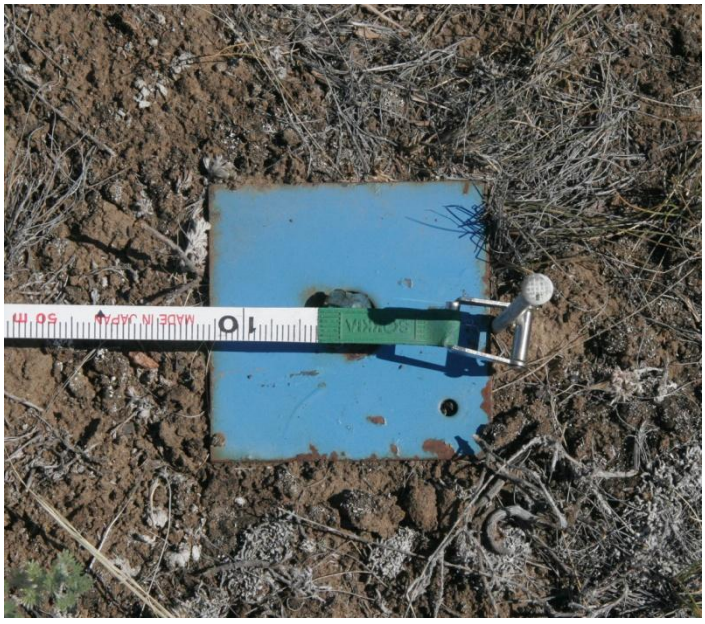

Figure 2. Attachment of 30 m transect line to start pin.

approximately 1m tall metal stake was also placed 1m from each start pin. At Macroplot 4, end pins do not have a welded steel plate but were placed within a small circle of blue painted stones.

Ten quadrats (microplots) were located along a line (meter tape pulled tight) between the start and end pins on each transect, for a total of 30 quadrats within the macroplot. Quadrats are 20 cm x 50 cm with the long edge on the line between the start and end pins. They were spaced at

3m intervals, with the near end of the first starting at 1.5m (i.e. quadrat extends from 1.5 to 2.0 m) and the near end of the last at 28.5m. All quadrats were placed on the left side of the tape between the start and end pins except at Macroplot 4 where they were all placed on the right (uphill) side.

Exceptions to the above quadrat layout are as follows. On transect 2 (central) at Macroplot 3, the 25.5 m quadrat was moved to 23.5 and the 28.5 m quadrat was deleted (only nine quadrats on this transect). This was done to avoid placing more than one of the quadrats on a wildlife/cattle trail rising gradually across the slope. At transect 2 (central) at Macroplot 2, the end pin was driven at 29 m rather than 30 m.

Data collected in each quadrat

The following data were recorded at each quadrat:

Mineral soil cover: percent of quadrat surface area (foliar method) which is exposed mineral soil.

Rock cover: percent of quadrat surface area (foliar method) which is exposed stones or rocks.

Herbaceous Litter cover: percent of quadrat surface area (foliar method) which is covered by herbaceous litter. In contrast to standing dead, litter is defined as material that is fallen to the surface and is no longer held off the surface as a result of connection to plant stem or root.

Woody litter cover: percent of quadrat surface area (foliar method) which is covered by woody litter > 5mm diameter. Smaller woody litter was included with herbaceous litter.

Herbaceous Litter depth: mean depth (mm) of herbaceous litter from representative location.

Woody litter depth: mean depth (mm) of woody litter from a representative location.

Standing dead herbaceous cover: percent of quadrat area (canopy drip line method) which is covered by herbaceous standing dead vascular plants. Standing dead did not include dead leaves of current year's growth, which was included as live plant cover. In contrast to litter, standing dead was defined as material that is elevated above the surface as a result of its remaining connection to a plant stem or root.

Standing dead woody cover: percent of quadrat area (canopy drip line method) which is covered by standing dead woody material > 5mm in diameter. Woody standing dead includes entirely dead shrubs and dead branches of a shrub that extend beyond the area of the live canopy; dead branches within the drip line of the live canopy were not included as woody standing dead.

Shrub total cover: percent of quadrat area (canopy drip line method) which is covered by live shrubs (all species combined).

Cover of each shrub species: percent of quadrat area (canopy drip line method) covered by each species of live shrubs present in the quadrat.

Graminoids total cover: percent of quadrat area (canopy drip line method) which is covered by live or current year's growth of grasses, sedges and other graminoids (all species combined). Dead leaves that were considered to be from current year's growth were included in total cover.

Cover of each graminoid species: percent of quadrat area (canopy drip line method) covered by live or current year's growth of each graminoid species present.

Forbs total cover: percent of quadrat area (canopy drip line method) which is covered by live or current years broad-leaved herbaceous plants (all species combined). Many herbaceous plant leaves were dead at the time of sampling (mid August) but were included in cover estimates if they were considered part of current year's growth.

Cover of each forb species: percent of quadrat area (canopy drip line method) covered by live or current year's growth of each forb species present.

Cryptogam total cover: percent of quadrat surface area (foliar method) which is covered by lichens, mosses, and other cryptogams (all species combined). No attempt was made to distinguish live and dead cryptogams. Generally, the vast majority appeared live.

Cover of each cryptogam species group: percent of quadrat surface area (foliar method) covered by each cryptogam species group. The following cryptogam groups were used for lichens and mosses noted in the quadrats:

- *Cetraria* spp.
- Cladonia: *Cladonia* spp and *Physconia muscigena*
- Collema: dark colored small scale and crust lichens; primarily *Collema* spp and *Psora* spp. (except *Psora decipiens*) with lesser *Catapyrenium squamulosum* and other small scale lichens
- Diploschistes: *Diploschistes muscorum* plus *Ochrolechia opsaliensis*
- *Caloplaca tominii*
- *Peltigera* spp.
- *Psora decipiens*
- *Xanthoparmelia coloradoensis*
- Bryophyta: all mosses and liverworts except *Tortula ruralis*
- *Tortula ruralis*

Two cover estimation methods were used as indicated above. The canopy drip line method was used for all live vascular plant and standing dead cover estimates. This method estimates percent cover as all area within the outer drip line of a canopy including gaps between leaves. In contrast, the foliar method was used for all cryptogams, litter, rock, and mineral soil. It includes only the actual area of leaves and other material that would intercept area-less pins lowered vertically to the surface. That is, it does not include gaps between leaves and other structures in the cover estimate.

Cover of each of the four materials estimated by the foliar method (cryptogams, litter, rock, and mineral soil) was considered mutually exclusive. That is if one subject overlay another, only the first contributed to cover estimates. For example, lichens covered by litter were not included in the cover estimate for lichens and only the litter was counted. This was done to avoid having to lift or remove litter in order to estimate underlying cover of lichens, mineral soil, or rock. Using the foliar estimate method, cover estimates for cryptogams, litter, rock, and mineral soil totalled the area of the plot not fully occupied by plant stems. Their total area usually exceeded 85% but never 100%. Cover estimates for cryptogams, litter, rock, and mineral soil were not affected by overtopping cover of standing dead or living vascular plants.

Data Collected by Line Intercept Method

Shrub cover, including live and dead, was also estimated by the line intercept method at the transects. Shrub canopy intercepts were recorded to the nearest centimetre along the 30m line between the start and end pins of each transect. Dead shrub canopy included shrubs that were entirely dead and dead portions of shrub canopies that extended beyond the drip line of live portions. Dead branches within the live canopy drip line were not recorded as dead intercepts.

On several transects, the line intercept method was also used to estimate basal cover of selected grass bunches by recording start and end intercepts of basal tufts. The selected grass species are *Pseudoroegneria spicata*, *Hesperostipa comata*, and *Koeleria macrantha*.

Exceptions to the above procedure were the following. No line intercept was established at macroplot 2 transect 2. No shrubs intercepted the line there. At macroplot 2 transect 3, the line for recording bunchgrass intercepts was stopped at 1500 cm but continued to 3000 cm for shrubs. At macroplot 3 transect 3, bunchgrass intercepts were not recorded.

Photographs

One or more photographs were taken of each quadrat, looking straight down on the entire quadrat. Sometimes a second photograph was taken of a portion of a quadrat or beneath a shrub canopy.

Two or more oblique photographs were taken of the transect line from each end of the line. The first was usually oriented vertically and taken at an equivalent focal length of approximately 50 mm. The second was usually oriented horizontally at a smaller focal length.

The camera-assigned number of each photograph was recorded on the data sheets.

RESULTS

Mean covers of each vascular and nonvascular species or species group and of mineral soil, litter, and rock for each quadrat within each macroplot are contained in Appendix 1. Line intercept data for shrubs and large bunchgrasses are contained in Appendix 2. Appendix 3 lists photograph numbers for each quadrat and transect line.

Few vascular species were present in quadrats and on line intercepts on the four pre-burn monitoring sites. All species and species groups recorded in the quadrats or line intercept transects are listed in Table 3 by species code used in this study, scientific name and common name.

Table 3. Species and species groups recorded in quadrats or on line intercepts

Species Code	Scientific name	Common name
Shrubs		
Arte tri	*Artemisia tridentata*	Big sagebrush
Eric nau	*Ericameria nauseosus*	Common rabbit-brush
Graminoids		
Care pet	*Carex petasata*	Pasture sedge
Care ros	*Carex rossii*	Ross' sedge
Hesp com	*Hesperostipa comata*	Needle-and-thread grass
Koel mac	*Koeleria macrantha*	Junegrass
Poa sec	*Poa secunda*	Sandberg's bluegrass
Pseu spi	*Pseudoroegneria spicata*	Bluebunch wheatgrass
Spor cry	*Sporobolus cryptandrus*	Sand dropseed

Table 3. (continued)

Species Code	Scientific name	Common name
Forbs		
Achi mil	*Achillea millifolium*	Yarrow
Alli cer	*Allium cernuum*	Nodding onion
Andr sep	*Androsace septentrionalis*	Fairy candelabra
Antennari	*Antennaria* spp.	Pussytoes
Ante dim	*Antennaria dimorpha*	Low pussytoes
Arte fri	*Artemisia frigida*	Pasture sage
Cera arv	*Cerastium arvense*	Field chickweed
Heuc cyl	*Heuchera cylindrica*	Round-leaved alumroot
Loma mac	*Lomatium macrocarpum*	Large-fruited desert-parsley
Opun fra	*Opuntia fragilis*	Brittle prickly-pear cactus
Orth lut	*Orthocarpus luteus*	Yellow owl-clover
Sedu lan	*Sedum lanceolatum*	Lance-leaved stonecrop
Soli spa	*Solidago spathulata*	Spikelike goldenrod
Ziga ven	*Zygadenus venenosus*	Meadow death-camus
Lichens and Mosses		
Calo tom	*Caloplaca tomentosa*	
Cetrari	*Cetraria spp.* esp. *C. islandica*	Cetraria lichens esp. Icelandmoss
Cladoni	*Cladonia* spp.	Cladonia lichens
Collema	*Collema* spp.	Tarpaper lichens
Dipl mus	*Diploschistes muscorum*	Cow pie lichen
Peltige	*Peltigera* spp.	Pelt lichens
Psor dec	*Psora decipiens*	Sockeye scale lichen
Xant col	*Xanthoparmelia coloradoensis*	Rockfrog lichen
Bryophy	*Bryophyta* spp.	Mosses and liverworts
Tort rur	*Tortula ruralis*	Rusty steppe moss

Mean percent cover of each species and species group in the quadrats at each monitoring site (macroplot) is listed is Table 4.

Macroplot 1 was dominated by big sagebrush and lichens, especially *Collema* spp. and *Cladonia* spp. with relatively little cover of grasses or forbs. Sandberg's bluegrass was present in many quadrats with small cover. Cladonia lichens were common primarily beneath big sagebrush plants. Percent exposed mineral soil was highly variable.

On Macroplot 2, the pre-burn vegetation consisted primarily of needle-and-thread grass, pasture sage, and lichens, especially *Collema* spp. and *Cladonia* spp. Percent exposed mineral soil was moderately high. No bluebunch wheatgrass was noted on this site.

Vegetation on Macroplot 3 is primarily bluebunch wheatgrass and lichens, especially *Cladonia* spp. Forbs and grasses, especially bluebunch wheatgrass, were much more abundant than at any of the other macroplots and many of the vascular species recorded on the four macroplots occurred only at this site. Percent exposed mineral soil cover was low.

On Macroplot 4, the vegetation was sparse, consisting primarily of big sagebrush but few grasses or forbs. Lichens were much less abundant than at the other sites and combined percent cover of exposed mineral soil and stones was very high. Surface soils on this site were actively eroding.

Table 4. Mean (standard deviation) percent cover of mineral soil, rock, litter, and species in the four macroplots

Species	Macroplot			
	1	2	3	4
Mineral soil	37 (25)	26 (16)	3 (8)	45 (25)
Rock	1 (1)	0	0 (2)	30 (23)
Herb Litter	16 (20)	22 (14)	44 (24)	14 (16)
Wood litter	1 (2)	0	0	5 (11)
Shrubs total	28 (27)	3 (14)	5 (19)	31 (35)
Arte tri	28 (27)	3 (14)	5 (19)	31 (35)
Graminoids total	4 (6)	20 (11)	33 (17)	7 (9)
Care pet	0	0	0 (2)	0
Care ros	0	0	0	0
Hesp com	1 (2)	20 (11)	0	5 (9)
Koel mac	0 (1)	0	0 (1)	0
Poa sec	4 (7)	0	0	0
Pseu spi	1 (3)	0	33 (17)	1 (5)
Spor cry	0 (1)	0	0	0
Forbs total	2 (3)	5 (9)	17 (12)	1 (1)
Achi mil	0	0	0 (1)	0
Alli cer	0	0	1 (2)	0
Andr sep	0	0	0	0
Antennari	0 (1)	0	13 (11)	0
Ante dim	2 (4)	2 (5)	0	0
Arte fri	0 (1)	6 (6)	1 (2)	0 (1)
Cera arv	0	0	0 (1)	0
Heuc cyl	0	0	1 (2)	0
Loma mac	0	0	0 (1)	0
Opun fra	0 (1)	0	0	1 (1)
Orth lut	0	0	0	0
Sedu lan	0	0	0	0
Soli spa	0	0	0 (1)	0
Zyga ven	0	0	0	0
Cryptogams total	49 (17)	45 (19)	50 (23)	7 (11)
Calo tom	0 (1)	0	0	0
Cetrari	0	0	2 (4)	0
Cladoni	30 (18)	24 (14)	45 (24)	0 (1)
Collema	33 (17)	32 (17)	0 (1)	7 (11)
Dipl mus	2 (2)	2 (2)	1 (1)	0
Peltige	0	0	1 (1)	0
Psor dec	0	0 (1)	0	0
Xant col	0	0	0	0
Bryophy	0	0	2 (5)	0
Tort rur	0	0	0	1 (3)

Appendix 1

2010 Vegetation Quadrat Data

Appendix 2

2010 Vegetation Transect Data

Appendix 3

Photographic Image Numbers for 2010 Vegetation Transects