Kvass Flats Prescribed Burn Habitat Enhancement Project Post-burn Report 2001

By

Emily Lemieux
Biotechnician

and

Sheldon Kowalchuk
District Programs Co-ordinator

Alberta Conservation Association
East Slopes Region

March, 2002

EXECUTIVE SUMMARY

Kvass Flats is an important ungulate winter range located on the north side of the Smoky River valley, approximately 10 kilometres west of Grande Cache, Alberta. In order to improve wildlife habitat, prescribed burns were conducted on a portion of Kvass Flats in 1987 and again in 1994. Efforts in 2001 were targeted at enhancing the wildlife habitat at the previous burn sites as well as reducing the fuel loads along the north side of the Smoky River valley, which would act as a fire break in future years if wildfires develop west of Kvass Flats in the Willmore Wilderness Park.

The objective of the 2001 Kvass Flats prescribed burn was to burn approximately 4,200 acres of mature aspen forest, grasslands, and coniferous forest located between Corral Creek and Eaton Creek. A remote automated weather station (RAWS) was installed at Kvass Flats on April 5, 2001 to help monitor the weather in the burn area. In order to secure the eastern end of the burn site, a fireguard was established between Davey and Eaton Creeks on April 27, 2001. Pre-burn vegetation sampling and pellet count surveys were conducted on May 10 and 11, 2001, and the main burn was ignited using a helitorch on May 12, 2001. Fuel conditions were not ideal on the day of the burn, giving mixed results due to large areas that did not burn effectively.

A post-burn assessment was conducted at the burn site on June 20, 2001 to visually assess the success of the burn. A more detailed assessment of the burn site was not completed due to the large areas that did not burn effectively - likely only 15% of the site burned as expected. Transects that were assessed prior to the burn were inspected during the post-burn assessment to determine if the areas had burned properly. Through these observations it was concluded that although the transects located in the grassland areas burned well, transects located in forested areas were unsuccessful, burning partially or not at all. As a result of the large forested areas that did not burn effectively, fuels were not reduced enough to create a firebreak in the Kvass Flats area.

Due to the lack of success of the 2001 Kvass Flats prescribed burn it is recommended that this burn be conducted again in 2002, weather permitting.

ACKNOWLEDGEMENTS

We would like to thank Dave Taylor for his desire to help carry out this project and his interest in using prescribed fire as both a fire management tool and a method to improve wildlife habitat in the Northern East Slopes Region. Kim Livingston has provided guidance and support related to the development of a prescribed burning program in the Northern East Slopes Region.

Thanks to staff from Alberta Sustainable Resource Development (Lands and Forest Service) for their assistance on the implementation of the burn, mainly Len Stroebel, Ray Olsson, Cordy Tymstra, Wes Nimco, Kevin Hartwell, Dale Bullock, Bill Allan and Stu Walkenshaw. Dennis Cox and Ray Olsson helped arrange financial support and provided approval for the burn. The work by all other staff working on the line and helping with other tasks associated with conducting this burn is greatly appreciated. Thank you to the Edmonton Weather Centre for providing weather data and for the use of a weather station. Thank you also to James Milner for assisting with pre-burn sampling, Kirby Smith for his help in identifying historic transect locations, and Cameron Broatch and John Hallet for their help on the day of the burn.

Thanks to Dave Taylor, Kirby Smith, Kim Livingston, Rich Rudolph, and D'Arcy Campbell for their comments on the draft copy of this report. Thanks also to Dave Taylor for his many contributions during the writing of the report, specifically the information he provided regarding prescribed fire and the activities associated with the 2001 Kvass Flats burn.

Funding for this project was provided by the Alberta Conservation Association's Wildlife Habitat Development Program (WHDP), the Rocky Mountain Elk Foundation, and Alberta Sustainable Resource Development.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 Introduction

1.1 Project Purpose and Objectives

The primary purpose of the 2001 Kvass Flats prescribed burn was to increase herbaceous forage production at the burn site and to maintain or increase open grassland areas for wildlife habitat (Appendix 4).

This was to be achieved through the following strategies:

- Removal of encroaching tree and shrub cover, which would allow herbaceous forage to re-establish and increase the accessibility and utilisation of the burn site by wildlife.
- A burn intensity capable of causing a 25-50% kill of aspen stems.

The secondary purpose of the prescribed burn was to reduce fuel loads along the Smoky River valley, which would act as a fire break in future years if wildfires develop west of Kvass Flats in the Willmore Wilderness Park (Appendix 4).

This was to be achieved through the following treatments:

- Burning of coniferous areas surrounding the flats in order to eliminate fuel loads that are flammable year-round.
- Burning of fuels in grassland and trembling aspen-dominated areas such as deadfall from previous burns.
- A high burn intensity to effectively burn the above fuels in addition to the more flammable grassland and trembling aspen forested areas.

1.2 Background

Elk *(Cervus elaphus)* are known to winter in a variety of locations throughout the Northern East Slopes. The slopes surrounding Kvass Flats are extremely significant as they are one of the most important wintering habitats in the Willmore Wilderness Park (personal communication, Kirby Smith) (Appendix 6, Plate 16). Elk preferentially graze, but will switch to browse if other forage is not available (Bighorn Environmental Design Ltd. 1994). For this reason, elk, among other ungulate species, are drawn to Kvass Flats to take advantage of the abundant grassland habitat available. Elk habitat can be improved through the removal of tree and shrub species, which allows increased growth of herbaceous forage. Over a number of years much effort has been put into the improvement of elk habitat in the Kvass Flats area.

In 1972, small mechanical clearings were created on the lower portion of the Kvass Flats site. This treatment was not repeated in future years due to the threat of negative public reaction to the use of mechanical equipment in the Willmore Wilderness Park, as well as the existence of issues relating to erosion, and high costs associated with the use of heavy equipment on steep slopes (Eslinger 1994).

In 1987 the lower portion of Kvass Flats was burned, a total of approximately 70 hectares, with the objective of removing the trembling aspen canopy in order to improve forage for elk (Bighorn Environmental Design Ltd. 1994). Pellet count surveys conducted during a post-burn assessment show that elk use of the burned area increased after the prescribed burn, particularly in 1989 (Bighorn Environmental Design Ltd. 1994). Observed browse use of all shrubs decreased in 1989 from 1987 levels; a reflection of increased grass cover in the area (Bighorn Environmental Design

Ltd. 1994). Also in 1987, the Corral Creek basin, which now forms the western edge of the burn site, experienced a wildfire resulting in much the same effect on the area as a prescribed burn.

Kvass Flats was re-burned in 1994, with approximately 445 hectares burned to varying degrees. Although no post-burn assessments were targeted specifically at wildlife response to the affected area, post-burn vegetation sampling was conducted. Results show that the prescribed burn caused structural changes in the vegetation in the area, killing all trembling aspen saplings, as well as reducing the density of mature trembling aspen, which resulted in an open poplar shrubland dominated by rose (McCallum and Irwin 1997). In accordance with the objective of improving forage throughout the burn site, ground cover was found to be higher than pre-burn levels. Because the desired results were achieved, it can be assumed that the prescribed burn had the intended effects on wildlife in the area.

1.3 Location and Characteristics of Study Area

The study area is contained within the ACA Northern East Slopes (NES) district, which is located within the ACA East Slopes Region. Kvass Flats is located on the north side of the Smoky River valley, approximately 10 kilometres south-west of Grande Cache, Alberta (Figure 1.1) (Appendix 6, Plate 15). The legal land description of Kvass Flats is Section 3 of TWP 56-RGE 9-W6M.

The 2001 Kvass Flats burn site is located at an elevation of 1050-1500m, with a slope of 5-60%, and a south facing aspect. The site is bordered by Corral Creek on the west and Eaton Creek on the east. The burn site consists of a fireguard between Davey Creek and Eaton Creek, and a main prescribed burn between Corral Creek and Davey Creek. An acceptable excursion area within which the fire may safely spread past the bounds of the intended burn site spans from Lawrence Creek to Eaton Creek, and is bordered by the Smoky River and the tree line, above which a fire is unable to burn (Figure 1.2).

1.3.1 Physical Characteristics

The Kvass Flats burn site falls within both the upper foothills and the subalpine ecoregions, which extend from 1000m to 1500m, and from 1360m to 2000m respectively (Lane and Willoughby 1998). These ecoregions experience cool temperatures and generally moist conditions (Holland and Coen 1983), and are characterised by well-drained regosols and brunisols in aspen-dominated areas, and well-drained brunisols and chernozems in grassland areas (McCallum and Irwin 1997). The mean annual temperature at low elevations is approximately $0^{o}C$, although temperatures decrease with increasing elevation by approximately $0.5^{o}C$ per 100m (Holland and Coen 1983). The amount of annual precipitation increases with elevation, ranging from 655mm/year in the upper foothills and lower subalpine to 763mm/year in the upper subalpine, with most precipitation occurring during the winter (Holland and Coen 1983).

1.3.2 Biological Characteristics

The subalpine ecoregion consists almost entirely of closed coniferous forest, and is dominated by Englemann spruce (*Picea engelmannii)* and subalpine fir *(Abies lasiocarpa)* (Holland and Coen 1983). Seral lodgepole pine *(Pinus contorta)* forests are also common, especially at lower altitudes (Holland and Coen 1983). Trembling aspen *(Populus tremuloides)* is found throughout the upper foothills ecoregion, and on south-facing slopes within the subalpine ecoregion.

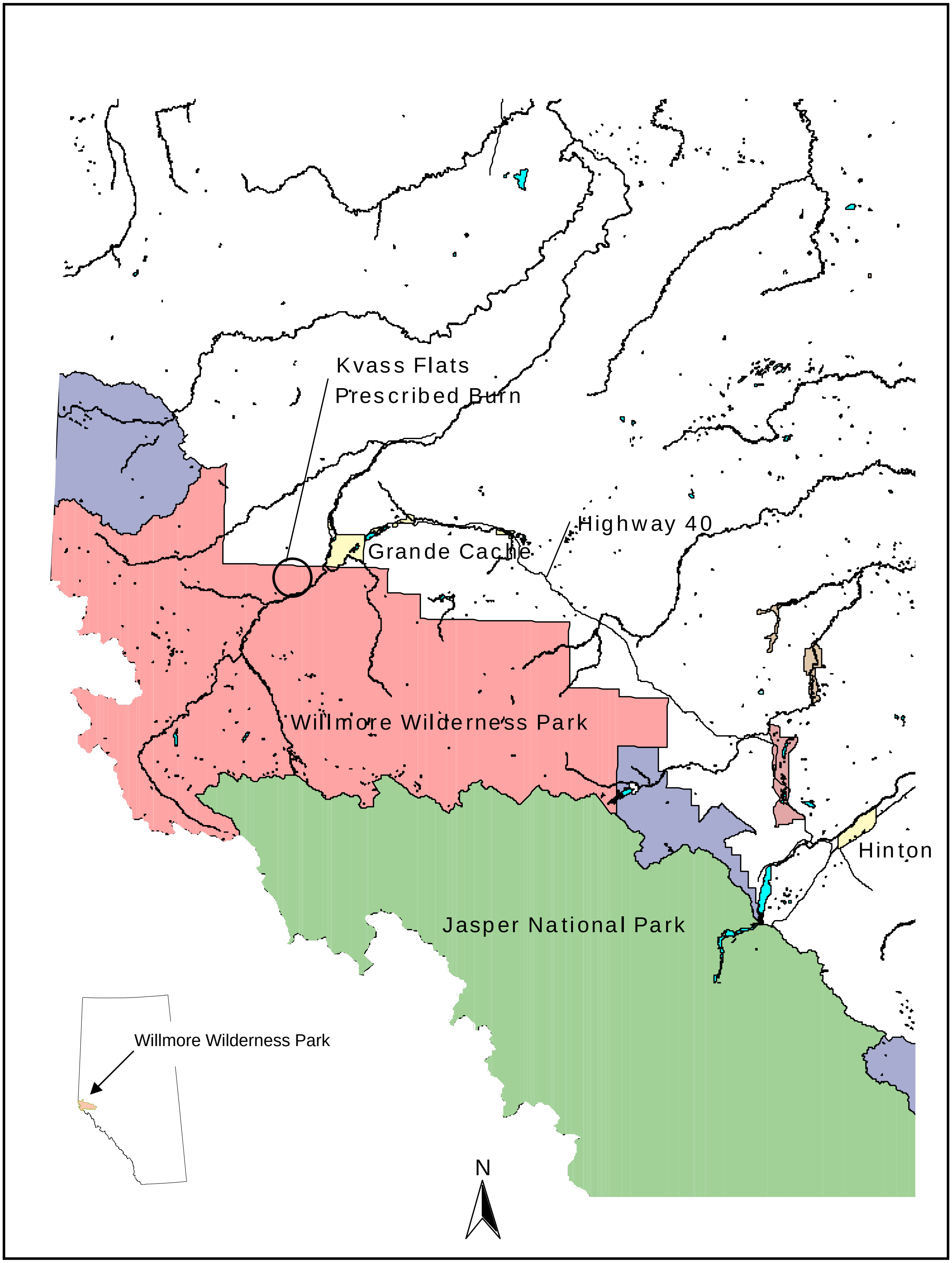


Figure 1.1 Location of Kvass Flats prescribed burn.

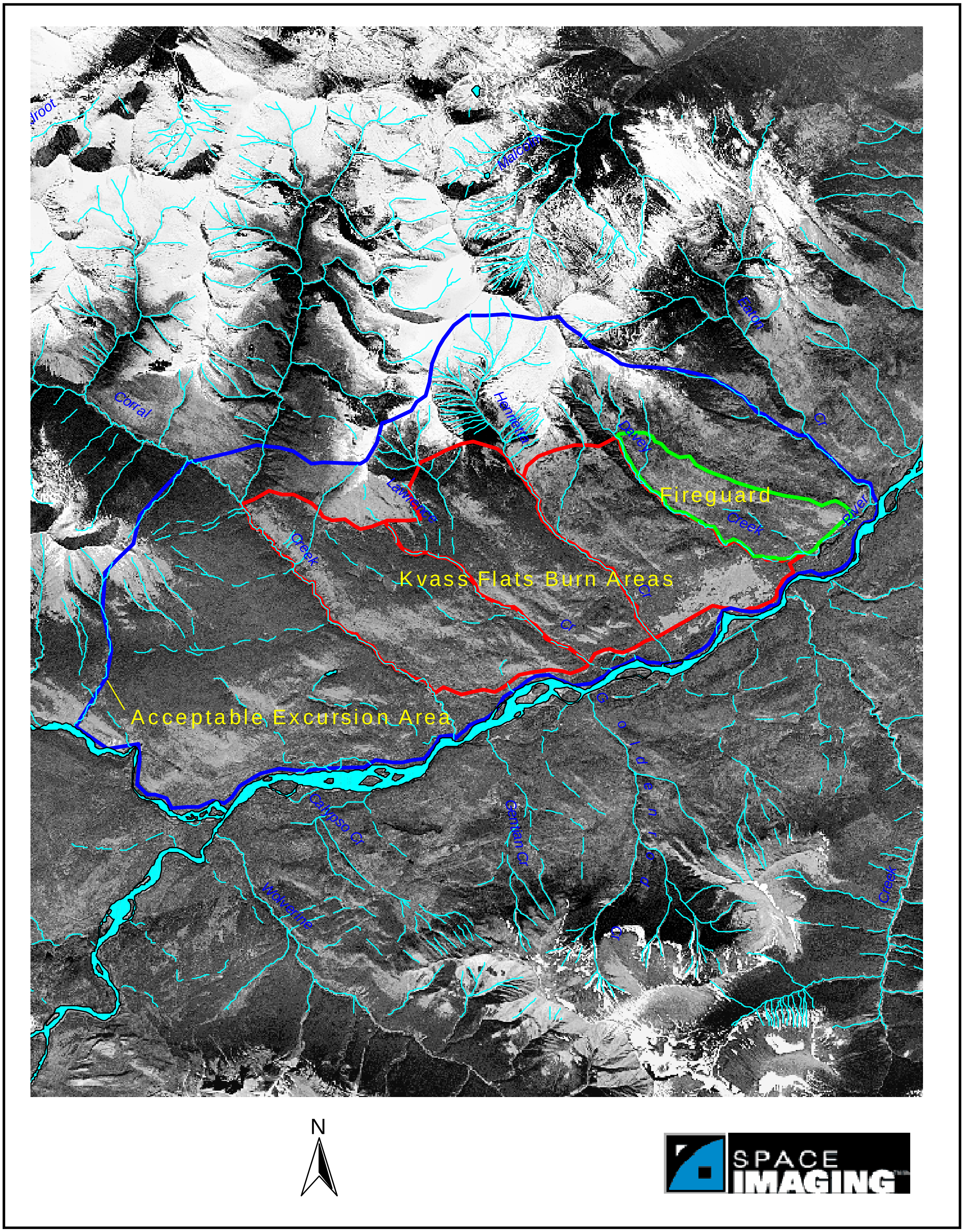


Figure 1.2 Map displaying details of prescribed burn at Kvass Flats.

The subalpine ecoregion supports a diverse assemblage of wildlife such as elk, moose *(Alces alces)*, mule deer *(Odocoileus hemionus)*, whitetail deer *(Odocoileus virginianus)*, black bear *(Ursus americanus)*, grizzly bear *(Ursus arctos)*, wolves *(Canis lupus)* and a large number of other fur bearing species (Holland and Coen 1983). Due to climatic conditions, fish species are limited to cool and coldwater fishes, with salmonids being the dominant sportfish.

1.3.3 Human Characteristics

The Kvass Flats study area is currently being impacted by a number of human-induced activities. Of greatest concern is long-term horse grazing in the area, and the adverse effects this has on available wildlife habitat (Appendix 6, Plate 14). On a number of occasions during pre- and post-burn assessments done in the Kvass Flats area in 2001, approximately 15 to 20 horses were observed grazing on the Kvass Flats. Though grazing is permitted, the timing of this grazing activity is at times inconsistent with management plans for the area, but has been occurring for an extended period of time. A post-burn report for the 1987 Kvass Flats prescribed burn documented increased horse grazing on the burn site after the completion of the prescribed burn (Bighorn Environmental Design Ltd. 1994). Because elk and horses find similar forage palatable, the presence of horse grazing in preferred elk habitat is potentially detrimental to elk populations in the area. The consumption of elk forage by horses also limits the success of any project aimed at improving elk habitat in Kvass Flats.

Recreational activity is also prevalent in the Kvass Flats area, and has increased a great deal in recent years. A majority of recreation in the area consists of both recreational and commercial trail riding, although hunting and fishing pressure in the area is also considered high. Due to its designation as a protected area, motorised vehicles are not permitted in the park (with the exception of registered trappers), deterring much of the public, and reducing the potential human impact on the area. Resource development is also prohibited in the Willmore Wilderness Park, which is extremely beneficial for wildlife in the park in that changes to the natural environment are minimal in comparison to heavily developed areas.

1.4 Factors Influencing Prescribed Burns

1.4.1 Weather Conditions

Weather plays an extremely important role in determining the success of a prescribed burn. Many specific weather conditions are necessary in order to have a successful burn. There are four main parameters influencing fire weather - relative humidity, temperature, wind, and precipitation (Alberta Environment 2000). These data can be used to determine the potential effectiveness of the burn throughout the day, and can be compared with ideal burn conditions in order to draw conclusions regarding the degree of success of the prescribed burn.

Relative humidity is possibly the most important weather parameter to consider, and should be approximately 15-30%. This range is ideal because conditions are dry enough for ignition, but not so dry that the fire is not easily controlled (Alberta Environment 2000). Relative humidities within this range result in moderate to good burning conditions. Temperature is an important factor due to the role it plays in determining relative humidity; an inverse relationship can be seen between the two variables. Wind contributes to the drying of fuels, and determines spread rates of fires and fire shape, influencing the locations of burned areas within the prescribed burn site, and the ability of crews to control the fire (Alberta Environment 2000). A maximum wind speed of 15-

20km/h is recommended to maintain control of a prescribed burn. Precipitation is the final parameter, obviously closely linked to relative humidity and the ability to achieve ignition. Zero precipitation is necessary to achieve ignition and to allow for the drying of fuels. Optimum conditions depend on the cumulative effect of all parameters, and are reached only when each parameter is within the desired range.

1.4.2 Fuel Conditions

Fuel conditions, closely related to the weather parameters discussed above, are extremely important in determining the results of a prescribed burn. Although weather conditions may allow for the ignition of a burn, the ability of the fire to burn at a certain intensity and spread effectively is determined by fuel parameters.

Although many fuel parameters need to be taken into consideration prior to and during a prescribed burn, the most significant of these is likely the build-up index (BUI). The BUI is the total weight of fuel available for combustion, and increases as fuels dry. The higher the BUI, the greater the fuel consumption, and therefore the higher the potential fire intensity (personal communication, Dave Taylor). BUI is determined by a combination of temperature, precipitation, duff moisture code (DMC) and drought code (DC). DMC and DC are measures of the moisture content of mid-size and large fuel types, and give qualitative ratings of the degree of flammability of the fuels (De Groot 1987). Based on the objectives of this project, the optimum BUI level was set at approximately 40 (no units), at which level fuel is able to burn intensely enough to scorch the cambium (sapwood) layer of mature aspen stems, but not so intensely that coniferous areas burn out of control (personal communication, Dave Taylor).

Another important parameter to consider in conjunction with BUI is the Initial Spread Index (ISI). The ISI is determined by wind speed and the fine fuel moisture code (FFMC), increasing as wind becomes stronger and fine fuels become drier. The drying of fine fuels is in turn dependent on temperature, precipitation, wind, and relative humidity. The optimal ISI level was set at 11 for the purposes of this project. ISI and BUI levels are combined in order to determine the potential fire intensity, which increases with an increase of either BUI or ISI levels.

An optimal fire intensity is chosen based on the objectives of the project, specifically the fuel types to be burned and the extent to which each fuel type is to be burned. When multiple fuel types are present, an average fire intensity is chosen. Because different fuel types will burn effectively at different fire intensities, it is extremely difficult to select effective BUI and ISI levels when sites contain mixed fuels. In this case, an ideal intensity was selected based on the objective of burning the less flammable trembling aspen stands thoroughly, while at the same time not allowing the more flammable coniferous stands to burn at an intensity with which control could not be maintained. Once the optimal fire intensity for the project is selected, an adequate burn window can be determined based on the weather and fuel conditions necessary to achieve the determined fire intensity.

Ideal prescribed burn conditions therefore depend not only on adequate weather conditions, but also to a great extent on fuel conditions, which determine the ability of the fire to burn at a desired intensity.

1.5 Time Line of Events

Activities relative to the 2001 Kvass Flats prescribed burn occurred on:

April 5, 2001	Installation of the remote automated weather station (RAWS)
April 27, 2001	Fireguard established between Davey Creek and Eaton Creek
May 10-11, 2001	Pre-burn vegetation sampling and pellet count surveys
May 12, 2001	Prescribed burn
June 20, 2001	Post-burn assessment

1.6 Funding

Funding for this project was provided by the Alberta Conservation Association's Wildlife Habitat Development Program (WHDP), the Rocky Mountain Elk Foundation, and Alberta Sustainable Resource Development (Appendix 7).

2.0 Methods and Description of Activities

2.1 Remote Automated Weather Station Installation

On April 5, 2001 a Remote Automated Weather Station (RAWS) was installed at Kvass Flats by Dave Taylor (LFS), Len Stroebel (LFS) and Sheldon Kowalchuk (ACA) (Appendix 6, Plate 1). A Bell 206 was used to transport the equipment to the burn site due to the remoteness of the site and the restrictions on motorised traffic in Willmore Wilderness Park. The weather data collected was monitored in order to determine a suitable burning window for the prescribed burn.

2.2 Fireguard Establishment

The fireguard located between Davey Creek and Eaton Creek was established on April 27, 2001, in order to secure the area to the east of the main prescribed burn (Appendix 6, Plate 2). A certified fire boss from Alberta Sustainable Resource Development (Lands and Forest Service) supervised activities during the establishment of the fireguard, and was assisted by two ACA employees and five Type III fire fighters. Personnel and supplies were transferred to the site with an A-star helicopter.

The burn was ignited using hand-held drip torches, with ignition proceeding progressively down slope in order to control the spread rate of the burn (Appendix 5). Due to the early season timing of the burn, burning conditions were moderate, consisting of low wind speeds, higher than desired relative humidities, and a low build-up index. In particular, the preferred duff moisture code and drought code were low in comparison to ideal burning conditions.

Fine fuels in forested areas bordering grassland slopes, and grassland slopes themselves were targeted during the burning of the fireguard due to the moderate burning conditions (Appendix 6, Plate 3). Because only fine fuels were successfully burned, it was concluded that the resultant fireguard was somewhat insufficient to allow ignition of the main prescribed burn. Larger fuels were to be burned the day of the main burn, when burning conditions were more favourable and a greater amount of dry fuels were available to burn.

2.3 Pre-burn Sampling and Pellet Count Surveys

Pre-burn vegetation sampling and pellet count surveys were conducted on May 10 and 11, 2001 in order to determine wildlife use, and the abundance and condition of trees found along pre-established transects (Appendices 1 and 2). Transects were set up in the early 1980s, and have been used to assess pre- and post-burn vegetation on Kvass Flats since that time (McCallum and Irwin 1997). Each transect measures 100 metres in length with stakes located at 20 metre intervals beginning at zero metres, and concluding at 100 metres. For each transect that could be located (Appendix 2), a 3.99 metre plot cord was used to determine the number of trees present within a circular plot at each stake. Only trees for which diameter at breast height could be measured were included in the survey, listing the species, diameter at breast height, and whether the tree was alive or dead at the time of observation (Appendix 3).

Pellet counts were taken along each 100 metre transect, recording all pellet types present within one metre either side of the transect line. Observations of species present and the total number of pellet groups of each species found along the transect were recorded and expressed as pellet groups per hectare (Appendix 3). These surveys were conducted in order to determine wildlife use of the area prior to the prescribed burn.

2.4 Prescribed Burn Activities

The main prescribed burn was conducted on May 12, 2001 by Alberta Sustainable Resource Development (Lands and Forest Service) and the Alberta Conservation Association. Crews were put in place the morning of the burn, and a safety meeting was conducted at the Grande Cache Ranger Station to address safety concerns prior to ignition. Personnel were then ferried to the burn site by helicopter, where the final fireguard was secured. Strips were ignited by hand in the fireguard area in order to burn the larger fuels that were unaffected by the fireguard burn conducted on April 27, 2001 (Appendix 6, Plate 6). The fireguard was successfully widened due to the lower moisture content of fuels in the area. In addition to widening the original fireguard, tankers stationed at the Grande Cache airport were used to increase the effectiveness of the fireguard by laying a foam line on the eastern perimeter of the fireguard area.

Following the completion of the fireguard, a meeting was held at the staging area to discuss a plan to implement the main prescribed burn (Appendix 6, Plate 4). Aerial ignition of the main burn was initiated following the removal of all personnel from the burn area, and, where possible, strips along the slopes were ignited (Appendix 6, Plate 7). Strips were ignited approximately 100 metres apart, beginning on the east end of the burn site, and proceeding progressively west so that each strip burned downwind and upslope into an area in which fuels had already been consumed. The main flats were ignited from the lower trail with a hand-held drip torch. The ignition pattern was altered midway through the burn, at which time fuel was dropped on areas that would burn effectively, with ignition occurring in a circular fashion. Open areas of higher flammability were ignited initially, with intentions of the burn spreading to surrounding areas of lower flammability.

2.5 Post-burn Sampling

In order to determine the success of the prescribed burn, the burn site was revisited on June 20, 2001, at which time observations were made regarding whether the desired results had been achieved (Appendix 6, Plate 11). Transects surveyed prior to the burn were revisited and visually assessed in order to record any changes in the area resulting from the burn. In general, the post-burn assessment was aimed at determining which transects burned, and to what extent. At each transect, an estimate of the percentage of area effectively burned was made, along with general observations of the vegetation found in the area. Although vegetation abundance was not measured as in the pre-burn survey, presence/absence data was collected, allowing some degree of comparison between pre- and post-burn conditions. Pellet count surveys were not conducted during the post-burn assessment due to the short length of time elapsed since the prescribed burn and the resultant inability to assess overwinter use of the site, however any observed wildlife activity was recorded in order to identify species present in the area.

3.0 Results

3.1 Pre-burn Vegetation Sampling and Pellet Count Surveys

Transect 1 - Vegetation consists mostly of trembling aspen, with occasional balsam poplar *(Populus balsamifera)*. Diameters at breast height range from 7.1cm to 36.8cm. Much deadfall is present throughout this transect. Pellet groups observed include hare (600 pellet groups/ha), elk (500 pellet groups/ha), deer (500 pellet groups/ha), and horse (350 pellet groups/ha).
Transect 2 - Vegetation consists entirely of trembling aspen, most of which is approximately one metre tall. Diameters at breast height range from 0.9cm to 8.4cm. Vegetation is heavily browsed throughout. Pellet groups observed include deer (600 pellet groups/ha), elk (350 pellet groups/ha), horse (250 pellet groups/ha), and bear (100 scat groups/ha). This is the only transect in which bear activity was observed.
Transect 3 - Vegetation consists of shrub species, dominated by rose *(Rosa acicularis)*, with an average height of 0.5m. No trees are found in this transect. Pellet groups observed include elk (850 pellet groups/ha), horse (600 pellet groups/ha) , and deer (450 pellet groups/ha). This transect contains a majority of the elk activity observed throughout the burn site.
Transect 4 - Vegetation consists of shrubs and grasses, with no trees present in this transect. Pellet groups observed include deer (800 pellet groups/ha), horse (450 pellet groups/ha), and elk (250 pellet groups/ha).
Transect 5 - Vegetation consists mostly of trembling aspen, with a single balsam poplar observed. Diameters at breast height range from 3.7cm to 38.2cm. Pellet groups observed include deer (500 pellet groups/ha), elk (300 pellet groups/ha), horse (250 pellet groups/ha), and hare (200 pellet groups/ha).
Transect 7 - Vegetation consists mostly of trembling aspen, with white spruce *(Picea glauca)* present in some areas. Diameters at breast height range from 0.6cm to 34.5cm. Pellet groups observed include hare (600 pellet groups/ha), deer (100 pellet groups/ha), and horse (50 pellet groups/ha). This transect contains the lowest amount of wildlife activity observed throughout the burn site.
Transect 8 - Vegetation consists entirely of trembling aspen, with diameters at breast height ranging from 7.0cm to 31.5cm. Pellet groups observed include horse (400 pellet groups/ha), elk (350 pellet groups/ha), deer (300 pellet groups/ha), and hare (150 pellet groups/ha).

In general, deer activity was observed more frequently than any other species, indicating heavy use of the area by deer. In total, 62 deer pellet groups were observed. Elk use was observed to be slightly less than that of deer, with 52 observed pellets groups. Elk activity was lacking only in transect 7, which consists of mature mixedwood forest. Horse activity was almost as frequent as elk activity, with 46 pellet group observations recorded throughout the burn site. Hare activity was observed only in transects dominated mature trees, with no observations in shrub-dominated transects. In total, 31 hare pellet groups were observed. Bear activity was noted in only one transect.

Refer to Appendix 3 for pre-burn vegetation sampling and pellet count survey field notes.

3.2 Main Burn Weather Data

Table 3.1 Weather information obtained from the Remote Automated Weather Station (RAWS), May 12, 2001.

Date	Time	Temperature (^oC)	Relative Humidity (%)	Avg. Wind Speed (km/hr)	Max. Wind Speed (km/hr)	Wind Direction (degrees)	Rainfall (mm)
2001 May 12	0:00	1.3	79	0	5	147	0
2001 May 12	1:00	0.4	85	4	5	85	0
2001 May 12	2:00	-0.4	89	0	5	69	0
2001 May 12	3:00	-0.3	90	3	5	74	0
2001 May 12	4:00	-0.1	91	2	5	147	0
2001 May 12	5:00	0.1	91	3	5	242	0
2001 May 12	6:00	-1.1	96	2	6	48	0
2001 May 12	7:00	-1.5	98	4	6	143	0
2001 May 12	8:00	2.8	82	2	5	325	0
2001 May 12	9:00	5.7	69	5	8	31	0
2001 May 12	10:00	10.5	48	4	10	1	0
2001 May 12	11:00	13.1	39	6	13	278	0
2001 May 12	12:00	15.7	35	7	15	288	0
2001 May 12	13:00	18.1	32	6	25	317	0
2001 May 12	14:00	20.3	27	6	17	285	0
2001 May 12	15:00	21.6	24	6	20	78	0
2001 May 12	16:00	22.1	23	8	22	64	0
2001 May 12	17:00	21.9	22	11	26	57	0
2001 May 12	18:00	20.5	24	10	25	74	0
2001 May 12	19:00	20.6	23	10	22	62	0
2001 May 12	20:00	19.4	26	5	25	84	0
2001 May 12	21:00	17.2	34	19	36	42	0
2001 May 12	22:00	12.7	62	12	30	104	0

3.3 Post-burn Assessment

<u>Transect 1</u> - Burned from stations A3 to A5, but was extremely patchy. Trees in this transect exhibited scorch heights of up to approximately two metres. Between transects 1 and 2 the burn was extremely effective, with scorch heights of up to approximately five metres observed on some mature trembling aspen.
<u>Transect 2</u> - Burned almost entirely (approximately 90%). Young trembling aspen in the area appear to be dead, with no leaves present at the time of observation.
<u>Transect 3</u> - Burned completely.
<u>Transect 4</u> - Burned partially for approximately 50m from K6, but was not burned toward K1 due to heavy grazing activity.
<u>Transect 5</u> - Unburned.
<u>Transect 7</u> - Unburned.
<u>Transect 8</u> - Burned partially, specifically around O4, but was unburned from O1 to O3. The majority of burned areas in this transect occurred where deadfall was present.
<u>Transect 9</u> - Unburned.

The difference in the effectiveness of the burn between grassland areas and forested areas is apparent based on the above observations. Results show that grassland areas burned extremely well, with some transects burning completely; transects 2 and 3 are good examples of this. Other grassland transects such as 4 and 8 did not burn entirely due to factors relating to the specific transect locations. Transect 4 would likely burn extremely well under normal circumstances, but at present is heavily grazed, resulting in a great deal of ground left unvegetated and exposed. Transect 8 does not consist entirely of open grassland habitat, therefore most of the burn occurred in areas consisting of deadfall, resulting in a partial burn of this transect (Appendix 6, Plate 12). A general observation made throughout all open grassland transects was the presence of saskatoon *(Amelanchier alnifolia)*, raspberry *(Rubus spp.)* and fireweed *(Epilobium angustifolium)* in abundance.

Forested areas consisting of mature trembling aspen burned somewhat less effectively than grassland areas, with some areas burning only slightly, and others left completely unburned. Transects 5 and 7 showed no effects of the burn, with thick understory vegetation and unscorched trembling aspen observed throughout. Transect 1 burned well in small patches, most of which were located on the edge of open areas and areas consisting of deadfall. Scorch heights of approximately two metres were observed on the east edge of the transect bordering an open area, although these trees were not killed by the burn (Appendix 6, Plate 13).

Coniferous forest areas also burned extremely poorly in comparison to open grassland areas. Only transect 9 was observed specifically in order to collect post-burn data for coniferous areas, but through general observation of the burn site it was determined that areas consisting of coniferous forest did not burn as expected. Transect 9 was left completely unburned, with a healthy understory and no scorching of mature trees. Stakes at stations J5 and J6 were not located during the post-burn assessment due to heavy understory growth.

4.0 Discussion

The main prescribed burn was conducted on May 12, 2001 based on weather data collected from the remote automated weather station (Appendix 6, Plate 5) and weather forecasts for the Grande Cache area. It was determined prior to the day of the main burn that this was the only acceptable window of suitable weather and fuel conditions in the near future (Appendix 5). Because deciduous trees in the area were nearing the leaf flush stage, it was decided that this was the final opportunity to implement a spring burn.

By mid-afternoon on the day of the prescribed burn, weather parameters were within an acceptable range. Although weather conditions were near ideal, fuel conditions were inadequate, and did not allow the fire to burn at an appropriate intensity. For this reason, forested areas containing larger, less flammable fuel types did not burn well. This was noted as the burn progressed (Appendix 6, Plates 8-10), and it was determined that strip ignition was inefficient as only certain fuel types were burning effectively. In response to this observation, the ignition pattern was changed midway through the burn in order to increase the effectiveness of the burn. This did not give the intended results, however, and the resulting burn consisted of patches of burned grassland area, surrounded by unburned forested area.

Although approximately 4,200 acres of mature trembling aspen forest, grassland, and coniferous forest was to be burned, the success of the burn was low with only approximately 15% of the area burning effectively (personal communication, Ray Olsson). Because very little area burned as expected, a full post-burn assessment was not deemed necessary, and the area was simply visually assessed. This allowed some conclusions to be drawn regarding the results of the burn, and will provide guidance for future burns in this area. Had a the fire intensity been high enough to burn a greater area effectively, however, a complete post-burn assessment would have been carried out, including measurements of vegetation and pellet count surveys. A fire intensity capable of burning forested sections could have been achieved by either a higher build-up index or a higher initial spread index.

The BUI was lower than desired on the day of the burn, with a level of 31 recorded at the Grande Cache weather station, somewhat lower than the preferred 35-40 (Appendix 5). Although the duff moisture code was at the high end of the acceptable prescription range, recorded at a level of 20, the drought code was significantly lower than the acceptable level of 399, recorded at only 166. Had the drought code been at a more acceptable level, fire intensity would have been increased significantly due to a resulting increase in BUI, and therefore the larger fuels found in forested areas would have burned effectively.

The fire intensity was also lower than desired due to a low initial spread index, which was recorded at 4.6, versus a desired 11. Higher wind speeds on the day of the burn were needed to increase ISI levels, as the fine fuel moisture code was at an optimal level, recorded at 91. This low fire intensity caused ignited grassland areas to burn, but did not allow the fire to spread to surrounding areas containing fuels of lower flammability, which resulted in the patches of burned grassland area, surrounded by unburned forested areas.

Had fuel conditions been ideal on the day of the Kvass Flats prescribed burn, results obtained would have been significantly more successful. Although weather conditions were certainly adequate for ignition, fuel conditions did not allow the fire to burn with the appropriate intensity, preventing it from spreading to the intended areas. This resulted in the large forested areas left unburned. Based on weather reports for the Grande Cache area, it is now apparent that May 12, 2001 was in fact not an acceptable burning window for the prescribed burn, exhibiting acceptable weather conditions but inadequate fuel conditions.

5.0 Summary and Recommendations

The prescribed burn at Kvass Flats could not be considered a complete success due to the large amount of land that did not burn. Because the area that burned effectively was so small (approximately 15%), neither the primary objective, increasing available elk grassland habitat, nor the secondary objective, creating a fire break through the reduction of fuels, were met. The burn was not a failure, however. The areas that burned effectively will provide valuable ignitions sites for future burns at Kvass Flats, which may help to improve the success of future projects.

As this was the first prescribed burn conducted in the Northern East Slopes Region since 1994, it was optimistic to see the various agencies come together in an attempt to achieve the pre-determined objectives. Because a large amount of time elapsed since the previous prescribed burn, a number of improvements could be made for future burns.

Recommendations to improve the success of future prescribed burns include:

1) Burning in the entire fireguard on a day prior to ignition day of the main burn.
2) Conduct a safety briefing in Grande Cache on the day before the main burn.
3) Ferry required staff to the burn area earlier in the day so that all staff are in place when the burning window appears.
4) Light the grassy flats with hand torches rather than using aerial ignition options. Helicopter will be used to light areas on steeper terrain.
5) Commence the ignition of the burn area between 12:00 and 13:00 in order to take advantage of the short burning window in the Kvass Flats area in April or May.
6) Discuss the ignition process used in mountainous prescribed burns, as opposed to flat terrain, prior to the main burn so that crews are comfortable using the necessary ignition techniques.
7) Conduct detailed post-burn evaluations of transects to determine the effects of the burn on trembling aspen, and carry out post-burn pellet count surveys.
8) Install additional RAWS to determine conditions at mid-slope and upper slope areas.
9) Conduct fuel loading transects for upper, mid and lower elevations in order to characterise the fuels available on-site that are likely to affect fire behaviour.
10) Locate or re-establish vegetation and wildlife monitoring transect markers.

An additional wildlife habitat impact closely associated with the Kvass Flats prescribed burn that has not yet been addressed is the management of horse grazing by local and recreational users. Kvass Flats wildlife will not receive the full benefit of the burn in accordance with the burn objectives if the increase in available forage is consumed by horses. This is problematic because the objectives of the project reflect those of the funding organisations, including dollars raised through levies placed on hunting licences and money contributed by other conservation organisations, whose interests are in improving elk habitat rather than forage for horses in the area. It is strongly recommended that efforts be made to curtail this problem in order to provide the maximum benefit for wildlife, as well as to improve chances of meeting future project objectives.

Literature Cited

Alberta Environment. 2000. Wildfire Orientation. Environmental Training Centre, Hinton, Alberta. Unit II A Part 3. Pp. 4.

Bighorn Environmental Design Ltd. 1994. Kvass Flats prescribed burn – post-burn evaluation 1989. Alberta Fish and Wildlife Services. Pp. 3.

De Groot, William J. 1987. Interpreting the Canadian Forest Fire Weather Data Index (FWI) System – a presentation made at the fourth Central Region Fire Weather Committee Scientific Technical Seminar, April 2, 1987, Winnipeg Manitoba. Pp. 7.

Eslinger, Dale. 1994. Kvass Flats Prescribed Burn Proposal. Fish and Wildlife Services, Rocky Mountain House, Alberta.

Holland, W. D., and G. M. Coen (eds.). 1983. Ecological (Biophysical) Land Classificatioin of Banff and Jasper National Parks. Volume I: Summary. Pp. 7.

Lane, C., and M. Willoughby. 1998. Rangeland monitoring in Willmore Wilderness Park – progress report for Foothills Model Forest. Alberta Environmental Protection. Pp. 1.

McCallum, B., and S. Irwin. 1997. Postburn vegetation inventory after the second Kvass Flats prescribed burn May 8, 1994. Alberta Fish and Wildlife Services. Pp. 2.

Olsson, Ray. Wildfire and Aviation Officer. Alberta Sustainable Resource Development (Lands and Forest Service), Edson, Alberta. Personal Communication. May 12, 2001.

Smith, Kirby. Area Wildlife Biologist. Alberta Sustainable Resource Development (Fish and Wildlife Service), Edson, Alberta. Personal Communication. Spring 2001.

Taylor, Dave. Forest Technician. Alberta Sustainable Resource Development (Lands and Forest Service), Edson, Alberta. Personal Communication. November 20, 2001 and December 3, 2001.

Appendices

Appendix 1. Description of locations and UTMs for transects located at the Kvass Flats prescribed burn site.

Transect 1
- 352086 and 5964593 (GPS location at start point, where the first stake should be).
- Bearing is 60^o from the western-most stake.
- A-series used to label stations along this transect.
- Missing the first stake.

Transect 2
- 352605 and 5964851 (GPS location at end point).
- Bearing is 160^o beginning 10 steps south of the trail.
- B-series used to label stations along this transect.

Transect 3
- 352868 and 5965083 (GPS location at end point).
- Bearing is 180^o.
- D-series used to label stations along this transect.
- D6 was not in line with the rest of the transect. We did not move the stake, so the transect was bent.

Transect 4
- 352030 and 5964450 (GPS location at end point).
- Bearing is 180^o.
- K-series used to label stations along this transect.
- Only the sixth stake remains.
- The first stake should be located approximately three steps north of bare soil area.

Transect 5
- 351805 and 5964653 (GPS location at start point).
- Bearing is 170^o beginning one metre south of the trail.
- I-series used to label stations along this transect.
- I1 has been replaced with T1.

Transect 6
- Unable to locate this transect.
- Located 165 steps at 240^o from the half-dead spruce tree on the hilltop at the edge of the grassy slope. This tree has since been burned and has fallen down. Watch for the large spruce at the north-west corner of the grassland and orient from there. In 1994 staff walked onto the fifth stake from the game trail from the lower meadow on the west side of the transect.
- Bearing is 180^o.
- C-series used to label stations along this transect.

Transect 7
- 352481 and 5965138 (GPS location at start point).
- Bearing is 360^o.
- H-series used to label stations along this transect.

Transect 8
- 351963 and 5964382 (GPS location at start point, where first stake should be).
- Bearing is 180^o along crest of ridge.
- O-series used to label stations along this transect.
- First and third stakes are missing.

Transect 9 - 351899 and 5964728 (GPS location at start point).
- Bearing is 360^o.
- J-series used to label stations along this transect.
- Due to time constraints could not find other stakes and survey transect.

Transect 10 - 351929 and 5964905 (Note: approximate GPS location obtained from locations on map in a previous report and from speaking with Kirby Smith. Derived the location using ArcView.).
- Located 48 steps at 80^o from the open grassland slope. No stakes found.
- Bearing is 350^o.
- E-series used to label stations along this transect.
- The first stake is missing.

Transect 11 - 351683 and 5965084 (Note: approximate GPS location obtained from locations on map in a previous report and from speaking with Kirby Smith. Derived the location using ArcView.).
- First stake is located 17 steps north-west (320^o) from the large dead pine tree at the edge of the clearing and 54 steps from the tallest pine tree.
- Bearing is 80^o.
- G-series used to label stations along this transect.

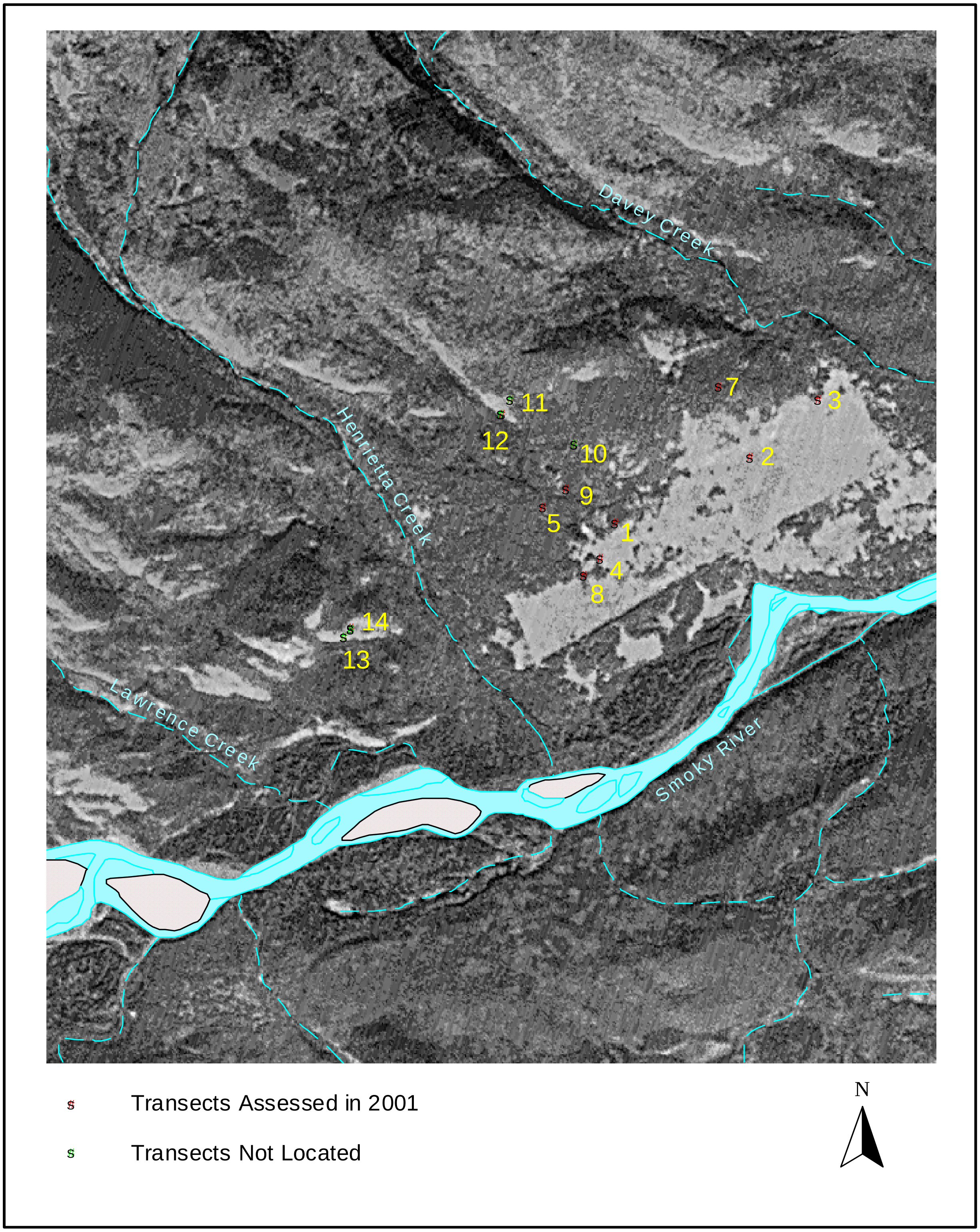
Transect 12 - 351648 and 5965026 (Note: approximate GPS location obtained from locations on map in a previous report and from speaking with Kirby Smith. Derived the location using ArcView.).
- First plot should be located 13 steps uphill of the large rock immediately below the large pine tree of transect 11.
- Bearing is 200^o, runs downhill for 50 metres.
- No stakes were located.
- Plots measured every five metres.

Transect 13 - 351042 and 5964134 (Note: approximate GPS location obtained from locations on map in a previous report and from speaking with Kirby Smith. Derived the location using ArcView.).
- First stake located in the bottom of the gully 144 cm north of the largest trembling aspen on the east-west path crossing the gully.
- Bearing is 330^o up the bottom of the gully.

Transect 14 - 351069 and 5964169 (Note: approximate GPS location obtained from locations on map in a previous report and from speaking with Kirby Smith. Derived the location using ArcView.).
- Bearing is 160^o; transect was 40 metres long with 11 plots located every four metres.
- Stakes marking the upper and lower plots were only located centrally on the slope. There are rock outcrops on the meadow to the west of T14. T13 is located in the gully separating these two meadows.

Transect 15 - Located on grassland to the west of T12.

Appendix 2. Map of historic transect locations at the Kvass Flats prescribed burn site.



Appendix 3. Pre-burn vegetation sampling and pellet count survey field data.

Transect 1

Stake A1	Sample	DBH (cm)	Species	Live - Y/N
	1	36.8	Trembling Aspen	Yes
	2	28.5	Trembling Aspen	Yes

Pellet groups per hectare:

Elk - 500
Deer - 500
Horse - 350
Hare - 600

Stake A2	Sample	DBH (cm)	Species	Live - Y/N
	1	26.4	Trembling Aspen	Yes
	2	27.5	Trembling Aspen	Yes
	3	26.1	Trembling Aspen	Yes
	4	26.3	Trembling Aspen	Yes
	5	19.7	Trembling Aspen	Yes
	6	22.0	Trembling Aspen	Yes
	7	26.2	Trembling Aspen	Yes
	8	21.0	Trembling Aspen	Yes
	9	30.4	Trembling Aspen	Yes

Stake A3	Sample	DBH (cm)	Species	Live - Y/N
	1	32.8	Trembling Aspen	Yes
	2	28.1	Balsam Poplar	Yes
	3	16.8	Balsam Poplar	Yes
	4	35.2	Trembling Aspen	Yes
	5	27.5	Balsam Poplar	No
	6	7.1	Balsam Poplar	Yes

Stake A4	Sample	DBH (cm)	Species	Live - Y/N
	1	32.9	Trembling Aspen	Yes
	2	33.6	Trembling Aspen	Yes
	3	28.1	Trembling Aspen	No

Stake A5	Sample	DBH (cm)	Species	Live - Y/N
	1	22.6	Trembling Aspen	No
	2	31.5	Trembling Aspen	Yes
	3	26.7	Trembling Aspen	Yes
	4	25.5	Trembling Aspen	Yes

Stake A6	Sample	DBH (cm)	Species	Live - Y/N
	1	28.5	Trembling Aspen	Yes
	2	22.9	Trembling Aspen	No
	3	29.0	Trembling Aspen	Yes
	4	23.2	Trembling Aspen	Yes
	5	25.5	Trembling Aspen	No
	6	33.3	Trembling Aspen	Yes
	7	34.7	Trembling Aspen	Yes

*Abundant deadfall present along this transect.

Transect 2

Stake B1 *No trees present.

Pellet groups per hectare:
Elk - 350
Deer - 600
Horse - 250
Bear - 100

Stake B2	**Sample**	**DBH (cm)**	**Species**	**Live - Y/N**
	1	1.6	Trembling Aspen	No
	2	1.3	Trembling Aspen	No
	3	0.9	Trembling Aspen	Yes
	4	0.8	Trembling Aspen	No
	5	1.0	Trembling Aspen	Yes

Stake B3 *No trees present.

Stake B4 *No trees present.

Stake B5	**Sample**	**DBH (cm)**	**Species**	**Live - Y/N**
	1	8.4	Trembling Aspen	No

Stake B6 *No trees present.

*Vegetation present along this transect consists of trembling aspen approximately 1m tall.

Transect 3

Stake D1 *No trees present.

Pellet groups per hectare:
Elk - 850
Deer - 450
Horse - 600

Stake D2 *No trees present.

Stake D3 *No trees present.

Stake D4 *No trees present.

Stake D5 *No trees present.

Stake D6 *No trees present.

*Vegetation present along this transect consists of rose and other shrubs.

Transect 4

Stake K1 *No trees present.

Pellet groups per hectare:
Elk - 250
Deer - 800
Horse - 450

Stake K2 *No trees present.

Stake K3 *No trees present.

Stake K4 *No trees present.

Stake K5 *No trees present.

Stake K6 *No trees present.

*Vegetation present along this transect consists of shrubs and grasses.

Transect 5

Stake I1	Sample	DBH (cm)	Species	Live - Y/N
	1	29.0	Trembling Aspen	No
	2	29.5	Trembling Aspen	Yes
	3	15.0	Trembling Aspen	Yes
	4	27.8	Trembling Aspen	Yes
	5	22.0	Trembling Aspen	Yes
	6	24.5	Trembling Aspen	Yes
	7	24.3	Trembling Aspen	Yes
	8	25.2	Trembling Aspen	Yes

Pellet groups per hectare:

Elk - 300
Deer - 500
Horse - 250
Hare - 200

Stake I2	Sample	DBH (cm)	Species	Live - Y/N
	1	22.4	Trembling Aspen	Yes
	2	24.2	Trembling Aspen	Yes
	3	33.0	Trembling Aspen	Yes

Stake I3	Sample	DBH (cm)	Species	Live - Y/N
	1	23.4	Trembling Aspen	Yes
	2	25.0	Trembling Aspen	Yes
	3	23.7	Trembling Aspen	Yes
	4	29.1	Trembling Aspen	Yes
	5	29.3	Trembling Aspen	Yes
	6	27.4	Trembling Aspen	Yes
	7	17.0	Trembling Aspen	Yes
	8	18.4	Trembling Aspen	Yes
	9	20.7	Trembling Aspen	Yes

Stake I4	Sample	DBH (cm)	Species	Live - Y/N
	1	17.4	Trembling Aspen	Yes
	2	19.6	Trembling Aspen	Yes
	3	23.9	Trembling Aspen	Yes

Stake I5	Sample	DBH (cm)	Species	Live - Y/N
	1	12.8	Trembling Aspen	Yes
	2	19.4	Trembling Aspen	Yes
	3	27.8	Trembling Aspen	Yes
	4	12.7	Trembling Aspen	No
	5	23.6	Trembling Aspen	Yes

Stake I6	Sample	DBH (cm)	Species	Live - Y/N
	1	6.8	Trembling Aspen	No
	2	3.7	Trembling Aspen	Yes
	3	14.5	Trembling Aspen	Yes
	4	22	Trembling Aspen	Yes
	5	11.2	Trembling Aspen	No
	6	8.0	Trembling Aspen	Yes
	7	34.3	Balsam Poplar	Yes
	8	13.0	Trembling Aspen	Yes
	9	7.6	Trembling Aspen	No
	10	38.2	Trembling Aspen	Yes
	11	15.0	Trembling Aspen	Yes
	12	20.7	Trembling Aspen	Yes

Transect 7

Stake H1	Sample	DBH (cm)	Species	Live - Y/N
	1	26.5	Trembling Aspen	Yes
	2	20.9	Trembling Aspen	Yes
	3	20.1	Trembling Aspen	Yes
	4	19.4	Trembling Aspen	Yes
	5	12.7	Trembling Aspen	Yes
	6	18.6	Trembling Aspen	Yes
	7	19.4	Trembling Aspen	Yes

Pellet groups per hectare:

Deer - 100

Horse - 50

Hare - 600

Stake H2	Sample	DBH (cm)	Species	Live - Y/N
	1	17.1	Trembling Aspen	Yes
	2	17.3	Trembling Aspen	Yes
	3	16.5	Trembling Aspen	Yes
	4	14.3	Trembling Aspen	No
	5	12.6	Trembling Aspen	No
	6	22.9	Trembling Aspen	Yes
	7	16.7	Trembling Aspen	Yes
	8	4.6	White Spruce	No
	9	20.4	Trembling Aspen	Yes
	10	5.6	White Spruce	No
	11	12.8	Trembling Aspen	No
	12	6.9	White Spruce	No
	13	10.0	White Spruce	No
	14	14.6	Trembling Aspen	Yes
	15	12.6	Trembling Aspen	No
	16	14.1	Trembling Aspen	No
	17	6.2	White Spruce	No

(Continued)

Stake H3	Sample	DBH (cm)	Species	Live - Y/N
	1	17.3	Trembling Aspen	No
	2	19.2	Trembling Aspen	Yes
	3	18.3	Trembling Aspen	Yes
	4	3.4	Trembling Aspen	No
	5	8.6	Trembling Aspen	No
	6	6.8	White Spruce	Yes
	7	10.7	Trembling Aspen	No
	8	3.8	Trembling Aspen	No
	9	2.1	Trembling Aspen	No
	10	1.8	Trembling Aspen	No
	11	1.9	White Spruce	No
	12	9.0	White Spruce	Yes
	13	12.5	Trembling Aspen	Yes
	14	15.1	Trembling Aspen	No
	15	22.6	Trembling Aspen	Yes
	16	9.2	White Spruce	Yes
	17	0.8	White Spruce	No
	18	19.7	White Spruce	Yes
	19	16.6	White Spruce	Yes
	20	13.0	Trembling Aspen	Yes
	21	6.9	White Spruce	Yes
	22	2.2	White Spruce	Yes
	23	1.8	White Spruce	No
	24	2.0	White Spruce	Yes
	25	12.4	White Spruce	Yes
	26	17.6	Trembling Aspen	Yes
	27	6.3	White Spruce	Yes
	28	14.9	Trembling Aspen	Yes

Stake H4	Sample	DBH (cm)	Species	Live - Y/N
	1	20.4	Trembling Aspen	Yes
	2	19.2	Trembling Aspen	No
	3	23.6	Trembling Aspen	Yes
	4	24.7	Trembling Aspen	Yes
	5	15.0	Trembling Aspen	Yes
	6	34.5	White Spruce	Yes
	7	17.1	Trembling Aspen	Yes
	8	1.0	White Spruce	Yes
	9	2.0	White Spruce	Yes
	10	1.6	White Spruce	Yes

(Continued)

Stake H5	Sample	DBH (cm)	Species	Live - Y/N
	1	2.7	White Spruce	Yes
	2	8.3	White Spruce	Yes
	3	3.6	White Spruce	Yes
	4	4.9	White Spruce	Yes
	5	11.4	White Spruce	Yes
	6	1.5	White Spruce	No
	7	5.2	White Spruce	Yes
	8	1.8	White Spruce	Yes
	9	5.5	White Spruce	Yes
	10	0.8	White Spruce	Yes
	11	1.3	White Spruce	Yes
	12	8.9	White Spruce	Yes
	13	5.1	White Spruce	Yes
	14	3.4	White Spruce	Yes
	15	3.8	White Spruce	Yes
	16	0.6	White Spruce	Yes
	17	23.3	Trembling Aspen	Yes
	18	13.6	Trembling Aspen	Yes
	19	8.8	Trembling Aspen	No
	20	9	Trembling Aspen	No
	21	11.2	Trembling Aspen	No
	22	4.3	Trembling Aspen	No
	23	24.9	White Spruce	Yes
	24	12.4	White Spruce	Yes

Stake H6	Sample	DBH (cm)	Species	Live - Y/N
	1	4.7	White Spruce	No
	2	14.5	Trembling Aspen	No
	3	6.7	White Spruce	No
	4	22.2	Trembling Aspen	Yes
	5	24.2	Trembling Aspen	Yes
	6	19.8	Trembling Aspen	Yes
	7	20.4	Trembling Aspen	Yes
	8	20.0	Trembling Aspen	Yes
	9	11.0	Trembling Aspen	No
	10	12.6	Trembling Aspen	No
	11	15.6	Trembling Aspen	Yes

(Continued)

Transect 8

Stake O1	Sample	DBH (cm)	Species	Live - Y/N
	1	22.4	Trembling Aspen	Yes

Pellet groups per hectare:
Elk - 350
Deer - 300
Horse - 400
Hare - 150

Stake O2	Sample	DBH (cm)	Species	Live - Y/N
	1	15.9	Trembling Aspen	Yes
	2	10.8	Trembling Aspen	No
	3	16.8	Trembling Aspen	Yes
	4	7.4	Trembling Aspen	No
	5	13.5	Trembling Aspen	No
	6	14.7	Trembling Aspen	Yes
	7	8.6	Trembling Aspen	No
	8	10.9	Trembling Aspen	No
	9	14.8	Trembling Aspen	Yes
	10	12.2	Trembling Aspen	Yes

Stake O3	Sample	DBH (cm)	Species	Live - Y/N
	1	7.0	Trembling Aspen	No
	2	28.5	Trembling Aspen	No

Stake O4	Sample	DBH (cm)	Species	Live - Y/N
	1	18.5	Trembling Aspen	Yes

Stake O5 *No trees present.

Stake O6	Sample	DBH (cm)	Species	Live - Y/N
	1	31.5	Trembling Aspen	No
	2	27.0	Trembling Aspen	No

Appendix 4. Lands and Forest Service prescribed burn proposal for Kvass Flats, 2001.

ALBERTA
ENVIRONMENTAL PROTECTION
LAND AND FOREST SERVICES

PRESCRIBED BURN

2.0 PRESCRIBED BURN PROPOSAL

2.1 Burn Number ______ **Burn Name** Kvass Flats / Corral Creek

Location Twp. 55 and 56, Rge 9 and 10, W6M **Disposition No.** ______

Area (ha) 1,776 **Elevation (m)** 1050-1500 **Aspect** south **Slope %** 5-60

(Check appropriate boxes)

2.2 Agency Alberta Conservation Association

A. Provincial	**B. Federal**	**C. Private**
☒ 1. LFS	☐ 1. Forestry Canada	☐ 1. Industry
☒ 2. F&W	☐ 2. Indian Reserves	☐ 2. Land Owner
☐ 3. Provincial Parks	☐ 3. Parks Canada	
☐ 4. Others	☐ 4. Others	

2.3 Purpose

- ☐ 1. Silviculture
- ☒ 2. Habitat
- ☐ 3. Range
- ☒ 4. Fuel Management
- ☐ 5. Insect
- ☐ 6. Disease
- ☐ 7. Research
- ☐ 8. Ecological
- ☐ 9. Other

2.4 Objectives

Silviculture

- ☐ S1. Planting
- ☐ S2. Seed Bed Preparation
- ☐ S3. Slash Reduction
- ☐ S4. Thinning
- ☐ S5. Species Conversion

Range

- ☐ R1. Improvement
- ☐ R2. Maintenance

Habitat Management

- ☐ H1. Development
- ☒ H2. Improvement

Fuel Management

- ☐ F1. Hazard Reduction

Ecology

- ☐ E1. Ecosystem Maintenance
- ☐ E2. Ecosystem Modification

Research

- ☐ R11. Fire Ecology
- ☐ R12. Fire Effects
- ☒ R13. Fire Containment
- ☒ R14. Fire Behaviour

Insect

- ☐ I1. Control

Disease

- ☐ D1. Control

2.5 Site Classification ______

2.6 Natural Region / Ecodistrict Sub-alpine / Upper Foothills

2.7 Vegetation

Timber Type	D1 / M1	**Grass**		**Shrub**	
Duff Depth (cm / est.)	8	**Slash Depth (cm / est.)**			

2.8 Site History

Small mechanical clearings created in 1972 on lower portion of site (Kvass Flats).
Approximately 70 ha. burned in 1987 on lower portion of site (Kvass Flats).
Approximately 445 ha. burned in May 1994 to varying degrees throughout area (Kvass Flats).
Standing dead and fallen fuels in areas affected by past prescribed burns.
Wildfire in the Corral Creek area (Phase 3 in 2001 burnplan) occurred in 1987.
Prescribed burn occurred on May 12, 2001. Approximately 15% if total area burned due to
burn conditions. Mainly the grassy flats burned in 2001.

2.9 Limitations and Constraints

Burning of conifer stand next to river in southwest portion of area could
variably increase silt load to the river. Avoid burning of this site.
From past burns no adverse impacts to the environment have been detected.
LFS Range monitioring exclosure is within burn area. Should protect wooden
posts. Allowing fire to burn through exclosure is acceptable and preferred.

Alternative	**Reason For Rejection Of Alternative**
1. Mechanical clearing.	1. Negative public reaction as site is within the
	Willmore Wilderness Park. Costs would be
	higher. Past clearing project showed a high
	increase in aspen regeneration.
2. Hand clearing.	2. High cost and would likely lead to increased
	stem density.
3. No treatment.	3. Decrease in forage productivity of grasslands
	currently under high utilization.

2.10 Prescribed Burn Proposal Approval In Principle

a) Agency or Company
b) Resource Manager or Applicant ______________________________

Name	Position

Signature	Business Phone

c) Chief Ranger

Name	Business Phone

Signature	Date

d) Agency acceptance: attach acceptance letter if applicable.

Comments

Appendix 5. Lands and Forest Service fire prescription and burn plan for Kvass Flats, 2001.

ALBERTA
ENVIRONMENTAL PROTECTION
LAND AND FOREST SERVICES

FIRE PRESCRIPTION AND BURN PLAN

Burn No. ________ **Burn Name:** Kvass Flats /Corral Creek

3.0 FIRE PRESCRIPTION

3.1 Resource Objectives

Increase forage production and maintain or increase open grasslands for wildlife. To achieve these objectives the burn objective will be to achieve fire intensities sufficient enough to damage (girdle) the cambium (sapwood) layer of the aspen stems.

3.2 Short Term Objectives

	remove		% of fine fuels (<1.0 cm)
Slash Reduction	remove		% of medium fuels (1.1 - 7.0 cm)
	remove		% of large fuels (>7.1 cm)
Duff	remove		cm depth of burn
			% area burnt
Tree Mortality		1.0	M average crown scorch height
			% canopy removal
		25 - 50	% stem mortality
Shrub Mortality			% stem mortality

3.3 Long Term Objectives

Target Species 1 Grasses **Time Frame (yrs.)** 1 2 $\boxed{3}$ 4 5 6
Target Species 2 Forbes **Time Frame (yrs.)** 1 $\boxed{2}$ 3 4 5 6

Specific Vegetation Management Objectives

a) plant composition d) plant vigour g) habitat cover characteristics (canopy and vertical)

$\boxed{\text{b) plant cover}}$ $\boxed{\text{e) amount of forage}}$ h) berry production

c) plant distribution f) seed production I) other ________

Other Management Objectives

a) soil pH c) hazard reduction e) other ________

b) nutrient availability $\boxed{\text{d) biodiversity}}$

Description of measurable field attributes

Stem mortality
Forage production
Plant cover

3.4 Fuel Description On Site

Fuel Type (Canadian Forest Fire Behaviour System)

1. C-1 2. C-2 3. C-3 4. C-4 5. C-5 6. C-6 7. C-7 $\boxed{\text{8. D-1}}$ 9. M-1

10. M-2 11. M-3 12. M-4 13. S-1 14. S-2 15. S-3 16. O-1a 17. O-1b

Fuels Inventory Summary **Estimated** [***] **Measured** [ ]

			Preburn Fuel Load		Expected Consumption	
Ground	**Duff**	**(depth)**		**cm**		**cm**
		(wt)		**Kg/m2**		**Kg/m2**
Surface	**Grass**		1.0	**Kg/m2**		**Kg/m2**
	Shrub			**Kg/m2**		**Kg/m2**
	Slash	**0.0 - 0.49**		**Kg/m2**		**Kg/m2**
		0.5 - 0.99		**Kg/m2**		**Kg/m2**
		1.0 - 2.99		**Kg/m2**		**Kg/m2**
		3.0 - 4.99		**Kg/m2**		**Kg/m2**
		5.0 - 6.99		**Kg/m2**		**Kg/m2**
		7.0 +		**Kg/m2**		**Kg/m2**
		foliage		**Kg/m2**		**Kg/m2**
Standing	**Crown Foliage**			**Kg/m2**		**Kg/m2**
	Total All Fuels			**Kg/m2**		**Kg/m2**

Average Tree Height (m) 15 **Crown Base Height (m)** ______

Horizontal Continuity **continuous** [ ] **patchy** [✓]

Ladder Fuels **present** [ ] **Absent** [✓]

Adjacent Fuels	Fuel Types				
North	rock	continuous	✓	patchy	
East	D - 1	continuous		patchy	✓
South	River	continuous	✓	Patchy	
West	D - 1 & M - 1	continuous		Patchy	✓

3.5 Fire Behaviour (as per LFS -D.Taylor fax of Apr.6, 2000 to ACA - K.Livingston)

Required Environmental Conditions

	Acceptable Prescription Range		
	Low	**High**	**Desired**
Temperature	15.5	20.0	20.0
Relative Humidity	19	28	28
Fine Fuel Moisture Code	87	91	91
Duff Moisture Code	19	20	20
Drought Code	360	399	399
Vegetation Cured %	30%	80%	60%
Initial Spread Index	11	12	11
Build-up Index	31	40	35
Head Fire Intensity	2	3	3

Wind Speed	15 km/hr	**Preferred Wind Direction**	sw
Slope %	0-20 %	**Aspect**	sw

Critical Fuel Type	Rate of Spread			Flame Length		
	Low	**High**	**Desired**	**Low**	**High**	**Desired**
D - 1	2	7	3	1.4	2.6	2.0

Outside area at critical holding point, maximum acceptable moisture codes.

FFMC	92	**DMC**	36	**DC**	489
ISI	12	**BUI**	59	**HFI**	3

Fire Behaviour Narrative

D1-Fuel - HFI Rank 3 500-2000 km/m2, vigorous surface fire. Accelerating ROS ½ km/hr.
Flame length over 2m. NOTE in M1 Fuel (25/75) - if BUI is over 40 HFI Rank 4 2000-4000 km/m3
Fireguard must be secure and all available fuel must be removed (burned) or with burn
prescription re-burn will likely occur.
Wind and BUI factors are critical.

3.6 Burn Plan

3.6.1 Preparation of Burn

a) Person responsible for preburn monitoring L. Stroebel / S. Kowalchuk

Monitoring will be carried out through the following activities.

A Remote Automated Weather Station (RAWS) will be placed at Kvass Flats in March, 2001.
Site checks will be carried out when conditions are nearing prescription range.

Weather stations to be used Grande Cache , on-site data loggers , RAWS, MDMRS WX station.

On site equipment to be set up, by (date) March 1, 2000

The availability of a (RAWS) weather station has been tentatively confirmed.

b) Burn site preparation required (show on ignition map)

what / date

1. Burn in fireguards on slopes and height of land between Davey and Eaton Creeks,
prior to burn day. Date to be confirmed. Will monitor chinook conditions in Feb. Mar.

Person responsible S. Kowalchuk / L. Stroebel

c) Fire behaviour monitoring (person responsible) LFS designate

Manpower and equipment needs

1- Prescribed Fire Manager Dennis Cox
2- Fire Boss TBA by LFS
3- Ignition Boss Dave Taylor
4- Line Boss Fire Boss designate

Number Supplied By

5- Personnel	Total No.	LFS	Agencies	Industries	Other
LFS	3	3			
NRS	2		2		
ACA	3		3		
Type I Fire-fighters	8		8		
Type II Fire-fighters	8		8		

6- Equipment

Number Supplied By

Ignition Equipment	Total No.	LFS	Agencies	Industry	Other
Hand torch	4	4			
Helitorch	1	1			

Suppression Equipment

Squad Kits	3	3			
Pump Shindiawa	2	2			
5/8 inch hose	2000	2000			
Mark III pump	2	2			
1.5 inch hose	8000	8000			
Gravity funnel	2	2			
1 inch hose	2000	2000			
Flex tanks (60 gal.)	3	3			
-if required					
Chainsaw Kits	2	2			

Aircraft

206B	1		1		
-light duty - limited use					
A-star or Long Ranger	1		1		
-utilise man-up machine if available					

Other (radios, belt kits, etc.)

Radios	14	14			
Weather Kits	2	2			

3.6.2 Public Information and Notification Plan

Contact	Date	Type of Contact	Responsibility
Correctional Institute	Jan.31	Letter and Map	ACA
	day of burn	Phone call	LFS
Trappers			
Sue Feddama	Jan.31	Letter and map	ACA
Billy McDonald	Jan.31	Letter and map	ACA
Recreationists	Jan.31	Signs at Willmore Staging Area	ACA
		Newspaper	ACA
Landowners / Leasee	Jan.31	Letter and map	ACA
Town of Grande Cache	day of burn	Phone call	LFS
Media	Jan.31	Letter and map	ACA
Grande Cache paper	day of burn	Phone call	LFS
Airports	Jan.31	Letter and map	ACA
Grande Cache	day of burn	Phone call	LFS

Fish & Wildlife	Jan.31	Letter and map	ACA
	day of burn	Phone call	LFS
Transportation	Jan.31	Letter and map	ACA
	day of burn	Phone call	LFS
Timber Dispositions	Jan.31	Letter and map	ACA
	day of burn	Phone call	LFS
Outfitters			
Gary Kruger	Jan.31	Letter and map	ACA
Peter McMahon	Jan.31	Letter and map	ACA
Others - *Smoky River*	Jan.31	Letter and map	ACA
Disaster Services	day of burn	Phone call	LFS
MD of Greenview (G.Frank)	Jan.31	Letter and map	ACA

Signage, if required, list location, who is responsible, etc.

Type of Sign	Location	Date to Install	Responsibility
NOTICE - showing	Hell's Gate	Jan. 31	ACA / NRS
area and rationale	AEP offices		

Other action or information

3.6.3 Ignition

a) Ignition Scheduling (estimate)

Date **April 10, 2000** **Time of day** **1300 hrs.**

Ignition method **Aerial / Hand torch** **Type of burn** **Surface**

Duration of ignition phase **4** **hr.** **Duration of burnout phase** **6** **hr.**

b) Ignition and Control (show on attached map)

Ignition Plan

Fire guard. Hand ignition will proceed progressively down slope from the height of land between Davey
and Eaton Creeks. Wind and steepness of slope will determine width of strip fires.
Burn. Aerial ignition will depend on prescription window achieved. Generally the burn will be strip
fired into the wind and/or progressively downslope. Ignition of heavy fuel areas on lower slope to be
carried out after upper slope and downwind areas are burned in. The burn will be conducted in 3 phases.
If goals are achieved and conditions are favourable after phase 1 and the area is secure, crews will
proceed with phase 2, followed by phase 3, which would complete the burn.

Potential Control Problems

With significant winds hot spots could jump the fire guard on the east flank between Davey and Eaton
Creeks during the burning of phase 1.

Control Measures on Critical Control Points

May need to fortify areas not completely burned during fire guard construction, prior to ignition of
main burn.
No personnel are to go after hot spots unless it is safe to do so.

Locations of Control Forces and Instructions

Fireguard. Control forces will be on the line for establishing the fireguard.
Burn. Control forces will be at staging area while aerial ignition is proceeding.
Type I crew will be on the line for any hand ignition on lower slope. Type II crew will be on standby
at staging area.

Contingency Plan

Additional resources available in Grande Cache. Additional a/c if needed is in Hinton or Whitecourt.

Safety Hazards

Site is in steep terrain.
Larger aspen will be falling shortly after the fire runs through.
No one is to enter burn site while aerial ignition is in progress.
Everyone must know escape routes and have radio communications with the Fire Boss.

Key Briefing Points (radio channels and procedures, escape routes, organisation, etc.)

Fire Boss will brief all personnel prior to ignition and cover areas such as: individual responsibilities;
chain of command; purpose of burn; ignition plan; control plan; present and predicted weather; escape
routes; safe areas; dangerous areas; smoke; radio communications/channels; reporting stations; MAPS
The Fire Boss prior to ignition will obtain spot forecast.

Water Sources (location, travel time, access, size, type, etc.)

Smoky River along the south.
Henrietta Creek along west flank of phase 1. Shallow flows. May need to dam creek at pump locations.
Davey Creek along east flank. Intermittent. Water availability to be determined. Corral Creek along the
west end of phase 3. Should have flows, but need to be determined on the ground.

Monitoring (as per requirements for post burn plan, identify who will be responsible for monitoring and recording on-site observations during the burn).

Ray Olsson (LFS)
K. Livingston and S. Kowalchuk – assistants (ACA).
Cordy Tymstra (LFS), Kelvin Hirsch (CFS), Bernie Todd (CFS)

3.6.4 Smoke Management Plan

a) Smoke Considerations

Identify any adverse impact of smoke.

1. **Off site:**

   i) **Populated areas, distance and direction from burn** Grande Cache 10km NE

   ii) **highways, major roads, distance and direction from burn** Highway 40 10 km NE

iii) **public facilities, distance and direction from burn** Hell's Gate 4 km NE

iv) other trappers cabin on-site

2. **On site:**

   i) safety, ensure safety plan has considered smoke strip ignition will limit smoke output

   ii) control problems none anticipated

3. **Other burns occurring in the area** none

Smoke Control Strategy

Describe action to be taken to avoid or reduce problems listed in "a" above

1. **Avoidance - schedule burn during conditions that make intrusions of smoke into smoke sensitive areas unlikely (wind direction unstable, etc.).**

Unstable conditions will make smoke concentrations unlikely.

2. **Dilution - smoke concentration can be reduced by diluting smoke through a greater volume of air, either by scheduling during good dispersion conditions or burning at slower rates through ignition of smaller or narrower strips.**

Good dispersion should occur.

3. **Emission reduction - effective firing techniques and proper scheduling can minimise the smoke output per unit area treated (backing fires, larger fuels or duff to wet to burn).**

Larger fuels limited.

b) Smoke Emergency Plan

Explain steps to be taken if traffic control on any nearby roads becomes necessary because of unexpected wind changes, or action to be taken if it becomes necessary to construct control lines and stop a burn if not burning according to plan or if weather changes.

If fire threatens escape all further ignition will cease.
Additional fire fighters will be brought in from Grande Cache, if fire escapes.

3.6.5 Safety Plan

1. Safety Checklist

To be used by the line boss, ignition boss and service chief in the absence of a safety officer.

- **Have you been briefed on safety responsibilities by the fire boss ?**
- **Have you a map of the area ?**
- **Have safety routes been clearly marked on the map ?**
- **Are you familiar with the organisation ?**
- **Are you familiar with possible areas of uncontrolled spread ?**
- **Are you aware of possible spotting or jump fires ?**
- **Has proper working apparel been provided and is it in use ?**
- **Do all pieces of equipment meet safety standards ?**
- **Did you make arrangements for safety signs within the operation ?**
- **Are first aid supplies available ?**
- **Has a first aid and safety station been identified ?**
- **Are you aware of any isolated unsafe areas of the burn that should be clarified ?**

2. On-site Briefing

The safety officer will briefly discuss safety aspects expected on the job and will highlight the following.

- **Importance of wearing protective clothing.**
- **What to do in excessively smoky areas.**
- **How to protect form heat radiation.**
- **Importance of drinking plenty of fluids.**
- **What first aid is available and where.**
- **Importance of working under safe conditions.**
- **Encourage the reporting and documentation of all potentially hazardous situations.**
- **Importance of reporting and documenting any injury, minor or major.**
- **Go over escape routes.**
- **Go over reporting locations or meeting sites in the event of an escaped fire, head count for each site must be known by all assigned to each meeting site.**

3. Action Plan

List action to be taken, by whom and when, for the burn to ensure safety (i.e. sign posting, line inspection, information feedback, head counts in case of an emergency, etc.)

All line personnel will be equipped with radios.
All personnel at the prescribed burn will attend briefings held by the Fire Boss.
Briefings will detail practices, action plans and maps will be distributed to all fire line staff.

3.6.6 Mop - up Plan (for next 24 hours)

Burn Date April 10, 2000 **Mop - up Date** April 11, 2000

Mop - up Plan Objective by Shift

A Type II crew will spend the following day(s) working on hot spots near the perimeter and areas of
concern. No further mop-up is planned for areas within the perimeter.
Staff from NRS or ACA would then patrol the perimeter and area and report to LFS daily.
If required a local trail rider will be contracted to patrol area for a seven-day period, post burn.

Special Considerations and Hazards

Outfitters / Commercial trail riders camps and the trappers cabin.

Contingency Plan

Contingency funds have been set aside for 3 crews (includes tent camp) for 4 days and a
205A @ 4hrs. / day for 4 days.
A certified sector boss would be required.

Mop - up Boss LFS designate.

		Number Supplied By			
Personnel	**Total No.**	**LFS**	**Agency**	**Industry**	**Other**
Type II Fire fighters	8		8		
ACA staff	3		3		

Equipment

Squad kits	3	3			
Flex tanks	2	2			
Shindiawa pump	1	1			
5/8 inch hose	1000 feet	1000 feet			

Aircraft

205A	1		1		
Other	**Total No.**	**LFS**	**Agency**	**Industry**	**Other**

3.6.7 Summary of Proposed Funds

		Wages	Aircraft	Equipment	Consumable	Total
Land & Forest Services	**Direct**	7,000	8,000			15,000
	Indirect	2,000				2,000
Fish & Wildlife	**Direct**					
	Indirect	500				500
Other Gov't Agencies	**Direct**					
	Indirect	1,000				1,000
Industry	**Direct**					
	Indirect	2,000				2,000
Other	**Direct**	1,000	12,300	1,000	1,000	15,300
	Indirect	1,800				1,800

Monitoring responsibility:

Short term R. Olsson, (LFS), S. Kowalchuk (ACA), Cordy Tymstra (LFS), Kelvin Hirsch (CFS), Bernie Todd (CFS)

Long term C. Lane / M. Willoughby (LFS Range Section)

3.6.7 Approvals

Resource Manager / Company Representative ______________________ ______________________

name **business phone**

______________________ ______________________

signature **date**

Chief Ranger ______________________ ______________________

name **business phone**

______________________ ______________________

signature **date**

Other Agencies ______________________ ______________________

name **business phone**

______________________ ______________________

signature **date**

Comments:

Forest Superintendent ______________________ ______________________

signature **date**

Comments:

Appendix 6. Photographs from activities associated with the prescribed burn at Kvass Flats, 2001.

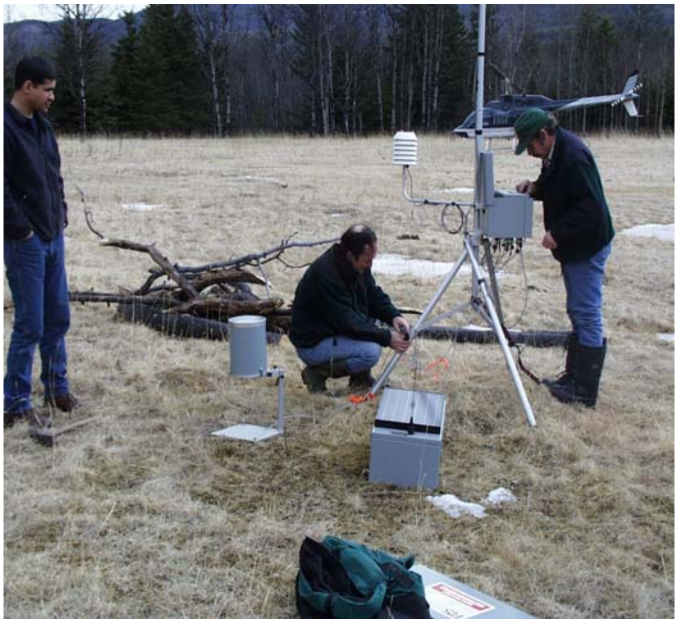


PLATE 1 Setting up Remote Automated Weather Station (RAWS) at Kvass Flats (April 5, 2001).

PLATE 2 Location of fireguard at the east end of burn area (April 5, 2001).

PLATE 3 Burning of fireguard on height of land between Eaton and Davey Creeks (April 5, 2001).

PLATE 4 Planning session to discuss ignition pattern for the main burn (May 12, 2001).

PLATE 5 Ray Olsson monitoring the weather data prior to ignition of the burn (May 12, 2001).

PLATE 6 Burning of the fireguard at the east end of the burn area prior to the ignition of the main burn (May 12, 2001).

PLATE 7 Helicopter used to conduct the aerial ignition of the burn (May 12, 2001).

PLATE 8 Burning near Mount Stern (May 12, 2001).

PLATE 9 Aerial view of Kvass Flats burning (May 12, 2001).

PLATE 10 Looking east at areas burning at Kvass Flats (May 12, 2001).

PLATE 11 Looking west at Kvass Flats following the prescribed burn (June 20, 2001).

PLATE 12 Looking at burned deadfall and trees following the prescribed burn (June 20, 2001).

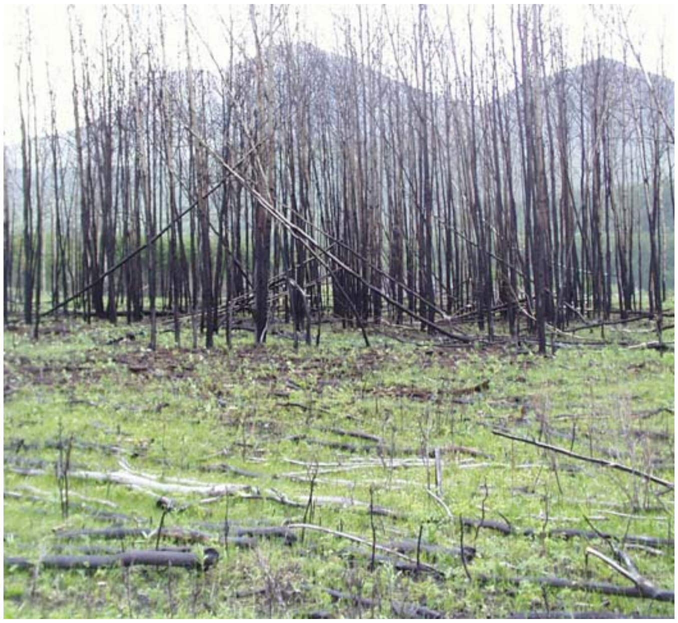


PLATE 13 Aspen trees burned during the prescribed burn on May 12, 2001 (June 20, 2001).

PLATE 14 Horse grazing at Kvass Flats (June 20, 2001).

PLATE 15 Aerial view looking west at Kvass Flats (July 17, 2001).

PLATE 16 Approximately 40 elk located at the west end of the main flats that were burned (July 17, 2001).

Appendix 7. Invoice submitted to the Rocky Mountain Elk Foundation to financially assist with the Kvass Flats prescribed burn.

Alberta Conservation Association

Alberta Conservation Association
PO Box 40027 Baker Centre Postal Outlet
Edmonton, AB T5J 4M9 (403) 427-5192

Invoice No. 218

INVOICE

Customer

Name: Rocky Mountain Elk Foundation Canada
Address: P.O. Box 940
City: Rocky Mtn House PROV AB PC T4T 1A7
Phone: (403) 845-6492

Date: 9/19/01
Order No.:
Rep: Sheldon K
FOB:

Qty	Description	Unit Price	TOTAL
1	Helicopter charter and fuel on April 5, 2001 to install the Remote Automated Weather Station	$1,659.01	$1,659.01
1	Helicopter charter and fuel to burn in fireguard at Kvass Flats on April 27, 2001	$5,691.90	$5,691.90
1	Helicopter charter and fuel on May 12, 2001 to conduct the prescribed burn at Kvass Flats	$8,559.01	$8,559.01
	GST # 889946141RT0001		

SubTotal	$15,909.92
Shipping & Handling	
Taxes GST	$1,113.69
TOTAL	$17,023.61

Payment Details

- ○ Cash
- ◉ Cheque
- ○ Credit Card

Name ______
CC # ______
Expires ______

Office Use Only
Project Code 010-50-50-002-4005

Please make cheques payable to the Alberta Conservation Association

"Working Together to Conserve, Protect and Enhance our Natural Resources"