MONITORING RESTORATION OF FIRE-MAINTAINED ECOSYSTEMS IN THE INVERMERE FOREST DISTRICT

INTERIM WORKING PLAN

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December 15, 1998

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EXECUTIVE SUMMARY

Dry forests in the Invermere Forest District have been highly altered by fire suppression, selective logging, Christmas tree production, and overgrazing. The altered landscape has diminished wildlife habitat, lower forage production, lower quality timber, increased insect and disease infestations, and an increased risk of wild fires. Restoration of open forest, and open range in the Invermere Forest District will be carried out through a three-phase, rotational prescription of thinning trees and prescribed burning. This adaptive management project will monitor the efficacy of the restoration system to allow the information generated from the initial restoration work to shape the restoration approach over the planned 60-year cycle of the restoration plan, and ensure the management goals of the restoration work are being met. The overall goal is to *restore historic ecological conditions of forests and open range in the Rocky Mountain Trench, especially open forest and bunchgrass communities, as per the Kootenay-Boundary Land Use Plan.* The specific goals of the Invermere Forest District ecosystem restoration work are to:

1. promote a higher proportion of open forest, and open range areas;
2. provide additional forage/production, emphasizing native bunchgrass recovery;
3. provide additional habitat for other grassland and open forest dependent wildlife species;
4. generate timber products from thinning and the restored open forest areas;
5. reduce the risk of stand-initiating wildfires;
6. reduce the risk of mountain pine beetle infestations; and,
7. improve the visual aesthetics of the forests;

Monitoring will document changes in understory plant community, record the volume and value of forest products harvested during the thinning process, and determine how the restoration treatments affect the visual appeal of the treatment units.

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1. INTRODUCTION

Dry forests, consisting of the Ponderosa Pine (PP) and Interior Douglas-fir (IDF) biogeoclimatic zones, extend over 5.6 million ha of the southern interior of British Columbia (BC). These areas include the warmest and driest forest zones in the province and are composed of a mosaic of forest and grassland openings, depending on the aspect, elevation, soils and fire history (Hope *et al* 1991a, Hope *et al* 1991b). The understory in the open, drier areas is dominated by bluebunch wheatgrass (*Elymus spicatus* (Pursh) Gould), fescues (*Festuca* spp.), saskatoon (*Amelanchier alnifolia* (Nutt.) Nutt.) and other grass and shrub species. Shaded, cooler areas are dominated by pinegrass (*Calamagrostis rubescens* Buckl.), and contain higher covers of forbs and mosses (Hope *et al* 1991a, Hope *et al* 1991b).

The diverse structure of these forests resulting from topographic variety, and complex mixture of overstory and understory layers, edges and openings has resulted in a wide range of habitat niches for wildlife (Hope *et al* 1991a, Hope *et al* 1991b). Moreover, because these zones are characterized by relatively short, mild winters with lower snow fall than higher elevation ecosystems, they attract and hold a diverse and large number of ungulates and non-migratory passerine birds during the winter and spring. These forests also provide forage and browse for livestock and include important ranges in the southern interior for late-spring, summer and early-fall grazing (Wikeem *et al.* 1993). Recreational opportunities and aesthetic values are also abundant in these zones.

Disturbance is one of the fundamental factors that shapes any ecosystem (Grime 1977). The type, intensity and frequency of a disturbance determines the structure and functions of an ecosystem. The dry forests of the southern interior are "fire-dependent" ecosystems because they evolved with recurring disturbance by fire (Heinselman 1978). Agee (1996) classified fire-dependent ecosystems by defining the severity of their fire regimes:

1. low severity fire regimes typically have frequent, low intensity fires; this category corresponds to the natural disturbance type (NDT) 4 of the Forest Practices Code (Province of BC 1995).
2. high severity fire regimes have infrequent, but high-intensity, stand-replacing fires; this category corresponds to the NDT 2 of the Forest Practices Code (Province of BC 1995).
3. mixed severity fire regimes have a complex combination of high, low and moderate severity fires.

Before European settlement, fires burned through BC's dry forest ecosystems an average of every seven to 21 years (Daigle 1996). Active fire suppression, however, has increased the return interval by as much as 60 years. As a consequence, the change in the natural fire return period may be shifting these ecosystems from a low-severity fire regime to a mixed, or high severity fire regime. Other human activities have also contributed to dramatically altering the landscape. Selective logging has removed large, old-growth ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*) and western larch (*Larix occidentalis*). Pruning and harvesting for Christmas tree production has resulted in high density, low-quality Douglas-fir stands. Overgrazing has contributed to shifting the understory vegetation from bunchgrasses to less palatable forbs and weedy invaders.

The dominant tree species, age class, and stand structure of these forests has shifted as consequence of over a century of severe human intervention in these ecosystems. Dense stands of seral and shade-tolerant tree species, such as lodgepole pine (*Pinus contorta*), and the younger age classes of Douglas-fir are dominating where scattered clusters of old-growth ponderosa pine, Douglas-fir and western larch once occurred. Stagnant stands of early-seral tree species have become infested with disease and Mountain Pine Beetle (*Dendroctonus ponderosae* Hopk.). Higher tree densities, and the loss of natural pruning by fire, have resulted in the ingrowth of the natural

openings. Decreased understory light, and increased woody debris and needle casts have decreased forage and browse production, and shifted the vegetation towards more shade-tolerant, lower quality forage species. These factors combined have resulted in the loss of thousands of hectares of grassland annually (Gayton 1997). Woody accumulations, abundant lower limbs on the trees, and well-developed understory layers of trees also have the potential to fuel large-scale, stand-initiating fires which would destroy the timber resource in these forests. The increased in risk of stand-initiating fires has led some to conclude that the current fire suppression is actually a fire-deferral program (Arno 1996).

Dry forest types in the East Kootenay are typical of the current altered state of fire-dependent ecosystems of BC. The altered fire regime and its impact on natural resource values was recognized in the regional land use planning (Province of British Columbia 1997). Restoration of the proportions of the landscape in managed (closed) forest, open forest, and open range/shrubland to approximately 40%, 30% and 30%, respectively, has been set (Province of British Columbia 1997). The need to increase open forest and open range habitats to meet these targets is the impetus for the restoration work in the Invermere Forest District.

In order to recreate the historical structure of these ecosystems "a semblance of the natural fire process" will have to re-introduced through prescribed burning (Arno 1996). However, because of the high tree density and fuel loads in these forests, and the need to protect adjacent private lands, developed areas and adjacent timber resources, it will be necessary to thin or partially cut the stands before prescribing fire (Arno 1996, Mutch and Cook 1996).

This project will monitor the efficacy of a restoration system to rehabilitate dry forests in the Invermere Forest District. Thinning, pruning, partial cutting and prescribed fire will be applied to ingrown NDT4 forests and their results will be monitored. An adaptive management approach was

adopted to allow the information generated from the initial restoration work to shape the restoration approach over the planned 60-year cycle of the restoration plan, and ensure the management goals of the restoration work are being met.

2. OBJECTIVES

The overall goal of the ecosystem restoration program is to *restore historic ecological conditions of forests and open range in the Rocky Mountain Trench, especially open forest and bunchgrass communities, as per the Kootenay-Boundary Land Use Plan.* This project will assess the potential recovery of understory grassland and open forest vegetation following thinning and prescribed burning in overstocked, closed stands of IDF and PP forests in the Invermere Forest District.

The specific goals of the Invermere Forest District ecosystem restoration program are to:

1. promote a higher proportion of open forest, and open range areas in the NDT4 ecosystems;
2. provide cattle forage production at 50% of maximum potential animal unit months (AUM), emphasizing native bunchgrass recovery;
3. provide wild ungulate forage/browse production at 50% of potential maximum, emphasizing native bunchgrass and native shrub recovery;
4. provide additional habitat for other grassland and open forest dependent wildlife species - e.g., Lewis's woodpecker (*Melanerpes lewis*), and sharp-tailed grouse (*Tympanuchus phasianellus*);
5. generate timber products from the restoration and maintenance thinning as the individual stands allow (primarily lodgepole pine in the short term);
6. grow the open forest at 50% of potential mean annual increment (MAI), favouring ponderosa pine, western larch and Douglas-fir;

7. reduce the risk of stand-initiating wildfire;
8. reduce the risk of mountain pine beetle infestations; and,
9. improve the visual aesthetics of the forests;

The general goals of this monitoring project are to document the changes in understory plant community following thinning and prescribed burning of ingrown forests, record the volume and value of forest products harvested during the thinning process, and to determine how the restoration treatments affect the visual appeal of the treatment units. This information will allow the District, over time, to adapt its management practices to meet the goals of the ecosystem restoration program.

The specific objectives of this monitoring project are to determine:

1. the relationship between canopy closure and light penetration to the herbaceous and shrub layer;
2. the effect of thinning and spring burning on the composition of the herbaceous and shrub layer;
3. the effect of thinning and spring burning on the production of forage and browse;
4. the effect of thinning and spring burning on the mean annual increment of timber; and,
5. the effect of thinning and spring burning on the visual appeal of the sites.

3. HYPOTHESES TESTED

The following null hypotheses will be tested in this adaptive management trial:

1. reduction of forest overstory canopy does not increase light penetration by more than 40% to the understory in the NDT4 ecosystems in the Rocky Mountain Trench of the East Kootenay;
2. reduction of forest overstory canopy and post-harvest, spring burning does not increase the individual cover of rough fescue (*Festuca campestris* Rydb.), or bluebunch wheatgrass by 100%, or saskatoon by 200% in the NDT4 ecosystems in the Rocky Mountain Trench of the East Kootenay;

3. Reduction of forest overstory canopy and post-harvest spring burning does not increase forage production by more than 20% in the NDT4 ecosystems in the Rocky Mountain Trench of the East Kootenay;
4. Stumpage generated from the thinning of overstocked stands is not sufficient to offset the extra direct and indirect costs of planning, layout, treatment and monitoring associated with restoration treatments in the NDT4 ecosystems in the Rocky Mountain Trench of the East Kootenay; and,
5. Reduction of forest overstory canopy and post-harvest spring burning does not increase the visual appeal of the NDT4 ecosystems in the Rocky Mountain Trench of the East Kootenay.

4. DESCRIPTION OF THE STUDY AREAS

All the sites are located along the east slope of the Rocky Mountain Trench, within the Invermere Forest District, in the East Kootenay of BC (Fig. 1). The restoration areas for this monitoring project fall within two range units: the Wolf/Sheep Creek Range Unit (RU5015), also known as Premier Ridge, and the Sheep Creek North Range Unit (RU5041).

4.1 Premier Ridge

The Premier Ridge unit lies east of the Kootenay River, west of Premier lake Provincial Park, north of Wolf Creek and south of the Lussier River. The study area was initially mapped by land ownership, tenure types and previous management activities to determine areas where the re-introduction of fire was feasible. Private land and areas permitted for Christmas tree production were not considered for the restoration work for jurisdictional and logistical reasons. Following the initial stratification of the restoration unit, range pastures were identified and mapped. Range pastures were considered to be logical treatment units for applying the prescribed burning, in that,

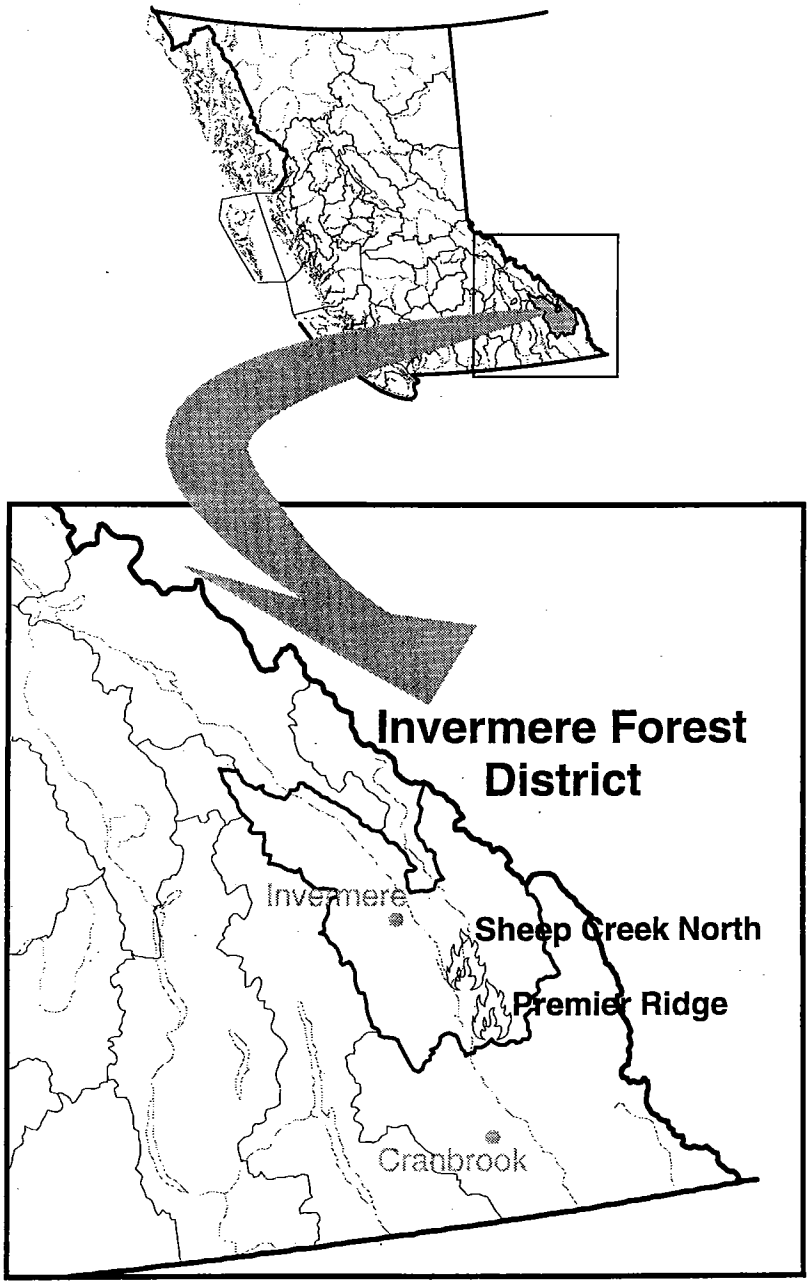

Figure 1. Location of Invermere Forest District and the Restoration Units

perimeter fire guards were generally present, and the pastures could be managed as a single unit before and after the fire to minimize the confounding effect grazing (see sections 5.2 and 5.3). Each treatment unit (Fig. 2) was further divided into strata corresponding to the series of tree removal treatments that were required, and feasible, in order to carry out the restoration to the open forest habitat. Monitoring will occur in three of the treatment units in the Premier Ridge restoration unit. Monitoring will be conducted in the Wolf, Alkali, and Gina pastures in the Wolf-Sheep Creek Range Unit.

4.1.1 Wolf Pasture

This unit is located in the south-western corner of the Premier Ridge restoration unit, north of Wolf Creek and east of the Kootenay River. The dominant tree species are immature to mature (age class 3-5 with scattered pockets of age class 2-3) Douglas-fir and ponderosa pine, interspersed with areas of lodgepole pine. Crown closure ranges from 15-65%, with the majority in the 50-65% range. The unit has been segregated into six strata; the monitoring described in this working plan will occur in stratum B. This stratum consists of areas occupied by various stocking levels of 20 to 60 year-old lodgepole pine in near monoculture stands. Multi-aged Douglas-fir and ponderosa pine are mixed with the lodgepole stands across the unit. For monitoring purposes, the stratum will be split into two areas. Restoration treatments will be applied to stratum east of the Wasa-Sheep Creek Road, and the area west of the road will remain untreated and will serve as a control.

4.1.2 Alkali Pasture

This unit has similar stand structures as Wolf pasture (age class 3-5, mixed species, with areas regenerated to pure stands of lodgepole pine) but had large-scale fires on approximately 40% of the area in the early to mid-1980's. Approximately 280 ha of this unit was burned at varying intensity and efficacy, 12- to 14-years ago. Follow-up burns are needed to maintain the fire-