3.6   Detailed Indicator Sheets

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Indicator 1.1.1

</div>

Value: Biodiversity – Ecosystem Diversity

Objective: Conserve ecosystem diversity by emulating natural disturbance patterns and the range of variation therein (i.e., coarse filter approach).

Indicator: Treatment size and residual pattern.

Target: Treatment size and pattern within the natural range of variation: multiple treatments over a series of years may be clustered to emulate larger natural burns. Greater than two thirds of these treatment events will be 600 ha or larger. The planning boundaries for individual treatment events will provide a minimum of 15% remnant undisturbed forest, with the average amount of post-treatment remnant area falling between 29% and 49%.

Current Status: In developing this indicator and the associated targets, the Planning Team reviewed the work done by the Foothills Model Forest Natural Disturbance Program and the associated Highway 40 North Demonstration Project. The Natural Disturbance Program is a large research project that has been studying fire regimes in the Rocky Mountain and Foothills Natural Regions of west-central Alberta. The Highway 40 project is a multi-partner initiative that is demonstrating how research results from the Natural Disturbance Program can be incorporated into a natural disturbance emulation approach to planning industrial activity. Assessing this indicator using methods similar to those of the Highway 40 project demonstrates use of the best available science, a direct recommendation of the Charrette process (Objective 5.1). Although the Foothills Model Forest study did not occur within the R11 FMU boundary, the study area did border R11 to the north-west and contained a similar compliment of natural subregions (Lower Foothills, Upper Foothills, Montane, Subalpine, and Alpine). As a result, the general findings have considerable applicability to the R11 area.

Planning for the Highway 40 North Demonstration Project, which can be viewed in detail at http://www.fmf.ca/HWY40/project.htm, utilized two tangible statistics that are relevant to the treatment size and pattern indicators chosen for the R11 FMU. The first is the natural distribution of disturbance event sizes (Andison 2006a). Andison (2006b) defined a disturbance event as "the general area affected by a single episode of disturbance where at least 20% of the vegetation is killed." For most natural disturbances in R11, this would be the result of a single wildfire, which would occur over the course of a single fire season. The emulation of natural disturbance patterns in industrial activity, as is being demonstrated through the Highway 40 project, applies this concept to a series of closely associated harvest disturbances created over an interval of time, such as a number of months or years. A similar approach can be taken to planning a series of prescribed burn treatment units that are

conducted individually to meet logistical needs, but that emulate larger natural patterns when viewed as a single disturbance event.

Research conducted by the Foothills Model Forest Natural Disturbance Program demonstrated that in the Rocky Mountain and Foothills Natural Regions, the majority of wildfires (over two thirds for all subregions) are less than 10 ha (Andison 2003a). However, it is the few large fires that have the greatest impact on the landscape (Figure 7).
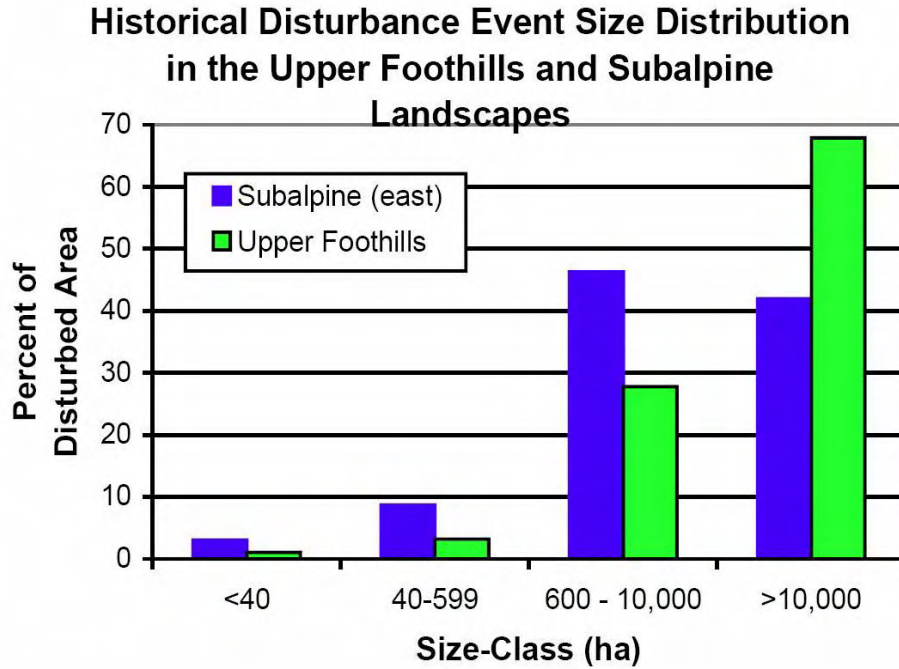

Figure 7. Distribution of historical disturbance event sizes in the Upper Foothills and Subalpine Natural Subregions (taken from Andison 2006a).

Because natural fire event size varies so greatly, the natural range of variation allows for considerable flexibility in planning the size of treatment events within R11. Disturbance events could be either very small (less than 10 ha) or very large (greater than 10,000 ha) and still be within the NRV. To provide further guidance to current and future planners, the Planning Team chose to set a target related to the proportion of large (600+ ha) treatment events that should occur in order to emulate broad natural landscape patterns. As Andison (2003a) found that greater than two thirds of the disturbed area in each natural subregion was associated with events larger than 600 ha, this was chosen as the target for R11 planning. Event boundaries are to be determined using the methods proposed by Andison (2006b), and a maximum implementation period of 10 years will define a single disturbance event.

The second aspect of natural fire patterns that has been used for planning the Highway 40 North Demonstration Project is an assessment of the residual structure left within each event. Within natural fires, especially the larger ones, patches of forest remain unburned. These remnant patches contribute to the mosaic of stand types, enhance biodiversity, and provide cover for large wildlife. Foothills Model Forest research demonstrated that 90% of burns

Island remnant within the Lost Guide burn

had on average 12%, and up to 30%, of the area within the burn perimeters left undisturbed in island remnants (Andison 2003c).   If forest matrix remnants within a fire boundary (peninsulas, corridors, etc.) were also considered, total residual structure ranged between 15% and 62%, with an average 39% of the area unburned (Andison 2006c). Thus, the target is to leave between 15% and 62% of the total area of individual treatment events as undisturbed forest remnants, with the average for all treatment events falling within the range of 29% to 49% (i.e., ± 10% of the 39% average reported by the Natural Disturbance Program). For harvesting treatments, this indicator can be measured using proposed block layout information and adjusted if necessary prior to harvesting. However, the amount of island and matrix remnants that will remain following a prescribed burn is much more difficult to predict due to the influence of environmental factors such as wind patterns, temperature, and relative humidity on the day of the burn. To ensure that each treatment event falls within the range of 15% to 62% residual structure, planners will strive to ensure that the minimum 15% is matrix remnants retained through boundary planning. Additional island remnants within these boundaries will be created through natural fire behaviour and operational activities at the time of treatment.

Forecast: Using the procedures described above, the operational plan for R11 was assessed using indicators for treatment size and residual pattern. As per Andison (2003a), events were attributed to the natural subregion that comprised the greatest proportion of the event.

Event sizes: The percentage of disturbed area by event size classes is represented in Figure 8. The target of having greater than two thirds of the disturbed area within event boundaries larger than 600 ha should be met. The general pattern, which shows most of the disturbance area occurring in large events is pleasing. However, there is one major difference between the outcome of the proposed treatments and the Foothills Model Forest Natural Disturbance Program information (Andison 2003a): there is a lack of any disturbance events in the 10,000 ha+ range. The Planning Team was left with two options for addressing this issue. The first option was to reexamine the proposed burn events and add additional units to increase the total size of some units to over 10,000 ha. The second option was to proceed with the events as planned and reexamine this issue for subsequent FMP updates. Given the novel nature of the natural disturbance emulation approach being proposed in this plan, the Planning Team opted to proceed with the events as planned for the initial phase of plan implementation. Although no events are expected to be greater than 10,000 ha, at least five proposed events are expected to be greater than 5,000 ha. Events of this size are ecologically appropriate as they fall within the natural range of variability for wildfire size; however, their social palatability is yet to be determined. If, after the implementation of multiple events greater than 5,000 ha, it is found that the public accepts this degree of disturbance, ASRD forest and land managers will consider increasing the size of some events to greater than 10,000 ha.
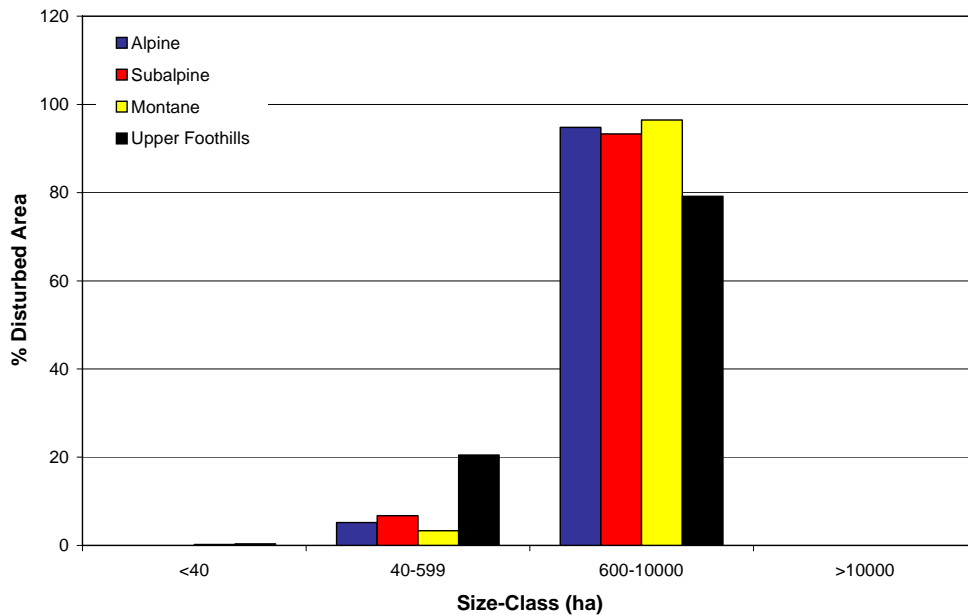
Figure 8. Projected percentage of area disturbed in event size classes for each R11 natural subregion based on proposed harvest and prescribed burn treatments.

Timing of events: When calculating the event sizes, the projected timing of treatments was ignored. The Highway 40 project suggests that adjacent treatment units, which in total comprise an event, should occur within a 10-year span to restrict variation in the plant communities among treatment units. This provides direction to ASRD that once harvest or prescribed fire is initiated in an area, the surrounding treatments should be completed within a 10-year span.

Residual structure: Treatment units proposed thus far for the R11 FMU identify conceptual perimeters and areas. Analysis of these proposed units indicates that approximately 13% of the total treatment area (range: 1%-36%) will be retained as undisturbed matrix remnants through boundary planning. This does not meet the 15% minimum or the 39% average (± 10%). Thus, operational plans for harvesting will incorporate additional forested island remnants within harvest units to more closely approach the target. Similarly, prescribed burn plans will have prescriptions designed to remove only 60% to 80% of the crown and leave forested islands where possible to further emulate natural burn patterns and attain the target for residual structure.

Monitoring: Following the completion of treatment activities, event boundaries will be determined using GPS, airphoto interpretation, or satellite imagery. Care will be taken to capture the extent of all island and matrix remnants. Actual event sizes will be calculated using a GIS and reported by natural subregion. The percent residual structure within each event will be calculated through GIS analysis. The average (i.e., mean) undisturbed area for all treatment events completed to date will be reported and assessed against targets. The

success of operational or unplanned structure retention activities will be assessed following each disturbance event. A summary of results will be presented in the Stewardship Report.

Response: If event size results are outside of an acceptable range, event sizes can be reassessed in subsequent FMPs. If residual structure results fall below target averages, additional matrix and island remnants will be incorporated during treatment planning.

Indicator 1.1.2

Value: Biodiversity - Ecosystem Diversity

Objective: Conserve ecosystem diversity by emulating natural disturbance patterns and the natural range of variation therein (i.e., coarse filter approach).

Indicator: Stand age distribution by area.

Target: Area of young (<20 years) and old (>180 years) forests falls within the natural range of variation for each natural subregion.

Current Status: In the primarily fire-adapted forest ecosystem found in R11, the associated fire regime will determine the amount of forest in various age classes at a given point in time. Maintaining or restoring these broad natural disturbance patterns on the landscape requires an understanding of key fire regime components, namely fire cycle, and the influence of local differences in climate and topography. Fire cycle is the time in years over which you expect a defined area to burn, and it can be used to model natural stand age distribution in a given natural subregion. This modelling method allows the identification of targets for restoring natural landscape patterns. Fire cycle is best determined through local fire regime analyses and modelling; however, local fire regime information is currently only available for a portion of the R11 FMU and no spatially-explicit natural range of variation modelling has been conducted (see the Landscape Description section for a more thorough discussion of the R11 fire regime). Accordingly, information for this FMP was generalized from several studies conducted within the same natural subregions in other areas of the province. Although local fire regime data are preferable, these provincial results provide a general understanding of the range of fire cycles that may be natural for the local area, and therefore an approximation of the NRV expected for each forest age class.

The NRV in stand age distribution was estimated using a negative exponential function applied to the range of fire cycles reported for each natural subregion (Tymstra et al. 2005). For this plan, the NRV for each age class was defined as the range between the minimum and maximum predicted values. Although the negative exponential function method of predicting stand age distribution provides a rather simplistic estimate without the inclusion of local fire cycle data, this method is accepted by fire scientists for basic modeling and the establishment of broad fire management goals (Pengelly and Rogeau 2001). This method suits our planning purposes well, with the assumption that the actual fire cycle for each natural subregion within the R11 FMU falls within or near the range reported for other areas of the same natural subregion. Results must be interpreted conservatively, however, as this is a fairly simple method, which does not account for local factors affecting fire patterns within a given natural subregion (e.g., evelation). Ideally, the natural range for stand age distribution would be modeled extensively using local landscape data (e.g., Foothills Model Forest Natural Disturbance Study, Andison 2000), and detailed information for the entire R11 FMU would be valuable. Until such data are available, the negative exponential

function will provide a coarse estimate of the natural range of landscape conditions: stand age data falling outside this range of predicted values are likely in an unnatural condition.

Table 15 to Table 18 demonstrate the amount of young (0-20 years), pole (21-100 years), mature (101-180 years), and old forest (>180 years) that are currently found in each of the R11 natural subregions compared to the estimated natural range. The definitions of young, pole, mature, and old forest were adopted from Andison's (2000) seral stage categories for pine and spruce-dominated stands as these are the dominant forest cover types in R11. Stand age data are not separated by cover class (i.e., conifer, deciduous, mixedwood), as fire cycle lengths are not reported in this manner. This additional detail could be incorporated into future plan updates if local fire regime analyses and modelling are conducted. Finally, data for the Alpine Natural Subregion are not presented as this area is predominantly non-forested.

Table 15. Estimated natural range and actual percentage of the forest area in each age class within the Subalpine Natural Subregion in R11.

Age Class	NRV Minimum	NRV Median	NRV Maximum	Current Percentage
Young	6	15	20	2
Pole	22	41	47	15
Mature	17	20	21	60
Old	14	23	55	23

Table 16. Estimated natural range and actual percentage of the forest area in each age class within the Montane Natural Subregion in R11.

Age Class	NRV Minimum	NRV Median	NRV Maximum	Current Percentage
Young	6	20	39	4
Pole	22	48	53	20
Mature	7	19	21	70
Old	1	13	55	6

Table 17. Estimated natural range and actual percentage of the forest area in each age class within the Upper Foothills Natural Subregion in R11.

Age Class	NRV Minimum	NRV Median	NRV Maximum	Current Percentage
Young	17	23	42	4
Pole	44	50	53	22
Mature	6	18	21	67
Old	1	10	18	7

Table 18. Estimated natural range and actual percentage of the forest area in each age class within the Lower Foothills Natural Subregion in R11.

Age Class	NRV Minimum	NRV Median	NRV Maximum	Current Percentage
Young	16	19	32	0
Pole	43	46	53	10
Mature	11	20	21	45
Old	3	15	20	45

In all natural subregions, the percentage area of forest currently observed in the 0-20 year age class is less than the expected NRV for young forest, while the amount of old forest generally falls within or near the expected range. The exception is the Lower Foothills Natural Subregion; however, these results may be influenced by the small area of R11 that falls within Lower Foothills. All natural subregions have greater area of forest in the mature age class than expected based on a negative exponential distribution. In the absence of fire suppression activities, a greater percentage of this mature forest would likely be converted to young forest annually. Thus, the smaller than expected percentage of young forest (0-20 years) and the larger than expected percentage of mature forest (101-180 years) represents an unnatural landscape condition for multiple natural subregions in the R11 FMU: these age classes will be targeted for restoration work through prescribed burn and harvest treatments.

Forecast: In the absence of prescribed burn and harvest activities, the amount of young forest would continue to fall well below the NRV. Conversely, the amount of old forest would eventually be much greater than the NRV if disease or insect threats such as mountain pine beetle do not kill significant areas.

If the treatment level objectives described in Indicator 2.1.1 are continually met over the long term (i.e., 200-year planning cycle), the amount of young and old forest will be within the target NRV range in the Subalpine and Montane Natural Subregions (Table 19). Although the Upper and Lower Foothills Natural Subregions are not expected to fall within the target range at the end of a 200-year planning cycle, they are expected to align more closely with the NRV (Table 19) than given a status quo scenario for an equivalent length of time. Treatments would need to be conducted at a rate greater than one half the median fire cycle length to achieve the target ranges for foothills areas.

Table 19. Predicted percentage of forest area within the young and old age classes after a 200 year planning cycle, based on disturbance from prescribed burn and harvest treatments alone or treatments plus the current wildfire rate over the last 20 years.

Natural Subregion	Age Class	Treatments alone	Treatments plus wildfire	New fire cycle length (yrs)	Within NRV?
Subalpine	Young	8	9	193	Y
Subalpine	Old	48	42	193	Y
Montane	Young	11	12	131	Y
Montane	Old	36	31	131	Y

Upper Foothills	Young	12	13	117	N
Upper Foothills	Old	32	28	117	N
Lower Foothills	Young	10	10	192	N
Lower Foothills	Old	39	39	192	N

Monitoring: Changes in the stand age distribution will be monitored through GIS analysis of the amount of area in each age class. This will require regular updates of the GIS vegetation inventory data as treatments and natural wildfires occur. A summary of the current stand age distribution compared to the NRV will be presented in the Stewardship Report.

Response: The greatest challenge to meeting the target for this indicator will be implementing an adequate level of ongoing treatments within the FMU. The targets identified under Indicator 2.1.1 are conservative, allowing for a significant amount of wildfire to occur before the amount of young forest exceeds the NRV. As a result, an increase in the treatment level may be necessary.

In the event of a large-scale die-off resulting from disease or mountain pine beetle, a reduction in the treatment level may be required to ensure that the amount of young forest does not exceed the NRV. In anticipation of such a potential outcome, however, the proposed amount of young forest must still be created in the short term as these areas will ultimately form the old forest component of the ecosystem. There may be limited recruitment of young pine trees after a large-scale mountain pine beetle kill as there will be little seed source for natural regeneration. In such a case, the young forest created through prescribed burning and wildfire will be extremely valuable in the long-term continuity of these ecosystems.

Indicator 1.2.1

Value: Biodiversity - Ecosystem Diversity

Objective: Conserve ecosystem diversity by maintaining or restoring uncommon plant communities.

Indicator: Uncommon plant communities, specifically whitebark pine, limber pine, Douglas-fir, and lowland grassland communities.

Targets: All total known area of each community type inside Protected Areas and 80% of the total known area of each community type outside Protected Areas will be maintained, including via burning if the community is identified as fire dependant.

Current Status: The Alberta Natural Heritage Information Centre (ANHIC) is housed within Alberta Tourism, Parks, Recreation, and Culture. The purpose of the Centre is to collect, evaluate, and make available information on the elements of natural biodiversity of Alberta – plants, animals, natural plant communities, and landscapes. ANHIC develops tracking lists of elements that are considered of high conservation priority because they are rare or special in some way. Tracking lists serve as a focus for data gathering to increase our knowledge and understanding of the elements of Alberta's biodiversity. The lists are under constant review and are updated periodically. Elements may be added, deleted, or their status may be revised as data become available. ANHIC also provides complete lists of vascular and non-vascular plants and lichens. This information can be accessed on ANHIC's website at http://www.tprc.alberta.ca/parks/heritageinfocentre/default.aspx.

A review of ANHIC's 2005 Ecological Community Tracking and Watch List resulted in a list of provincially uncommon community types which are either known to occur (7 types) or can potentially occur (35 types) within the R11 boundaries (Table 20). All seven presently known uncommon community types within the R11 area have been reported from Protected Area sites and include six lowland grassland types and one limber pine – Douglas-fir community type. Remaining potentially occurring community types can be roughly grouped into lowland grassland communities, riparian communities, whitebark or limber pine communities, and various other communities found on mountain slopes. Given the limitations of our current knowledge about plant community types in Alberta and the lack of a good inventory within the R11 FMU specifically, additional uncommon plant community types may be present.

Table 20. Potentially occurring and known ANHIC Ecological Community Tracking List communities within the R11 FMU.

Code	Scientific Name	Common Name	Rank*	Type	Group	Comments
CEAB000050	*Abies bifolia – Pinus albicaulis – Picea engelmannii / Empetrum nigrum*	subalpine fir - whitebark pine - Engelmann spruce / crowberry	S2	Whitebark or Limber Pine	Forest/ Woodland	Could occur
CEAB000073	*Pinus albicaulis – Pinus contorta / Juniperus communis – Leymus innovatus – Linnaea borealis*	whitebark pine - lodgepole pine / ground juniper - hairy wild rye	S2S3	Whitebark or Limber Pine	Forest/ Woodland	Could occur
CEAB000074	*Pinus albicaulis / Juniperus communis – Arctostaphylos uva ursi*	whitebark pine / ground juniper - common bearberry	S2S3	Whitebark or Limber Pine	Forest/ Woodland	Could occur
CEAB000075	*Pinus flexilis - Pseudotsuga menziesii / Juniperus spp. / Arctostaphylos uva-ursi*	limber pine - Douglas-fir / juniper species / common bearberry	S2	Whitebark or Limber Pine	Forest/ Woodland	Does occur in R11 (Kootenay Plains); locations not mapped
CEAB000076	*Pinus flexilis / Arctostaphylos uva ursi - Juniperus horizontalis*	limber pine / common bearberry - creeping juniper	S2S3	Whitebark or Limber Pine	Forest/ Woodland	Could occur
CEGL000815	*Pinus flexilis* scree	Limber pine scree	S1S2 G3Q	Whitebark or Limber Pine	Forest/ Woodland	Could occur
CEAB000054	*Antennaria lanata – Artemisia norvegica*	woolly everlasting - mountain sagewort	S1	Grassland	Herbaceous	Only known from Whitehorse Wildland; could occur in R11
CEAB000055	*Artemisia norvegica – Mertensia paniculata – Leymus innovatus*	mountain sagewort - tall lungwort - hairy wild rye	S1	Grassland	Herbaceous	Only known from Whitehorse Wildland; could occur in R11
CEAB000143	*Elymus lanceolatus - Antennaria parviflora*	northern wheat grass - small-leaved everlasting	S1	Grassland	Herbaceous	Confirmed in R11
CEAB000144	*Elymus lanceolatus - Artemisia dracunculus - Artemisia frigida*	northern wheat grass - dragonwort - pasture sagewort	S1	Grassland	Herbaceous	Confirmed in R11

Code	Scientific Name	Common Name	Rank*	Type	Group	Comments
CEAB000025	*Elymus lanceolatus - Artemisia frigida*	northern wheat grass - pasture sagewort	S2S3	Grassland	Herbaceous	Found in Banff and Jasper NP; could occur in R11
CEAB000142	*Elymus lanceolatus - Elymus trachycaulus*	northern wheat grass - slender wheat grass	S1	Grassland	Herbaceous	Confirmed in R11
CEAB000147	*Elymus lanceolatus - Stipa comata*	northern wheat grass - needle-and-thread	S1S2	Grassland	Herbaceous	Confirmed in R11
CEAB000150	*Elymus trachycaulus - Koeleria macrantha*	slender wheat grass - June grass	SU	Grassland	Herbaceous	Could occur
CEAB000118	*Festuca campestris - Leymus innovatus (Elymus innovatus)*	mountain rough fescue - hairy wild rye	S2S3	Grassland	Herbaceous	Confirmed in R11
CEAB000026	*Koeleria macrantha – Artemisia frigida – Linum lewisii*	June grass - pasture sagewort - wild blue flax	S2S3	Grassland	Herbaceous	Could occur
CEAB000140	*Pascopyrum smithii - Pyrrocoma uniflora*	western wheat grass - one-flowered ironplant	S1	Grassland	Sparsely Vegetated	Confirmed in R11
CEAB000028	*Stipa richardsonii – Koeleria macrantha – Antennaria parvifolia*	Richardson's needle grass - June grass - small-leaved everlasting	S2S3	Grassland	Herbaceous	Could occur
CEAB000020	*Picea glauca / Rosa acicularis / Thuidium abietinum*	white spruce / prickly rose / fern moss	S1	Riparian	Forest/ Woodland	Could occur
CEAB000021	*Picea glauca / Shepherdia canadensis / Thuidium abietinum*	white spruce / Canada buffaloberry / fern moss	S2	Riparian	Forest/ Woodland	Could occur
CEAB000056	*Betula occidentalis - Amelanchier alnifolia / Artemisia campestris - Elymus lanceolatus (Agropyron dasystachyum)*	water birch - saskatoon / plains wormwood - northern wheat grass	S1	Riparian	Shrubland	Only known from Jasper area; could occur in R11
CEAB000069	*Picea glauca / Betula pumila - Salix bebbiana / Carex eburnea*	white spruce / dwarf birch - beaked willow / bristle-leaved sedge	S1?	Riparian	Forest/ Woodland	Could occur
CEAB000070	*Picea glauca / Thuidium abietinum*	white spruce / fern moss	S2S3	Riparian	Forest/ Woodland	Could occur
CEAB000084	*Salix drummondiana / Thalictrum venulosum*	Drummond's willow / veiny meadow rue	S1	Riparian	Shrubland	Could occur

Code	Scientific Name	Common Name	Rank*	Type	Group	Comments
CEAB000167	*Salix bebbiana / Cornus stolonifera*	beaked willow / red-osier dogwood	S3?	Riparian	Shrubland	Could occur
CEAB000169	*Betula occidentalis* riparian shrubland	water birch riparian shrubland	S2S3	Riparian	Shrubland	Could occur
CEAB000162	*Cymbella pusilla - Mastogloia smithii - Nitzschia palea*	diatom ponds	S1S3	Riparian	Aquatic	Could occur
CEGL001098	*Elaeagnus commutata* riparian shrubland	silverberry riparian shrubland	SU G2Q	Riparian	Shrubland	Could occur
CEAB000016	*Betula papyrifera / Betula occidentalis / Arctostaphylos uva-ursi*	white birch / water birch / common bearberry	S1	Slope	Forest/ Woodland	Only known from Jasper area; could occur in R11
CEAB000017	*Picea engelmannii - Abies bifolia / Dryas octopetala*	Engelmann spruce - subalpine fir / white mountain avens	S2S3	Slope	Forest/ Woodland	High elevation front range type; could occur
CEAB000018	*Picea engelmannii – Abies bifolia / Salix vestita / Cassiope tetragona*	Engelmann spruce - subalpine fir / rock willow / white mountain-heather	S2	Slope	Forest/ Woodland	Permafrost front range type; could occur
CEAB000019	*Picea engelmannii / Leymus innovatus*	Engelmann spruce / hairy wild rye	S2	Slope	Forest/ Woodland	Found in Banff & Jasper NP; could occur in R11
CEAB000022	*Populus tremuloides / Menziesia ferruginea*	aspen / false azalea	S1	Slope	Forest/ Woodland	Could occur
CEAB000023	*Populus tremuloides / Leymus innovatus – Aster conspicuus* avalanche community	aspen / hairy wild rye - showy aster avalanche community	S2	Slope	Forest/ Woodland	Could occur
CEAB000024	*Dryas integrifolia – Carex rupestris*	white mountain avens - rock sedge	S1	Slope	Dwarf Shrubland	Could occur
CEAB000065	*Penstemon ellipticus* talus barren	creeping beardtongue talus barren	S1?	Slope	Sparsely Vegetated	Could occur
CEAB000066	*Picea engelmannii – Abies bifolia / Salix planifolia / Hylocomium splendens*	Engelmann spruce - subalpine fir / flat-leaved willow / stair-step moss	S1?	Slope	Forest/ Woodland	Could occur
CEAB000067	*Picea engelmannii / Salix drummondiana*	Engelmann spruce / Drummond's willow	S1?	Slope	Forest/ Woodland	Could occur

Code	Scientific Name	Common Name	Rank*	Type	Group	Comments
CEAB000130	*Pinus contorta / Ledum groenlandicum / Vaccinium scoparium / Pleurozium schreberi*	lodgepole pine / common Labrador tea / grouseberry / Schreber's moss	S1?	Slope	Forest/ Woodland	Could occur
CEGL001894	*Dryas octopetala - Polygonum viviparum*	white mountain avens - alpine bistort	S1S2 G3?	Slope	Dwarf Shrubland	Could occur
CEGL005877	*Phyllodoce glanduliflora / Sibbaldia procumbens*	yellow heather / sibbaldia	SNR G2G3	Slope	Dwarf Shrubland	Could occur

* See Appendix II for a description of ranks.

Whitebark and limber pine communities – Both whitebark and limber pine are species on ANHIC's Tracking List and are seriously threatened by an exotic rust (white pine blister rust), by mountain pine beetle, and by fire suppression activities in Alberta. A report on the status of whitebark pine in Canada will soon be submitted to COSEWIC by Parks Canada for assessment and possible listing under the federal Species at Risk Act (SARA). Known or suspected whitebark pine and limber pine stands are shown in Map 38. These locations likely also have uncommon community types. All whitebark and limber pine communities should be protected within R11, thus their manipulation through prescribed burning should be considered experimental and closely monitored for changes.

Douglas-fir communities – Although Douglas-fir community types could occur within the R11 FMU, research and surveys on plant communities dominated by this species are lacking and a list of potential communities cannot be generated. All Douglas-fir community types within R11 should be reported to ANHIC and monitored, especially those falling within the boundaries of planned prescribed burns.

Lowland grassland communities – Six uncommon lowland grassland communities are known to occur within the R11 FMU, primarily in the Kootenay Plains area, and four others could potentially occur. Historically, these communities likely experienced a high fire frequency, thus prescribed burn treatments should prove effective in their maintenance.

Riparian communities – At least ten of the potentially occurring uncommon community types are related to riparian areas. Maintaining the integrity of riparian areas throughout the R11 FMU will protect these communities (see Indicators 1.5.1 and 1.6.1).

Forecast: All uncommon communities may show an initial decrease in size within burned areas, but fire-dependant communities (e.g., whitebark pine, limber pine, and Douglas-fir community types) should rebound or even expand in size given sufficient time.

Monitoring: Forestry personnel and contractors will be trained by ANHIC staff to identify these community types. Prior to prescribed burn or harvest treatments, potential sites within R11 will be assessed by personnel working in these areas for the presence of uncommon community types, focusing primarily on whitebark pine, limber pine, and Douglas-fir community types. Any new information will be deposited with ANHIC, which maintains an inventory of rare community types in a database as well as a GIS system. New locations of whitebark pine and limber pine will also be reported to ASRD for inclusion in their inventory of these species.
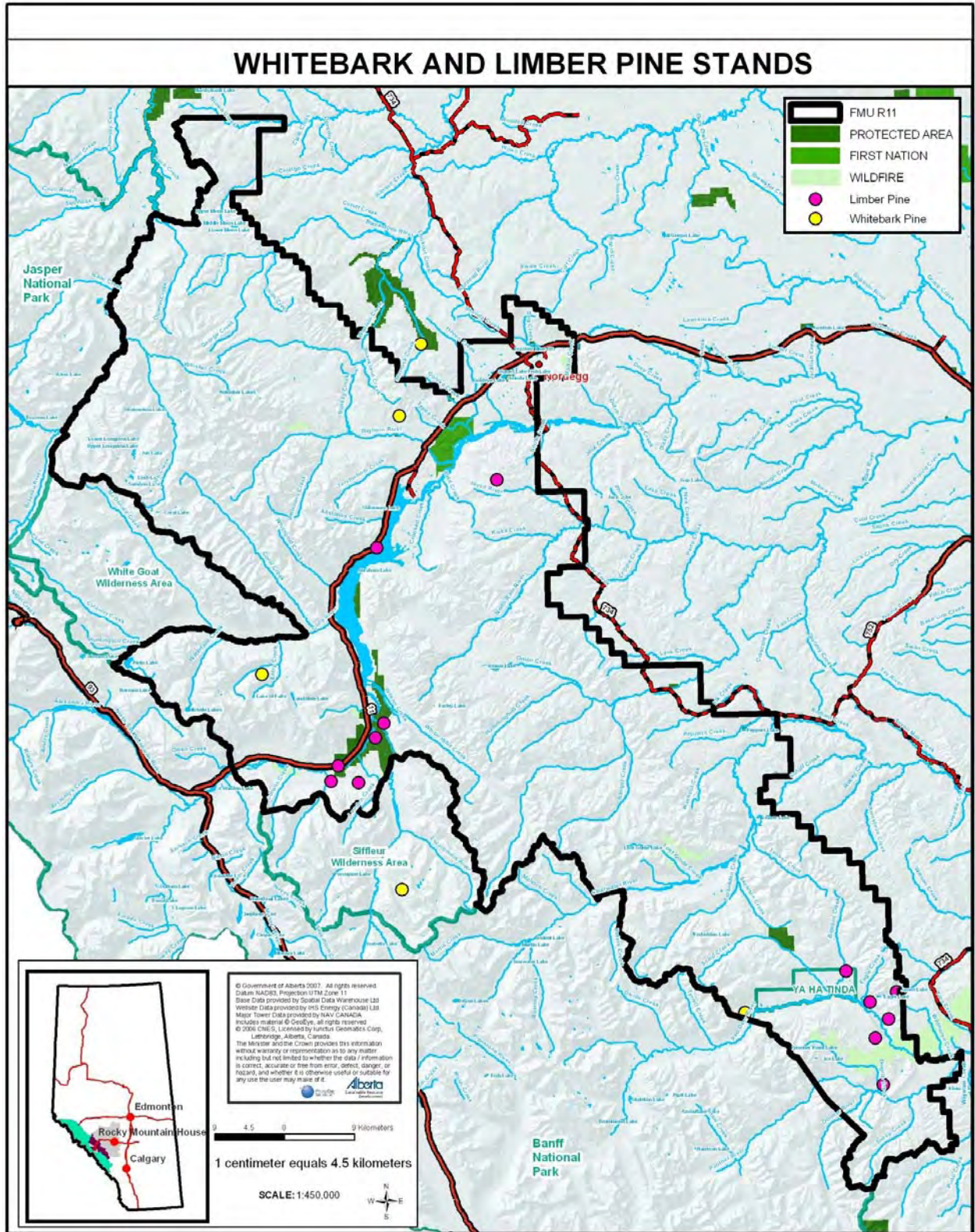
Map 38. Location of known and suspected whitebark and limber pine stands in the R11 FMU.

Fiscal and manpower limitations will likely constrain post-treatment monitoring of all identified uncommon communities. Accordingly, permanent sample plots (PSPs) will be established in 25% of the identified communities planned for prescribed burn or harvest treatments as well as in control areas having no active vegetation management (i.e., provincial Protected Areas, areas identified in special feature reports). Design and sampling methodology for the plots will be based on ANHIC's Draft Plant Community Sampling Guidelines as well as methods devised by the Canadian Forest Service and the Whitebark Pine Ecosystem Foundation (http://www.whitebarkfound.org). The surveys will provide information about the community composition, the number of regenerating trees, and the presence of white pine blister rust and overall health of tree species. A given PSP may not sample the entire area of the community, thus the extent of the community will have to be estimated on the ground or from aerial photographs. PSPs will be resurveyed every 10 years. Results of the monitoring will be reported in the Stewardship Reports.

Response: Any reduction in community size greater than 10% will be assessed for potential causal factors and prescribed burn or harvest plans will be adjusted accordingly.

Indicator 1.3.1

Value: Biodiversity - Ecosystem Diversity

Objective: Conserve ecosystem diversity by maintaining unique habitats provided by burns and blowdown.

Indicator: Area of unsalvaged burned forest and blowdown.

Target: 90% of burned and blowdown areas remaining unsalvaged.

Current Status: In most forests across Canada where timber has been allocated, salvage of merchantable trees is a common practice after disturbances such as wildfire, blowdown events, or insect outbreaks. Post-disturbance salvage is generally driven by three factors: (1) public perception of wildfire as detrimental, (2) reduction of the impact on the Annual Allowable Cut, and (3) economic or policy incentives (Schmiegelow et al. 2006). Knowledge is limited on the cumulative effects of human disturbance following natural disturbance, especially information specific to the foothills and mountains of Alberta. However, available evidence from other ecosystems indicates that post-disturbance salvage logging results in the alteration of stand structural complexity, changes in ecosystem processes, and changes in composition and abundance of species relative to traditional logging in undisturbed areas (see Lindenmayer and Noss 2006 for a review). For example, burned habitats within the boreal forest are often hotspots of biodiversity, in part a result of juxtaposition of live residual patches and burned snags, and contain many bird species associated with late successional stages, while salvaged burns may take decades to recover their complement of species (Schieck and Hobson 2000). Furthermore, elk, moose, and deer in the southern portion of the R11 FMU selected unlogged burned areas and avoided salvage-logged portions of the Dogrib Creek burn (Hebblewhite et al. 2005). The lack of timber commitments within the R11 FMU provides an opportunity to maintain unsalvaged disturbed areas and the unique habitats contained therein. Safety concerns in certain locations, such as along designated trails, may drive some limited salvage of timber within R11; however, 90% of the area of burns and blowdowns will remain unsalvaged. Prescribed burn plans will help determine if dead trees will be a hazard along roads, trails, etc.

Forecast: not applicable

Monitoring: GIS analysis will be used to compare the boundaries of salvage areas to the boundaries of prescribed fires, natural wildfires, or blowdown events. The Stewardship Report will summarize the total area burned/blowdown and the total area remaining unsalvaged each year.

Response: The area remaining unsalvaged may vary from the 90% target within the individual burn or blowdown but not within the landscape. If the target is not achieved at the landscape level, investigations will determine the cause of the deviance, and strategies to retain additional unsalvaged habitats will be developed for subsequent FMPs.

Indicator 1.4.1

Value: Biodiversity - Plant Species Diversity

Objective: Conserve plant species diversity by maintaining viable populations of native species (i.e., fine filter approach).

Indicator: Location of individual whitebark and limber pine.

Target: 80% of identified populations/individual trees will be maintained.

Current Status: Whitebark pine and limber pine are slow growing, long-lived conifers typically found on dry, wind-swept, rocky sites in montane to upper subalpine habitats. Although their seeds may be eaten by wildlife ranging from squirrels to bears, these pine species rely heavily on Clark's nutcracker for seed dispersal: the birds open cones and hoard the seeds in caches often found in open, windy areas that remain snow-free throughout much of the year. Some of the stored seeds may germinate, and the trees subsequently help stabilize steep slopes, regulate runoff, and facilitate community succession by creating more hospitable microenvironments. Whitebark pine and limber pine are pioneer species that are among the first to establish post-disturbance (i.e., typically wildfire). Given the various ecological functions these trees fulfill, they are often considered keystone species in upper subalpine ecosystems.

Limber pine

Both whitebark and limber pine are on ANHIC's Vascular Plant Tracking and Watch List, and a status report on whitebark pine in Canada will soon be submitted to COSEWIC by Parks Canada for assessment under SARA. These species are seriously threatened by the introduced white pine blister rust, fire suppression activities, and mountain pine beetle. An inventory on the location and status of these two pine species within Alberta has been developed though it is not yet considered complete. There are currently 3 suspected whitebark pine stands and 13 confirmed or suspected limber pine stands within the R11 FMU (Map 38).

Forecast: Regeneration of these species occurs shortly after a disturbance and subsequent seed dispersal into the disturbed area by Clark's nutcracker. Accordingly, these species should respond positively to prescribed burns within their habitat, provided seed sources and dispersal agents (i.e., birds) remain. As white pine blister rust infestation generally proves fatal for the individual tree, population resilience also depends upon the presence of rust-resistant trees that can act as seed sources.

Monitoring: Potential sites within R11 will be surveyed for whitebark and limber pine during the development of prescribed burn plans and design of harvest blocks. Any new locations will be deposited in the inventory database. Permanent sample plots will be established in 25% of the identified pine stands found in the planned burn or harvest areas as well as in control areas having no active vegetation management (i.e., provincial Protected Areas, areas identified in special feature reports) (see also Indicator 1.2.1). The sample plots will be consistent with PSP methodology devised by the Whitebark Pine Ecosystem Foundation (http://www.whitebarkfound.org/) or the Canadian Forest Service. The surveys will provide information about the presence of white pine blister rust, the number of regenerating pine, and the overall health of the stand. Changes to the stands will be tracked by resurveying the plots every 10 years. Since both of these pine species are fire-dependent, the 10-year surveys will provide information on the regenerative success after burning. Results of the monitoring will be reported in the Stewardship Reports.

Whitebark pine

Response: If natural regeneration is not successful after fire disturbance, a planting program can be implemented. Burn or harvest plans will also be adjusted based on the 10-year surveys.

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Indicator 1.4.2

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Value: Biodiversity - Plant Species Diversity

Objective: Conserve plant species diversity by maintaining viable populations of native species (i.e., fine filter approach).

Indicator: Location of mountain bladder fern populations.

Target: All identified populations will be maintained.

Current Status: Several factors were considered in the selection of individual rare plant taxa to be included in fine-filter, species-specific indicators. In particular, existing data must be available in government files, or new data must be easily collected by Forestry Division staff trained through a few focused workshops provided by specialists (likely ANHIC staff or other provincial rare plant specialists). These limitations eliminated non-vascular plants and lichens as well as the majority of vascular plants that would be difficult to identify by non-botanists. Alpine or non-treed cliff species were also excluded, as no significant impact is expected on their populations from the FMP-related activities. Finally, most riparian species and communities were excluded because riparian systems have high habitat values for many fish, wildlife, and plant species and were specifically considered in other indicators. Three rare plant species were selected and are presented in the following indicators.

Mountain bladder fern (*Cystopteris montana*) is a perennial fern which grows on damp calcareous sites, often by springs or along streams in mixed or coniferous forests. This species is one of 304 rare vascular plant species reported from the five Natural Subregions occurring within R11 and is listed as provincially rare (ranked S2) by the Alberta Natural Heritage Information Centre (see description of ANHIC in Indicator 1.2.1). There are 17 known locations of this species in Alberta, 13 of which are based on historic observations (i.e., last observation date older than 20 years). Aside from two recently reported locations which held a total of approximately 300 individual leaves (fronds), population size of this species in our province is presently unknown. There are no known sites within R11 as of November 2005, though locations have been reported just outside the R11 boundaries. Rare plant data, including information on mountain bladder fern, is lacking for the R11 FMU as a good inventory of vascular plants has never been conducted (except for a few Protected Area sites). However, suitable habitat does exist both near the Hamlet of Nordegg and elsewhere within R11 and could be impacted by harvest or prescribed burn treatments. Any identified populations of mountain bladder fern within the FMU will be maintained by setting aside an adequate area that will not be burned or harvested if possible.

Forecast: No information exists on this species' response to fire or harvest, though populations will likely be at least temporarily removed if burned.

Monitoring: Forestry personnel and contractors will be trained by ANHIC staff to identify this species, and they will assess proposed harvest or burn sites within R11 for the presence

of mountain bladder fern while conducting other fieldwork in these areas. If located, the number of individual fronds, their aerial extent, and a GPS location will be recorded. Identified sites will be monitored in consultation with ANHIC. The location and size of any identified populations will be reported in the Stewardship Report.

Response: Any significant downtrend in population size will be assessed for potential causal factors.

Indicator 1.4.3

Value: Biodiversity - Plant Species Diversity

Objective: Conserve plant species diversity by maintaining viable populations of native species (i.e., fine filter approach).

Indicator: Location of wood anemone populations.

**Target:** All identified populations will be maintained.

Current Status: Wood anemone (*Anemone quinquefolia*) is a delicate spring wildflower that is typically found on sites with rich, moist soil and moderate shade at the edges of deciduous or mixedwood forests. This species is one of 304 rare vascular plant species reported from the five Natural Subregions occurring within R11. Ranked S1 by the Alberta Natural Heritage Information Centre (see description of ANHIC in Indicator 1.2.1), this small flower is one of the rarest species in the province with only one extant and one historical population known as of November 2005. The next closest populations are found in Saskatchewan.

Wood anemone

The only existing population is located just outside the R11 FMU, about 1 km north of Stevens Creek (NAD 83, 573150E, 5839000N; 52 42.217/115 54.733; LSD8 of 14; also LSD5 of 13-43-14-W5), in a lodgepole pine-feathermoss forest with scattered white spruce, fir, wild sarsaparilla, and little understory diversity. This population has been known since 1953 from a specimen collection and was estimated to contain about 500 plants in 1995 and several thousand plants in 1996. The area lies within the Sundre Forest Products Forest Management Agreement area, so logging poses a threat; additional seismic, oil and gas activities could also impact the population. In early 2004, Weyerhauser proposed to set aside up to four legal subdivisions to protect this population, although they feared road construction may have eliminated the population in the meantime. The single historic location is based on a 1961 observation within R11 about one mile west of Nordegg (likely a pine-spruce-fir community; Map 39). Population size associated with this historical location is unknown, and there have been no recent attempts to relocate this population. Rare plant data, including information on wood anemone, is lacking for the R11 FMU as a good inventory of vascular plants has never been conducted (except for a few Protected Area sites). If populations of wood anemone are located within R11, they will be maintained by setting aside adequate areas that will not be burned or harvested if possible.
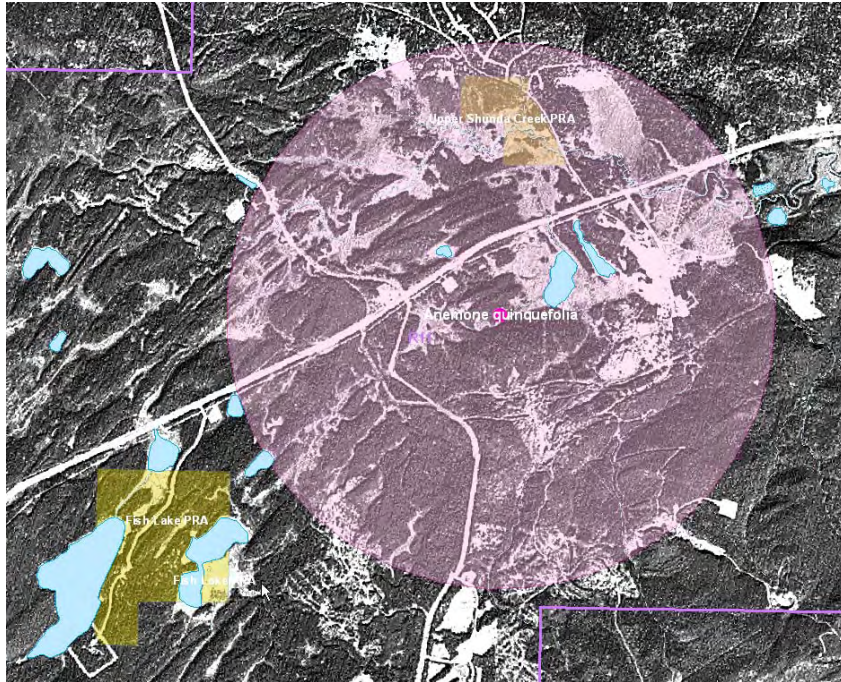
Map 39. Historical location of the only known wood anemone population within the R11 FMU.

Forecast: No information exists on this species' response to fire or harvest, though populations will likely be at least temporarily impacted if burned.

Monitoring: Forestry personnel and contractors will be trained by ANHIC staff to identify this species, and they will assess proposed harvest or burn sites within R11 for the presence of wood anemone while conducting other fieldwork in these areas. If located, the number of individual plants, their aerial extent, and a GPS location will be recorded. Identified sites will be monitored in consultation with ANHIC. The location and size of any identified populations will be reported in the Stewardship Report.

Response: Any significant downtrend in population size will be assessed for potential causal factors.

Indicator 1.4.4

Value: Biodiversity - Plant Species Diversity

Objective: Conserve plant species diversity by maintaining viable populations of native species (i.e., fine filter approach).

Indicator: Location of Lapland rose-bay populations.

Target: All identified populations will be maintained.

Current Status: Lapland rose-bay (*Rhododendron lapponicum*) is a small evergreen shrub that generally grows on moist alpine slopes and upper subalpine sites near timberline. The species is listed as a provincially rare species (ranked S2) by Alberta Natural Heritage Information Centre (see description of ANHIC in Indicator 1.2.1) and is mainly restricted in its Alberta distribution to the central Rocky Mountains region (i.e., Jasper National Park and Bighorn Backcountry, with only one other location found in the Grande Cache area). Four locations within the R11 boundaries are currently recorded in the ANHIC database (Map 40), though this species may be quite frequent, but often overlooked, throughout Job Creek-Coral Creek area and the Wapiabi front ranges (Pharis 2003). Rare plant data, including information on Lapland rose-bay, is lacking for the R11 FMU as a good inventory of vascular plants has never been conducted (except for a few Protected Area sites). Known and newly identified populations of Lapland rose-bay will be maintained by setting aside an adequate area that will not be burned or harvested if possible.


Dr. Joyce Gould

Lapland rose-bay

Forecast: No information exists on this species' response to fire or harvest, though populations will likely be at least temporarily impacted if burned.

Monitoring: Forestry personnel and contractors will be trained by ANHIC staff to identify this species, and they will assess proposed harvest or burn sites within R11 for the presence of Lapland rose-bay while conducting other fieldwork in these areas. The number of individual plants, their aerial extent, and a GPS location will be recorded for both previously known and newly discovered populations. Identified sites will be monitored in consultation with ANHIC. The location and size of any identified populations will be reported in the Stewardship Report.

Response: Any significant downtrend in population size will be assessed for potential causal factors.
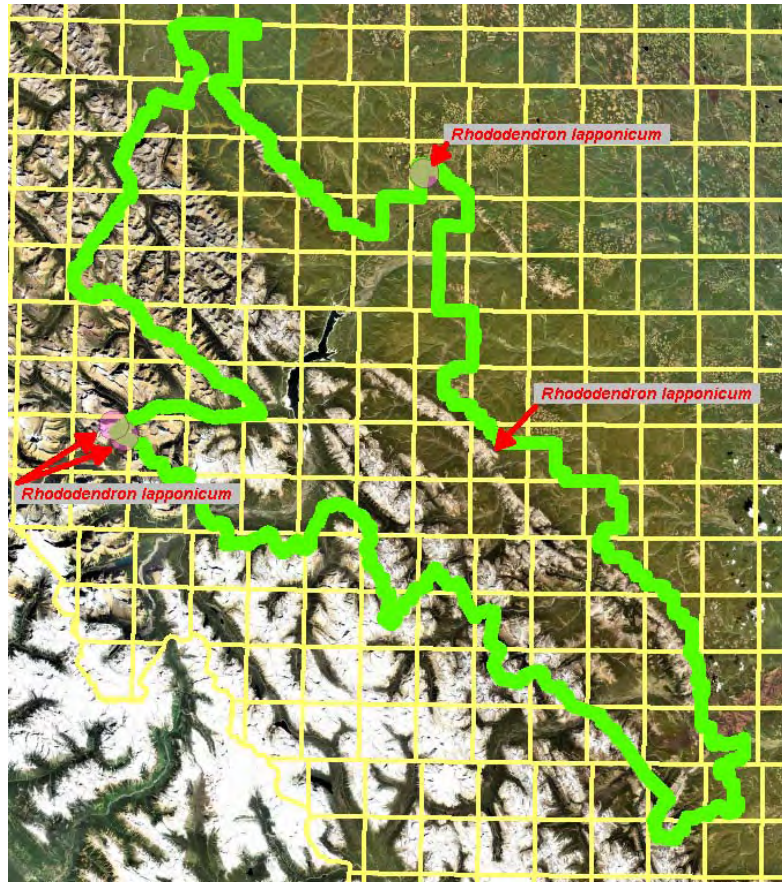
Map 40. Locations of known Lapland rose-bay populations with the R11 FMU.

Indicator 1.5.1

Value: Biodiversity – Fish Species Diversity

Objective: Maintain important habitat for populations of fish species.

Indicator: Area of disturbed riparian habitat.

Target: Complete protection of all riparian habitats.

Current Status: One habitat component considered integral to the persistence of fish populations in R11 is riparian areas, the lands adjacent to streams, river, lakes and wetlands where the vegetation and soils are strongly influenced by the presence of water. Comprising only a small percentage of the landbase, riparian areas are among the most productive of all habitat types and are particularly valuable to both terrestrial and aquatic ecosystems. Important ecological functions provided by riparian vegetation include stabilizing stream banks and channels, regulating temperature and light effects in the watercourse, regulating water flow regimes, filtering runoff before it enters the watercourse, providing long-term recruitment of coarse woody debris and nutrient inputs for aquatic biota, and supplying food and cover for fish species. Accordingly, riparian areas will be protected during the implementation of R11 forest management activities.

Although fire disturbance of riparian areas and sedimentation events can be natural processes, precautions will be taken to ensure treatment activities will not accelerate erosion and sedimentation and will protect sensitive soils and water quality. Protection of water quality during harvest activities is covered in detail in Objective 4.2. Protection of riparian areas and water quality during prescribed burn activities is similarly desirable; however, precision with prescribed fire can be challenging due to topography, fuel types, and local fire weather conditions. Nonetheless, prescribed burn plans will be designed with the protection of riparian values in mind where possible.

Forecast: Complete protection of riparian areas is anticipated in all harvest areas and the majority of prescribed burn areas.

Monitoring: Given the relative paucity of fish inventory data for the R11 FMU, habitat monitoring will be used instead of population monitoring. Post-treatment analyses will determine the amount of the riparian areas disturbed. Results will be presented in the five-year Stewardship Report.

Response: If regular field inspections detect harvest operations occuring within riparian areas, immediate remedial action will be taken to stop, and correct such operations. Riparian areas adjacent to permanent watercourses will likely be used as the boundary between prescribed burn treatments and thus will not be targetted for burning; however riparian habitats in west-central Alberta do experience wildfire disturbance at similar rates as upland habitats (Andison and McCleary 2002). Therefore, incidental removal of riparian vegetation

through prescribed burning will be considered natural and will not trigger action such as adjustments to prescribed burn plans unless excessive impacts are noted (e.g., amount of area disturbed is outside the natural range of variation).

Indicator 1.6.1

Value: Biodiversity – Fish Species Diversity

Objective: Minimize impact of treatment activities on known bull trout and cutthroat trout streams.

Indicator: Maintenance of stream buffers.

Target: Sundre Forest Products Operating Ground Rules for stream buffers met or exceeded on all bull trout and cutthroat trout streams.

Current Status: Recreational fishing holds both social and economic values within the R11 FMU, with bull trout and cutthroat trout two of the most popular sport fish species. Bull trout and cutthroat trout are found predominantly in cool, high elevation, low to mid-order watersheds (summarized in Post and Johnston 2002 and Costello 2006). Unsilted gravel-cobble substrates, stable channels and flows, overhead and instream cover (e.g., boulders,

large woody debris, undercut banks, pools), and suitable overwintering habitat further characterize streams utilized by these species. Historically found in all eastern slopes drainages, populations of bull trout have been in decline for the last century, and are now generally confined to less accessible, tributary headwaters of the major river systems including the North
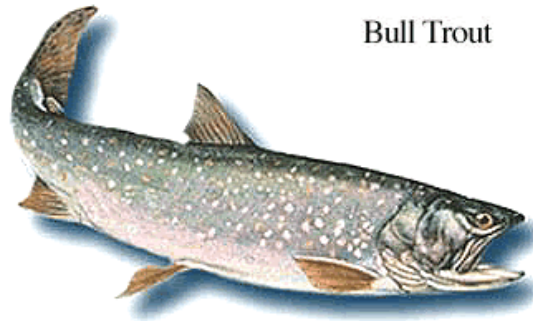
Bull Trout

Saskatchewan and Red Deer Rivers (Post and Johnston 2002). Accordingly, bull trout are considered a Species of Special Concern in Alberta (ASRD 2006). Information for R11 populations, other than the Upper Clearwater drainage (see Rhude and Rhem 1995; Rodtka 2005), is lacking. Although R11 cutthroat trout populations are introduced, cutthroat trout native to the Bow and Oldman River drainages in Alberta are considered Threatened by COSEWIC. Similar to bull trout, native cutthroat trout are now restricted to the headwaters and upper reaches of tributaries of mainstem rivers (Costello 2006).

Life history traits (i.e., slow growth, late maturity, alternate year spawing), migratory barriers, habitat degradation and fragmentation, angling pressure, and detrimental interactions with introduced species are thought to limit bull trout abundance. The latter three factors, especially hybridization with introduced salmonid species, have also contributed to cutthroat trout declines over the last century. Habitat loss and degradation, in particular, may result from harvesting operations. Removal of forest cover can decrease the stability and the complexity of habitat through removal of riparian vegetation, erosion of stream banks, removal of large woody debris and coarse substrates, channel alterations, and sediment accumulation in streams (MBTSG 1998). Furthermore, harvesting can cause increases in the rate of runoff leading to flooding events, cause changes in the groundwater

recharge and seasonal flows, and increase stream temperature through a decrease in canopy cover (MBTSG 1998). Wildfires may also lead to a loss of habitat complexity, increased sediment load, and increased temperatures, but habitat may be enhanced through the introduction of large woody debris and subsequently pools (MBTSG 1998). Sestrich (2005) also found that connected bull trout and cutthroat trout populations rebounded within three years following wildfire while non-native brook trout were less resilient to disturbance.

ASRD Fish and Wildlife Division maintains a list of known bull trout and cutthroat trout streams. Harvest activities occurring adjacent to any known bull trout or cutthroat trout stream will adhere to the stream buffers identified in Sundre Forest Products Operating Ground Rules (OGR), the standard adopted for this R11 Forest Management Plan. Prescribed burn plans will attempt to avoid disturbance to riparian areas by utilizing these areas as boundaries between treatment units. Areas with high potential for siltation will be identified. Note that Indicator 4.2.2 also addresses harvest buffer retention to protect water quality and Indicator 1.5.1 addresses the protection of riparian habitats for the benefit of all fish species and populations.

Forecast: Achievement of stream buffer retention is anticipated on all harvest and prescribed burn areas.

Monitoring: The inspecting Forest Officer will conduct regular reviews, and any deviation from the approved Annual Operating Plan will be documented. A summary will be presented in the five-year Stewardship Report.

Response: Immediate remedial action will be taken to correct, where possible, harvesting operations that are not adhering to the OGR.

Indicator 1.6.2

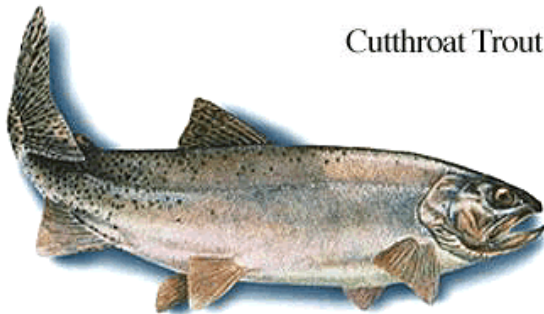**Value**: Biodiversity – Fish Species Diversity

Objective: Minimize impact of treatment activities on known bull trout and cutthroat trout streams.

Indicator: Number of stream crossings.

Target: No permanent crossings wherever possible.

Current Status: See Indicator 1.6.1 for general habitat requirements and population information for bull trout and cutthroat trout in Alberta. Habitat loss and degradation are thought to be one of the limiting factors for both bull trout and cutthroat populations (Post and Johnston 2002; Costello 2006), and the construction of roads and watercourse crossings has the potential to impact their habitat. Blockages and hanging culverts form physical barriers to migrating individuals, while removal of riparian cover for road right-of-ways, increased sediment inputs through ditches and eroding stream banks, and channel alterations resulting from crossings can decrease habitat quality and complexity (MBTSG 1998).

Harvest areas identified in the R11 operational plan are reasonably accessible with minimal road construction, and harvesting will be conducted under competitive permits, where ASRD can specify time of harvest, access routes, and crossing types if desired. Access will be coordinated with adjacent land managers whenever possible, although coordination of activities may dictate adjustment of harvest schedules to achieve joint roading and reclamation. As most harvest will occur in winter months, construction of new permanent stream crossings is not expected, and any temporary crossings will be removed upon completion of activities. Note that Indicator 4.2.1 addresses the impact of road and watercourse construction on water quality.

Cutthroat Trout

Forecast: No new permanent stream crossings are anticipated, unless upon consultation, stakeholders (e.g., Bighorn Steering Committee) request access to be retained for other purposes.

Monitoring: The inspecting Forest Officer will conduct regular reviews. A summary will be presented in the five-year Stewardship Report.

Response: Immediate remedial action will be taken to correct road and crossing construction, maintenance, or reclamation operations that do not comply with the OGR or that are creating impacts in known bull trout or cutthroat trout streams.

Indicator 1.6.3

Value: Biodiversity – Fish Species Diversity

Objective: Minimize impact of treatment activities on known bull trout and cutthroat trout streams.

Indicator: Timing of instream work.

Target: No instream work from September 1 to April 30 (bull trout streams) or May 16 to August 15 (cutthroat trout streams).

Current Status: See Indicator 1.6.1 for general habitat requirements and population information for bull trout and cutthroat trout in Alberta. Habitat loss and degradation are thought to be one of the limiting factors for bull trout and cutthroat trout populations (Post and Johnston 2002; Costello 2006); instream work associated with harvesting activities and road construction can impact habitat and subsequently result in habitat degradation. For example, bull trout habitat quality and complexity can be decreased by the removal of riparian cover, increased sediment inputs, stream bank erosion, and channel alterations (MBTSG 1998).

Harvest areas identified in the R11 operational plan are reasonably accessible with minimal road construction, and harvesting will be conducted under competitive permits, where ASRD can specify time of harvest, access routes, and crossing types if desired. Most harvest will occur in winter months and thus should not require any instream work. When bull trout or cutthroat streams cannot be avoided or when instream work is required to cross the streams, work will be conducted as outlined in the *Code of Practice for Watercourse Crossings* under the provincial *Water Act*. Map 41 shows Restricted Activity Periods for specific watersheds within R11.

Forecast: No incidences of instream work are anticipated in bull trout or cutthroat trout streams. If instream work is necessary, adherence to the timing restriction will ensure protection of bull trout or cutthroat trout spawning, incubation, and hatching.

Monitoring: The inspecting Forest Officer will conduct regular reviews. A summary will be presented in the five-year Stewardship Report.

Response: Instream work conducted outside the Restricted Activity Period in contravention to the *Water Act* will be detected by field inspections and could result in fines.
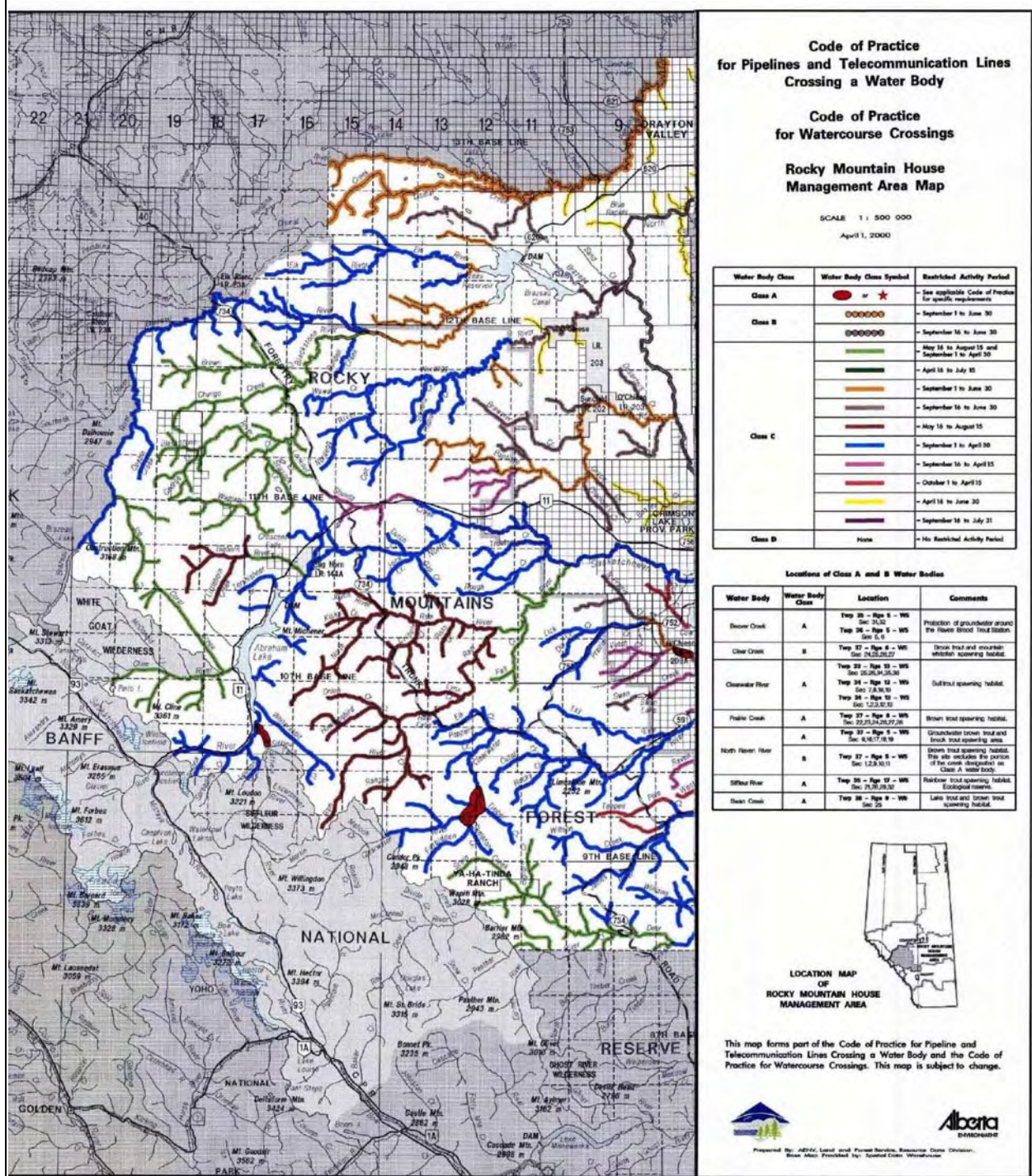
Map 41. Code of Practice for Watercourse Crossings map showing the Restricted Activity Periods for various watersheds within the R11 FMU. Watersheds identified in blue contain bull trout while brown indicates cutthroat trout and green indicates both bull trout and cutthroat trout.

Indicator 1.7.1

Value: Biodiversity – Fish Species Diversity

Objective: Maintain the integrity of key instream habitats.

Indicator: Spawning, rearing, and overwintering habitat condition.

Target: No significant increase in sediment load in spawning, rearing, or overwintering areas.

Current Status: The introduction of sediments into spawning, rearing, and overwintering fish habitats can have detrimental physiological, behavioural, and population effects (Andersen 1998). High rates of sedimentation can scour out eggs within spawning beds or, alternatively, bury eggs in the spawning beds. Fine sediments can fill the spaces within the gravel thereby reducing the flow of oxygenated water and resulting in impaired respiration or death of embryos. The emergence of hatched fry may be impeded by sediments, and fry further rely on interstitial spaces within gravel beds for cover during rearing. Increased sedimentation levels in watercourses can also cause direct mortality of adults or juveniles through gill trauma, reduce aquatic invertebrate populations, reduce growth rates, disrupt territoriality, displace individuals from preferred habitat to less turbid areas, and infill deep pools required for overwintering (see reviews in Newcombe and MacDonald 1991 and Andersen 1998).

ASRD Fish and Wildlife Division maintains an inventory of spawning, rearing, and overwintering areas in certain streams within the R11 FMU, recognizing that many streams have not been surveyed or existing data is dated. The preparation of prescribed burn or harvest plans will include consultations with fisheries staff to identify known sites. Indicators 1.6.1 to 1.6.3 and 4.2.1 to 4.2.4 detail important measures that will be taken to minimize the potential for harvest-induced sedimentation from adjacent or upstream activities (e.g., maintaining OGR buffers on known fish-bearing streams, minimizing the number of watercourse crossings, avoiding instream work, avoiding bared soil surfaces). When instream work cannot be avoided, the incorporation of proactive, sediment-reduction measures into normal construction practices (e.g., utilizing silt barriers, deflection berms, revegetation) is the next most effective way to minimize impacts on instream habitats. The potential for fire-induced sedimentation depends on fire severity, soil erodibility, steepness of slope, and intensity or amount of precipitation before vegetation has regenerated. Prescribed burn activities will attempt to protect key habitats and minimize sedimentation by retaining riparian areas.

Forecast: Protective measures outlined above will help ensure minimal harvest-induced sedimentation of important fish habitats. Recognizing a degree of unpredictability associated with prescribed fire, protection of riparian areas is anticipated on known fish-bearing streams within prescribed burns.

Monitoring: Post-treatment site visits will assess sedimentation into watercourses. Results will be summarized in the Stewardship Report. Additional fisheries inventories are necessary to identifiy additional spawning, rearing, and overwintering sites within R11 and to permit monitoring of population-level responses to treatment activities.

Response: If post-treatment monitoring of run-off from ditches, stream crossings, bare soil, etc. identifies impacts to important habitats, some remedial measures such as additional revegetation may be utilized; however, there are few options for rehabilitating the impacted habitat. The harmful alteration, disruption, or destruction of fish habitat is an offence under the federal *Fisheries Act*, and may result in charges being laid by the Department of Fisheries and Oceans.

Indicator 1.8.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Ensure treatment activities do not unduly benefit either predator or prey populations.

Indicator: Predator-prey ratio.

Target: Targets to be determined after completion of ongoing research.

Current Status: Integral to the terrestrial ecosystem found within the R11 Forest Management Unit are multiple large predators including wolves, cougar, black bear, grizzly bear, and their prey, primarily large herbivores such as elk, mule deer, white-tailed deer, moose, bighorn sheep, and feral horses. (Wolverine, coyotes, and mountain goats are either rare or localized in their R11 distribution and thus will not be considered in this indicator.) Such a diversity of predator and prey species necessarily denotes complex predator-prey relationships. Our understanding is further confounded by a lack of information and difficulties in obtaining accurate population data. For example, wolf and cougar populations are thought to have increased over the past two decades, but these reports are largely based on voluntary harvest summaries or anecdotal records as few rigorous studies have been conducted in the Alberta foothills (e.g., Ross and Jalkotzy 1992, Kuzyk 2002). Similarly, trend counts for elk via annual aerial surveys of open winter ranges have produced highly variable estimates, likely because individuals also use nearby forested habitats where sightability issues limit detection (Merrill et al. 2005).

Predator-prey relationships, their impacts on population dynamics, and the influence of industrial development have been the focus of recent and ongoing research at the University of Alberta (see http://ursus.biology.ualberta.ca/ceswes/index.htm and http://www.ualberta.ca/%7Ekknopff/cougars/index.htm). The Central East Slopes Wolf Study was initiated in the spring of 2003 and fieldwork is now completed, while only one year of fieldwork in a three-year cougar study has been completed. Results from the wolf study as of late 2005 indicate that numerically about 50% of wolf kills were deer with the other 50% of kills made up of elk, moose, and feral horses, though proportionately more food comes from these larger prey. Fecal analysis from four wolf packs sheds a different light on the predator-prey picture with wolves preferring to prey on moose, using elk in relation to their availability, and preying on deer less than expected based on their abundance (Webb et al. 2006).

Harvest and prescribed burn treatments planned in this FMP will likely benefit herbivore species as young forests regenerate providing high forage availability. Caution must be exercised to ensure any newly created ungulate habitat and the individuals foraging therein are not so attractive to predators that the areas become population sinks (i.e., more predation than the prey population can sustain). Such attractive habitats can also be detrimental if they result in increased predation on alternative prey populations that are already facing other

challenges or limitations. For example, elk and moose populations in the Red Deer, Bow, Spray, and Cascade River valleys declined over the same time period that the North Banff woodland caribou herd experienced a dramatic decline; wolf numbers, on the other hand, increased (see references in Parks Canada 2006). Prey switching by wolves was likely a contributing factor as caribou are more susceptible to wolf predation than other ungulates and are the first prey species to decline and the last to recover (Seip 1991). Although likely perceived as less of a problem, the predator-prey balance could shift in favour of the prey species if treatment activities overachieve. This FMP proposes to monitor the predator-prey ratio as an indicator of how treatments are impacting populations. Given the complexities of a dynamic, multi-predator, multi-prey system and the population data limitations noted above, neither targets will be set nor the predator-prey ratio tracked until after the completion of ongoing research studies.

Forecast: To be determined after the completion of ongoing research.

Monitoring: A complete description of how the predator-prey ratio will be calculated and monitored will not be available until the completion of ongoing research studies. At the current time, available data on ungulate populations is derived from annual aerial surveys. Voluntary trapper harvest reports currently provide the only annual information on predator numbers, though limitations exist with harvest return data as trapper effort and reported success can be influenced memory recall, furbearer population status, fur prices, weather conditions, landscape and landuse changes, and available time and income (Mullen 2006). Annual aerial survey data are compiled yearly and results will be summarized in the five-year Stewardship Report.

Response: To be determined after the completion of ongoing research.

Indicator 1.9.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain and restore high quality ungulate summer and winter range and associated movement habitat.

Indicator: Stand age distribution broken down by habitat capability for elk, deer, and moose.

Target: Current stand age distribution within the natural range of variation for areas identified as capable of supporting elk, deer, moose, and bighorn sheep.

Current Status: Elk, mule deer, bighorn sheep, and moose within R11 hold ecological value as large herbivores and prey species as well as social and economic value in recreational hunting. Young seral stages generally represent high quality ungulate habitat as these species favour early successional vegetation for forage. However, aggressive fire suppression, particularly in forested areas without compensatory timber harvesting, has resulted in progressively more mature and old forests, forest encroachment into grasslands,

Bighorn sheep

meadow complexes, and alpine habitats, and thus habitat loss for many ungulates. The harvest and prescribed burn treatment activities identified in this FMP will restore areas of prime ungulate habitat by returning the stand age distribution to within its natural range of variation. Potential ungulate habitat is defined as per the Canada Land Inventory Land Capability for Ungulates map (see Monitoring below for more details) and the current distribution of stand ages is shown in Table 21 and Table 22.

Table 21. Current percentage of forest in each age class in areas identified as capable of supporting a given ungulate species throughout the year, compared to the natural range of variation.

Natural Subregion	Age Class (yrs)	Deer	Elk	Moose	Bighorn Sheep	NRV
Subalpine	1-20	4	3	4	1	6-20
	21-100	14	13	13	12	22-47
	101-180	61	62	62	62	17-21
	181+	21	21	21	25	14-55
Montane	1-20	4	4	4	4	6-39
	21-100	16	15	16	21	22-53
	101-180	75	76	75	72	7-21

	181+	5	5	5	4	1-55
Upper Foothills	1-20	5	5	3	0	17-42
	21-100	25	24	27	4	44-53
	101-180	64	65	64	80	6-21
	181+	5	6	6	17	1-18
Lower Foothills	0-20	0	0	0	-	16-32
	21-100	12	12	12	-	43-53
	101-180	35	35	35	-	11-21
	181+	53	53	53	-	3-20

Table 22. Current percentage of forest in each age class in areas identified as capable of supporting a given ungulate species during the winter, compared to the natural range of variation.

Natural Subregion	Age Class (yrs)	Deer	Elk	Moose	Bighorn Sheep	NRV
Subalpine	1-20	4	4	4	2	6-20
	21-100	13	12	13	9	22-47
	101-180	59	61	60	62	17-21
	181+	24	23	23	27	14-55
Montane	1-20	6	6	6	5	6-39
	21-100	19	19	20	25	22-53
	101-180	68	68	67	65	7-21
	181+	7	7	7	5	1-55
Upper Foothills	1-20	5	4	2	0	17-42
	21-100	29	27	31	1	44-53
	101-180	62	63	63	68	6-21
	181+	4	6	5	31	1-18
Lower Foothills	0-20	0	0	0	-	16-32
	21-100	12	12	12	-	43-53
	101-180	35	35	35	-	11-21
	181+	53	53	53	-	3-20

Forecast: R11 forest management activities should create additional habitat for ungulate species by shifting the stand age distribution toward young seral stages.

Monitoring: The Canada Land Inventory has mapped Land Capability for Ungulates throughout many parts of the province. This classification is not based on current or known ungulate production or habitat, but rather on the physical characteristics that determine the land's potential to provide sufficient quantity and quality of food and cover resources. Seven capability ratings are identified ranging from lands with no significant limitations on ungulate production to lands with severe limitations imposed by local conditions (e.g., aspect, snow depth, aridity, etc.). Within these classes, polygons retaining specific potential as winter range habitat are identified, and the most applicable ungulate species for each area

are also noted. The Canada Land Inventory ungulate coverage will be used in a GIS to distinguish areas in R11 capable of supporting survival and reproduction of elk, deer, moose, and bighorn sheep throughout the year (Classes 1, 2, 3, and 1W, 2W, 3W; Map 42) and specifically during the winter (Classes 1W, 2W, 3W) period. The stand age distribution will then be assessed for areas capable of supporting a given species during a given time period (e.g., stand age distribution for areas capable of supporting sheep during the winter; stand age distribution for areas capable of supporting moose at some point during the year). Results will be presented in the five-year Stewardship Report. This will be a landscape-level filter using a general habitat capability map to provide a crude estimate at the operational level: finer detail could be ascertained using more species-specific maps or models that take into account mortality risk from predation or hunting, current landcover, human development, etc. in future iterations of the FMP.

Response: More aggressive harvesting or prescribed burning will be required if the stand age distribution does not return to within the natural range of variation.
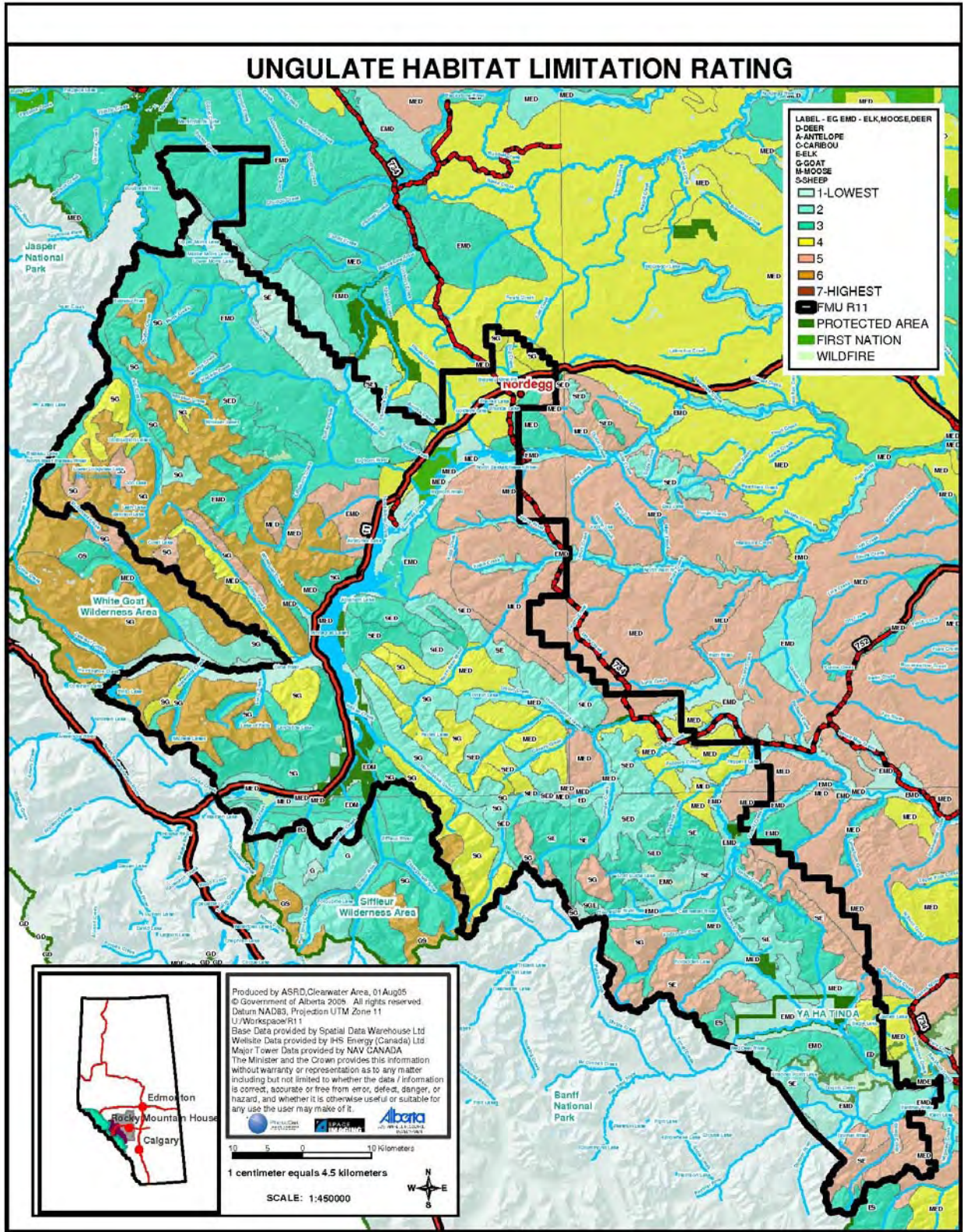
Map 42. Ungulate habitat limitation rating for R11 based on the Canada Land Inventory. A rating of 1 indicates the least limitations and thus the highest habitat capability.

Indicator 1.9.2

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain and restore high quality ungulate summer and winter range and associated movement habitat.

Indicator: Location and extent of high quality ungulate winter range and associated movement habitat.

Target: Not yet completed; target needs to be set using the Elk Habitat Effectiveness Planning tool.

Current Status: Winter is a challenging season for many northern ungulate species as energy costs are higher but forage availability is lower than at other times of the year. Native ungulate species found within the R11 Forest Management Unit include elk, mule deer, and bighorn sheep as well as moose and mountain goat where appropriate habitats exist. Elk will be used as the representative ungulate species in this FMP for both ecological and empirical reasons. In addition to habitat overlap between the generalist elk and other ungulates, snow depth also determines winter habitat use patterns of most ungulates and its effects on elk are intermediary between that of moose and deer. Furthermore, elk within the R11 Forest Management Unit have been the focus of scientific research over the past several years (Merrill et al. 2005), in part to assess the impacts of landscape change on elk populations. Supported by information and

Government of Alberta

Herd of bull elk in R11

technological products from this research, elk winter habitat will be one indicator of landscape changes resulting from R11 forest management activities. Additional ungulate species could be considered in future iterations of the FMP.

Winter habitat components required by elk include available forage, shallow snow depths, security cover, and possibly thermal cover. Typical winter forage includes forbs and shrubs, although grasses will be used preferentially where available. Snow depths exceeding 40 cm can force elk to move to areas with low snow cover and high forage availability such as south-facing slopes (Irwin and Peek 1985) and mature, closed-canopy conifer stands that better intercept snow, while depths exceeding 70 cm can impede movement (Sweeney and Sweeney 1984). Security cover includes habitat that is proximate to foraging areas and contains vegetative diversity to reduce detection by predators. Such cover should conceal 90% of a standing adult elk from a distance of approximately 60 m. Thermal cover (i.e., conifer-dominated stands that are 10-12 m tall with greater than 70% canopy closure) may

only be necessary during severe conditions when temperatures drop and wind-chill increases. Suitable wintering habitats can include grassy meadows, willow flats, creek and river valleys, floodplains, south-facing slopes, and low elevation ridges.

Harvest and prescribed burn treatment activities planned in this Forest Management Plan have the potential to maintain, and in some instances restore, high quality ungulate winter ranges. However, the ability of prescribed fires to enhance elk habitat depends on the wolf predation risk (Hebblewhite 2006): habitat treatments may be less desirable in some areas from an elk forage standpoint but would not result in a predation sink (e.g., higher elevation habitats distant from suitable wolf denning habitat). The Elk Habitat Effectiveness Planning Tool, based on landcover maps, predation risk models, and forage availability models from the Central East Slopes Wolf and Elk Study (Merrill et al. 2005), will be used to set habitat targets and assess the effects of forest management activities both pre-treatment and post-treatment. The planning tool uses resource selection function models that predict occurrence and survival of elk as a function of forage abundance, terrain complexity, predation risk, travel corridors, and human disturbances. Summer and winter seasons are treated separately within the models. Note that at this time, the Elk Habitat Effectiveness Planning Tool is in the final development phase and has not been released for general application. Accordingly, setting targets and forecasting the impacts of proposed treatments on elk winter habitat has not been completed for this version of the R11 Forest Management Plan.

Forecast: A quantitative analysis using Elk Habitat Effectiveness Planning Tool and proposed harvest block and prescribed burn boundaries will be completed for the next iteration of this FMP.

Monitoring: The Elk Habitat Effectiveness Planning Tool will be used to assess post-treatment landscape changes and their impacts on elk winter habitat. Results will be summarized in the Stewardship Report.

Response: Harvest and prescribed burn plans will be adjusted if the location and extent of elk winter range falls below the established targets.

Indicator 1.9.3

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain and restore high quality ungulate summer and winter range and associated movement habitat.

Indicator: Location and extent of high quality ungulate summer range and associated movement habitat.

Target: Not yet completed; target needs to be set using the Elk Habitat Effectiveness Planning tool.

Current Status: Winter range is generally accepted as a critical habitat requirement for northern ungulates balancing high energy expenditures and forage limitations, but recent studies suggest the importance of summer range has been underestimated (Cook et al. 2004; Stewart et al. 2004). Lack of access to high quality summer and early autumn forage can negatively influence body condition and subsequent pregnancy rates in elk (Cook et al. 2001). Ungulate summer range must also provide adequate forage, security cover, and lack of disturbance to meet the energy demands of lactation, calf rearing, antler growth, and accumulation of body stores for the fall and winter period.

Of the ungulate species found within the R11 Forest Management Unit, elk are the most general in their summer habitat preferences and graze on grasses and forbs within a variety of habitats also used by other species. Furthermore, elk within the R11 FMU have been the focus of scientific research over the past several years (Merrill et al. 2005), in part to assess the impacts of landscape change on elk populations. Supported by information and technological products from this research, elk summer habitat will be one indicator of landscape changes resulting from R11 forest management activities. Elk summer habitat overlap is not as pronounced with other ungulate species, especially moose and bighorn sheep, as during the winter period. Additional indicators and targets specific to these species may therefore be considered in the next FMP.

Harvest and prescribed burn treatment activities planned in this Forest Management Plan have the potential to maintain, and in some instances restore, high quality ungulate summer ranges. However, the ability of prescribed fires to enhance elk habitat depends on the wolf predation risk (Hebblewhite 2006): habitat treatments may be less desirable in some areas from an elk forage standpoint but would not result in a predation sink (e.g., higher elevation habitats distant from suitable wolf denning habitat). The Elk Habitat Effectiveness Planning Tool, based on landcover maps, predation risk models, and forage availability models from the Central East Slopes Wolf and Elk Study (Merrill et al. 2005), will be used to set habitat targets and assess the effects of forest management activities both pre-treatment and post-treatment. The planning tool uses resource selection function models that predict occurrence and survival of elk as a function of forage abundance, terrain complexity, predation risk, travel corridors, and human disturbances. Summer and winter seasons are treated separately

within the models. Note that at this time, the Elk Habitat Effectiveness Planning Tool is in the final development phase and has not been released for general application. Accordingly, setting targets and forecasting the impacts of proposed treatments on elk summer habitat has not been completed for this version of the R11 Forest Management Plan.

Forecast: A quantitative analysis using Elk Habitat Effectiveness Planning Tool and proposed harvest block and prescribed burn boundaries will be completed for the next iteration of this FMP.

Monitoring: The Elk Habitat Effectiveness Planning Tool will be used to assess post-treatment landscape changes and their impacts on elk summer habitat. Results will be summarized in the Stewardship Report.

Response: Harvest and prescribed burn plans will be adjusted if the location and extent of elk summer range falls below the established targets.

Indicator 1.10.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain important habitat for grizzly bear.

Indicator: Location and extent of high quality grizzly bear habitat and associated movement habitat.

Target: Targets to be determined after the Grizzly Bear Recovery Plan is approved.

Current Status: Grizzly bears in Alberta 'may be at risk' (ASRD 2006), while federally they are considered a species of 'special concern'. Human-caused mortality is the primary source of mortality (Nielsen 2004a, Alberta Grizzly Bear Recovery Team 2005), and is facilitated by motorized access and human activity within grizzly bear range. Within the Bear Management Units covered by the R11 boundaries (primarily BMU 4B and BMU 4C; Map 7), poaching is the primary mortality source.

Grizzly bears require large areas of land: annual home ranges of adult females range from 165 km^2 to 532 km^2 while those of males range from 644 km^2 to 2755 km^2, depending on the natural subregion in which they are found (see Kansas 2002 for references). Typical forage items include green herbaceous vegetation, roots, berries and pine seeds, ungulates and rodents, and ants. High quality grizzly bear habitat generally encompasses a diverse mosaic of early seral-staged forests and natural openings with vegetative cover for hiding and resting and with suitable forage plants, the use of which varies with dietary needs and the availability and nutritional status of foods. Lack of human disturbance, availability of den sites, and proximity of movement corridors also characterize high quality habitat, which may be found in wet riparian areas, groundwater seepage areas, and avalanche slopes. Historically, wildfire also would have created the young seral stages associated with high berry and *Hedysarum spp*. production (Hamer 1996a, 1996b); anthropogenic clearings such as regenerating clearcuts, pipeline right-of-ways, and roadside ditches can similarly support forage production.

Extensive grizzly bear research by Foothills Model Forest (FMF) and the University of Alberta has resulted in the development of several important GIS-based tools for land and resource managers to help predict changes in grizzly bear habitat resulting from land management activities and industrial development (Nielsen et al. 2006). Once the draft Recovery Plan (Alberta Grizzly Bear Recovery Team 2005) is approved, regional recovery efforts will be outlined: these FMF Grizzly Bear Planning Tools will likely play a critical role in target-setting exercises at both the regional and R11 levels. Specific components of the FMF application are as follows:

- Landcover Maps – show landscape configuration and plant phenology over time for large landscape areas, based on satellite/remote sensing imagery

- Resource Selection Function (RSF) Maps – show relative probability of grizzly bear occurrence on the landscape and thus the spatial distribution of high quality grizzly bear habitat, derived from GPS collar locations, landcover habitat maps, and other data layers such as access (e.g., Map 43)
- Mortality Risk Map – shows the probability of human-caused grizzly bear mortality over the landscape, based on known mortality data as well as data on open, motorized linear access routes (such as roads, right-of-ways)
- Safe Harbours and Attractive Sinks – combines RSF maps with mortality risk map to safe harbours and attractive sinks. Safe harbours are areas with high RSF scores and low mortality risk, while attractive sinks have high RSF scores and high mortality risk.
- Grizzly Bear Movement Corridors – RSF maps are combined with graph theory to show location and relative rank of important movement corridors on the landscape

These tools will be used to assess habitat impacts of proposed prescribed burn and harvest plans, though specific targets remain to be established.

Forecast: A quantitative analysis of the impacts of proposed prescribed burn and harvest plans on grizzly bear habitat has not been completed; however, the creation of young seral stages on the landscape should coincide with increased production of berries and hedysarum, two important grizzly bear forage items. Furthermore, access restrictions (as per the *Bighorn Backcountry Access Management Plan*) and the commitment to no new permanent access (see Indicator 11.1.1) should limit mortality risk.

Monitoring: The models and maps contained in the Grizzly Bear Planning Tools will be used to monitor habitat within the R11 FMU. Results will be summarized in the Stewardship Report.

Response: To be determined.
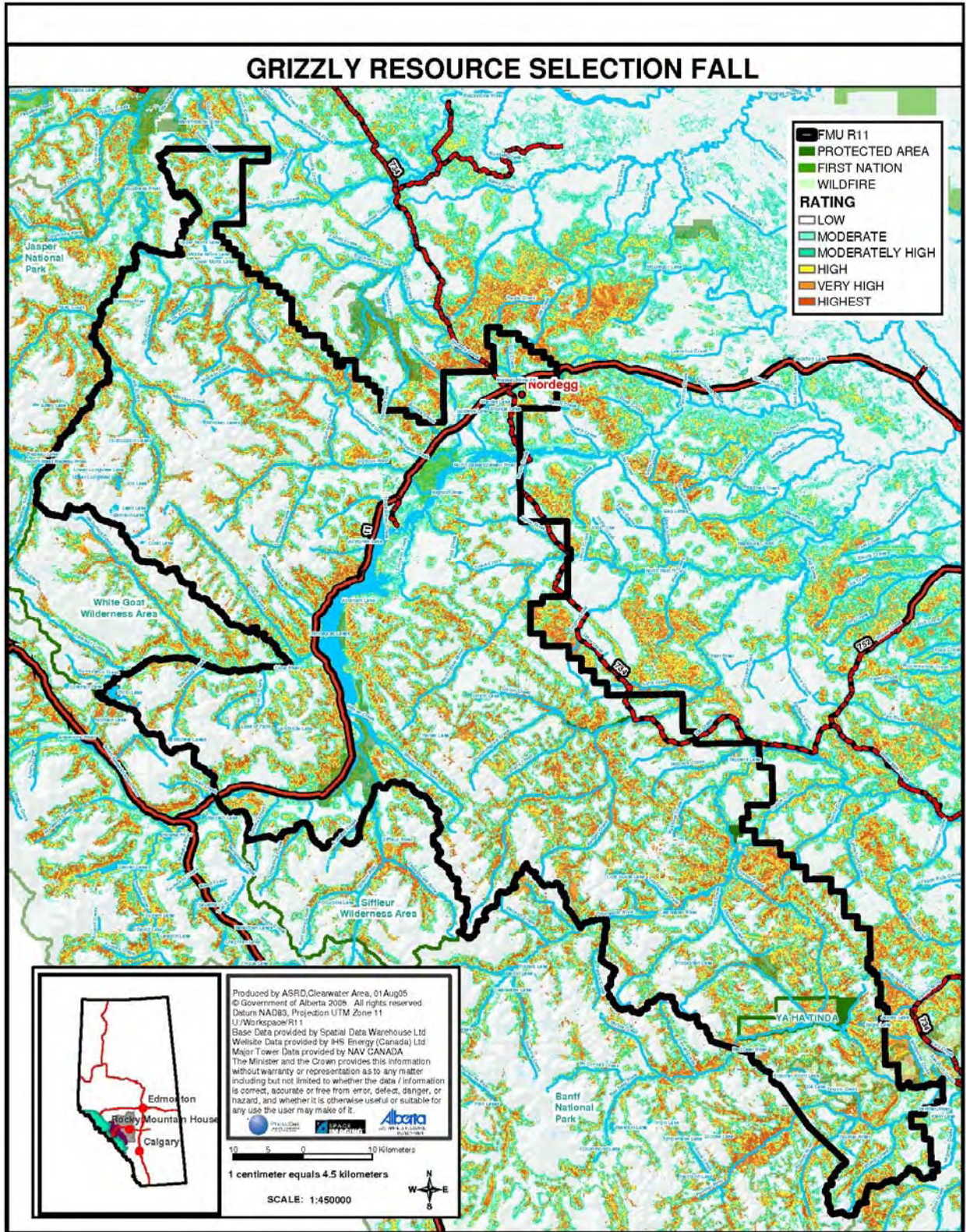
Map 43. Sample resource selection function map for grizzly bear based on the FMF Grizzly Bear Planning Tools.

Indicator 1.11.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain important habitat for wolverine.

Indicator: Location and extent of high quality wolverine habitat.

Target: Current stand age distribution within the natural range of variation. See Indicator 1.1.2.

Current Status: Wolverine are a reclusive, wide-ranging member of the weasel family. Once distributed throughout much of Alberta, their current range is thought to coincide with areas that have the lowest levels of human development, namely the mountains, foothills, and northern boreal regions of the province. However, information is lacking on their distribution, abundance, demographics, and habitat use. Such data deficiencies are reflected in their designation as a species that 'may be at risk' (ASRD 2006). Management of wolverine is difficult, although they are classified under the Alberta *Wildlife Act* as a furbearer and thus are subject to limited management through harvest quotas, area closures, and regulated seasons. Historical harvest data indicate that wolverine populations are declining (Poole and Mowat 2001).

Wolverine are scavengers of carrion, often that of large ungulates killed by other carnivores, but they will hunt opportunistically for marmot, hare, small mammals, and even ungulates if prey are in a weakened condition or if snow conditions hinder prey escape. Home ranges in other jurisdictions encompass a diversity of habitat types and are usually several hundred square kilometres although sizes may vary with season, year, habitat, age, and sex (see review in Peterson 1997). Such large home ranges
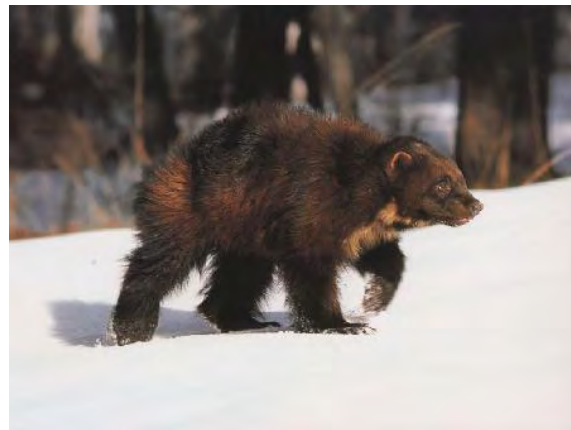
Wolverine

are likely necessary to ensure sufficient availability of food given natural fluctuations in resources. Their apparent aversion to areas with human development coupled with their low reproductive output also contributes to low densities on the landscape. The latter factor results from late sexual maturity, low litter sizes, and low juvenile survival (Peterson 1997). Species with low reproductive productivity, such as wolverine, are characteristically less resilient to population impacts when compared to species with much higher productivity, such as wolves. Limiting influences on wolverine populations are largely speculative given the lack of empirical data, but are thought to include habitat loss, trapping, and reductions in ungulate populations over the last century.

The Alberta Research Council Wolverine Experimental Monitoring Project has developed a protocol for detecting wolverine presence and identity via remote cameras and hair snagging for DNA analysis (Fisher 2005). Preliminary data from this pilot project suggest densities in the foothills are low and that habitat is being heavily impacted by human development (Fisher et al. *in prep*). Densities within R11 remain a mystery as monitoring stations were accessed from the Forestry Trunk Road, yielding little information specific to this FMU. In the absence of adequate information or current research on wolverine populations or habitat use, treatment activities planned in this FMP will maintain a mosaic of habitat types across the landscape by ensuring the current stand age distribution is within the natural range of variation. Furthermore, linkages with other landscapes presumed important for wolverine (i.e., National Parks) will be maintained. Future research or monitoring efforts initiated in or adjacent to R11 will be supported. Inasmuch as wolverine and grizzly bear are both wide-ranging, low reproductive output mammals that are either averse to or negatively impacted by human development, R11 activities to maintain grizzly bear habitat may also provide some benefits for wolverine populations.

Forecast: Impacts of R11 treatment activities on wolverine are not clearly understood nor can they be accurately predicted given the current paucity of information on wolverine populations, distribution, and habitat requirements.

Monitoring: GIS analysis will be used to monitor the stand age distribution resulting from forest management activities. Results will be reported in the five-year Stewardship Report.

Response: Strategies to return the stand age distribution and area to within the natural range of variation will be adjusted in subsequent FMPs if the target is not achieved.

Indicator 1.12.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain habitat for important furbearer populations, specifically pine marten and red squirrel.

Indicator: Average number of individuals harvested each year on traplines active for a given species.

Target: No decrease in average number of individuals trapped per year over five years.

Current Status: Furbearer species within R11 are valued for their ecological roles as well as the economic resources and lifestyle choices their harvest provides. Most wildlife species relying on young seral stages should benefit from forest management activities within the FMU that will return the amount of disturbed area and the stand age distribution to within the natural range of variation. However, two important furbearers, pine marten and red squirrel, rely on mature and old-growth habitats and thus may experience reduced population sizes following prescribed burn and harvest treatments.

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Pine marten

Twenty-eight Registered Fur Management Areas are found in part or in whole within the R11 boundaries (Map 33). Trappers are required to submit an affidavit detailing all furbearers harvested during the previous year when applying for an annual license renewal (Table 23), and these trapper affidavits are thought to be roughly indicative of furbearer population changes (Poole and Mowat 2001). There is no annual monitoring of marten and squirrel populations: fur harvest returns represent the only way to gauge whether populations are maintained at levels that can support trapping. Fur harvest returns must be used with caution as trapper effort and reported success can be influenced by a suite of factors including memory recall, furbearer population status, fur prices, weather conditions, landscape and landuse changes, and available time and income (Mullen 2006). Until a more appropriate indicator can be derived, annual fur harvest returns will be used to monitor the impacts of treatment activities on furbearer populations within the R11 FMU.

Forecast: Annual variation is expected, as furbearer populations will respond to variation in food supply (e.g., pine marten may increase in response to a peak in voles; red squirrels will increase following a cone mast). At the trapline level, marten and squirrel populations may decrease significantly if a large prescribed burn or several harvest blocks occur within the trapline. At the landscape level, however, sufficient habitat will be present to maintain

populations in perpetuity, albeit at lower levels than currently present in the abundant mature and old-growth forests, and to provide source populations for regenerating habitats.

Table 23. Fur harvest returns for traplines within R11.

Species	2001/2	2002/3	2003/4	2004/5	2005/6
Badger	2	21	7	0	0
Beaver	8	4	12	13	42
Black Bear	2	1	1	1	1
Bobcat	0	0	1	0	7
Coyote	22	40	47	22	46
Ermine/Weasel	4	11	16	5	13
Fisher	1	0	0	2	0
Fox	5	4	2	5	9
Lynx	1	3	2	9	4
Marten	154	142	155	110	179
Mink	1	9	5	4	6
Muskrat	1	11	5	2	6
Otter	0	0	0	0	0
Red Squirrel	573	150	186	49	418
Wolf	14	25	15	20	11
Wolverine	0	0	0	0	1
Other (skunk, raccoon)	0	1	2	1	0

Monitoring: The Stewardship Report will summarize the average number of pine marten and red squirrels harvested per trapline each year, excluding traplines where these species were not targeted (i.e., traplines with zero captures for these species). The annual averages will then be examined for population decreases over a five-year period: the use of a five-year window will account for natural variation in populations. One confounding factor in the use of annual fur harvest returns to monitor populations is that Mullen (2006) found trappers in the foothills of Alberta are less likely to maintain an active trapline in areas with less closed conifer forest and more access and industrial disturbance. Thus if traplines experiencing greater disturbance from treatment activities are abandoned even temporarily, population estimates may be somewhat inflated. Given the shortcomings of fur harvest return data (see Poole and Mowat 2001 for a complete review of furbearer harvest data collection and associated limitations), another indicator may have to be considered in subsequent FMPs.

Response: If a significant portion of a given trapline is impacted by treatment activities, options for compensation will be explored through the Trappers' Compensation Program administered by the Alberta Trappers' Association. The program provides compensation to registered fur management licence holders when there are long-term effects of significant habitat changes from industrial activities such that the trapper can no longer maintain his traditional fur harvest and cannot make up the loss by shifting to other available species of furbearers.

Indicator 1.12.2

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain habitat for important furbearer populations, specifically pine marten and red squirrel.

Indicator: Stand age distribution, specifically mature and old-growth.

Target: Current stand age distribution within the natural range of variation. See Indicator 1.1.2.

Current Status: Most wildlife species relying on young seral stages should benefit from proposed prescribed burn and harvest treatments that will increase the amount of younger forest within the R11 landscape. However, two important furbearers, pine marten and red squirrel, rely on mature and old-growth habitats and thus may experience reduced populations following forest management activities. The inclusion of an objective specific to species requiring older seral stages represents a balance for those species requiring young seral stages and ensures forest management activities within the R11 FMU will retain the full spectrum of habitats on the landscape. Specific actions will be directed at creating a stand age distribution and residual structure patterns within the natural range of variation. For further details, see Indicator 1.1.2.

Indicator 1.13.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain important habitat for Harlequin duck.

Indicator: Quality of nesting, breeding, and foraging habitat for Harlequin duck.

Target: No net increase to motorized access (both on- and off-highway vehicles) on streams with historic duck observations.

Current Status: Harlequin ducks are small, long-lived ducks that winter at traditional sites along the seacoast and breed in fast-flowing mountain streams, with females likely returning to the area of their natal stream. Prime breeding habitat contains vegetative cover on islands and shorelines, braided channels, lower gradients, cobble and boulder streambeds, clear water for foraging on streambed invertebrates, and lack of human disturbance (MacCallum 2001). These narrow habitat requirements coupled with low food availability in breeding streams appear to limit Harlequin duck distribution and reproductive productivity. Landuse activities that alter streambank or channel characteristics, influence water yield levels, or reduce water quality through increased sedimentation can significantly degrade Harlequin duck habitat (Cassirer et al. 1996). Classified as a migratory game bird, Harlequin ducks are protected under the Migratory Birds Convention Act. Furthermore, the distinct coastal/inland migratory pattern and specialized breeding habitat requirements of this species have lead to an Alberta status designation of 'sensitive' (ASRD 2006).
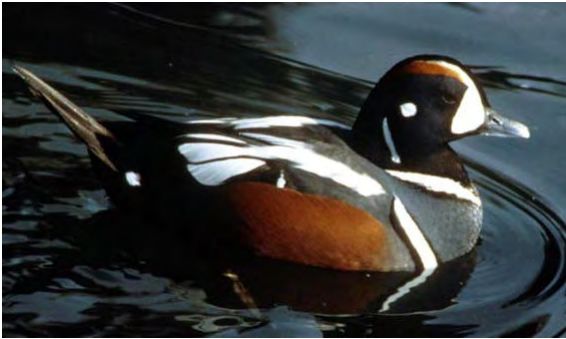
Harlequin duck

Very little information exists about Harlequin ducks within the North Saskatchewan and Red Deer River watersheds, although there are numerous streams with potential habitat. Table 24 shows the R11 watercourses on which ducks have been observed as well as the likelihood of breeding based on these observations. Even if Harlequin ducks are observed outside the R11 boundaries but on watercourses that flow in or through R11, duck presence is possible on those watercourses. Studies in the McLeod River watershed have shown harlequins to use different areas of the river system depending on the season and stage of reproduction (see summary in MacCallum 2001).

Table 24. Watercourses within the R11 FMU on which Harlequin ducks have been observed. Note that the observation location itself may not be within the R11 boundaries. Records of most observations are stored in the Biodiversity/Species Observation Database and are summarized in MacCallum (2001).

Creek/River	Breeding Status
Blackstone River	Breeding
Brazeau River	Breeding
Bighorn River	Unknown
Brown Creek	Unknown
Clearwater River	Probable
Cline River	Unknown
Cripple Creek	Unknown
Elk Creek	Probable
Hummingbird Creek	Unknown
North Ram River	Breeding
North Saskatchewan River	Unknown
Onion Creek	Probable
Ram River	Breeding
Siffleur River	Unknown
Timber Creek	Unknown
Wapiabi River	Probable
Red Deer River	Unknown
Panther River	Unknown

Impacts to Harlequin duck nesting, foraging, and breeding habitat as a result of R11 forest management activities will be minimized in two ways. First, stream quality will be maintained by implementing practices identified in Indicators 4.2.1 to 4.2.4 and by using bridges as the preferred crossing method on streams with historic Harlequin duck observations. Second, human disturbance levels will be minimized by ensuring no net increase in motorized access (both on- and off-highway vehicles) on streams with historic duck observations (see also Objective 11.1). The impacts of prescribed burns on Harlequin duck habitat are unknown: any new scientific information on these impacts will be assessed and management activities adjusted accordingly.

Forecast: Much of the Harlequin duck range in R11 falls within Prime Protection Zone where industrial activity is excluded. Accordingly, new, temporary access will only be created where necessary to conduct forest management activities under this R11 FMP, and all access will be reclaimed upon completion of treatment activities. The lack of industrial activity will also help limit new access for users of off-highway vehicles, who rarely develop new access themselves but instead use existing trails or seismic lines created by industry. Furthermore, access by OHVs is governed by the *Bighorn Backcountry Access Management Plan*, which excludes them from some Forest Land Use Zones and excludes them during the majority of the harlequin breeding season from most other FLUZs.

Monitoring: GIS analysis will be used to determine the amount of motorized access present on streams with historic duck observations and results will be recorded in the Stewardship Report.

Response: Trail closures will be required if the amount of motorized access increases on streams with historic Harlequin duck observations.

Indicator 1.14.1

Value: Biodiversity - Wildlife Species Diversity

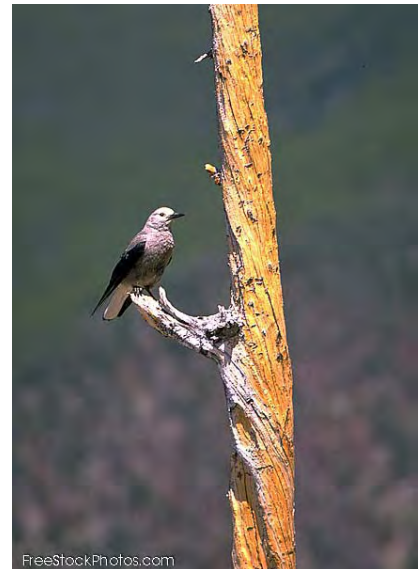**Objective**: Maintain important habitat for Clark's nutcracker.

Indicator: Location and extent of high quality Clark's nutcracker habitat, including whitebark and limber pine stands.

Target: 80% of identified populations and individual whitebark and limber pine trees maintained. See Indicator 1.4.1.

Current Status: Clark's nutcracker is a year-round resident of montane to upper subalpine habitats, although they may migrate to lower elevations in winter. Similar to other members of the crow family, this species is an omnivore and will eat insects, berries, and small vertebrates; however, the Clark's nutcracker primary and preferred food source is whitebark and limber pine seeds. Their relationship with whitebark and limber pine is mutualistic: the seeds represent an important high protein food source for the birds while the pines rely heavily on the birds for seed dispersal through hoarding in caches (Tomback 1998).

Both whitebark and limber pine are seriously threatened by the introduced white pine blister rust, fire suppression activities, and mountain pine beetle. Loss of these habitats would be detrimental to Clark's nutcracker populations, and they are listed as 'sensitive' in Alberta (ASRD 2006).

Clark's nutcracker

There is currently no monitoring of Clark's nutcracker populations within the R11 Forest Management Unit, and efforts to ensure population persistence must focus on their habitat. Thus the indicator, target, and monitoring for Clark's nutcracker will follow Indicator 1.4.1 for conservation of the pine species, under the assumption that maintenance and restoration of whitebark and limber pine stands will provide sufficient habitat for current nutcracker populations.

Indicator 1.15.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain habitat capable of sustaining future woodland caribou range expansion into the R11 area.

Indicator: Area of mature and old-growth forest.

Target: Area of mature and old-growth forest within the natural range of variation; Target could be further refined once west-central habitat planning targets are developed.

Current Status: Woodland caribou are classified as 'threatened' under both the federal *Species at Risk Act* and Alberta's *Wildlife Act*, prompting the preparation of the *Alberta Woodland Caribou Recovery Plan 2004/05 – 2013/14* (Alberta Woodland Caribou Recovery Team 2005). Woodland caribou are found in low-density populations and, during the winter, use late seral stage habitats that contain abundant terrestrial and arboreal lichens. Large, contiguous tracts of habitat are also necessary to allow dispersion of individuals as an anti-predator strategy, and to provide sufficient undisturbed habitat when other portions of the range have been disturbed. Limiting factors on caribou population size and distribution include habitat change (either from natural processes such as fire or human landuse activities such as increased access and oil and gas development), predation, hunting/poaching, and vehicle collisions (Dzus 2001).

Government of Alberta

Woodland caribou

No caribou population is currently known to overlap with the R11 FMU, although the core winter ranges of Banff and Jasper populations historically included portions of Siffleur and White Goat Wilderness Areas, where rare sightings still occur, and possibly adjacent areas in the Bighorn Backcountry (Map 44). The southernmost population in Alberta is found in Banff (headwaters of the Clearwater, Siffleur, Red Deer, and Bow Rivers). This population may have declined to less than five individuals (Parks Canada 2006) and is isolated from the next closest population in southern Jasper (Maligne, Tonquin, Jonas Creek, and Poboktan Pass areas). Thus the North Banff population is at immediate risk of extirpation while the South Jasper population is in decline (Alberta Woodland Caribou Recovery Team 2005).
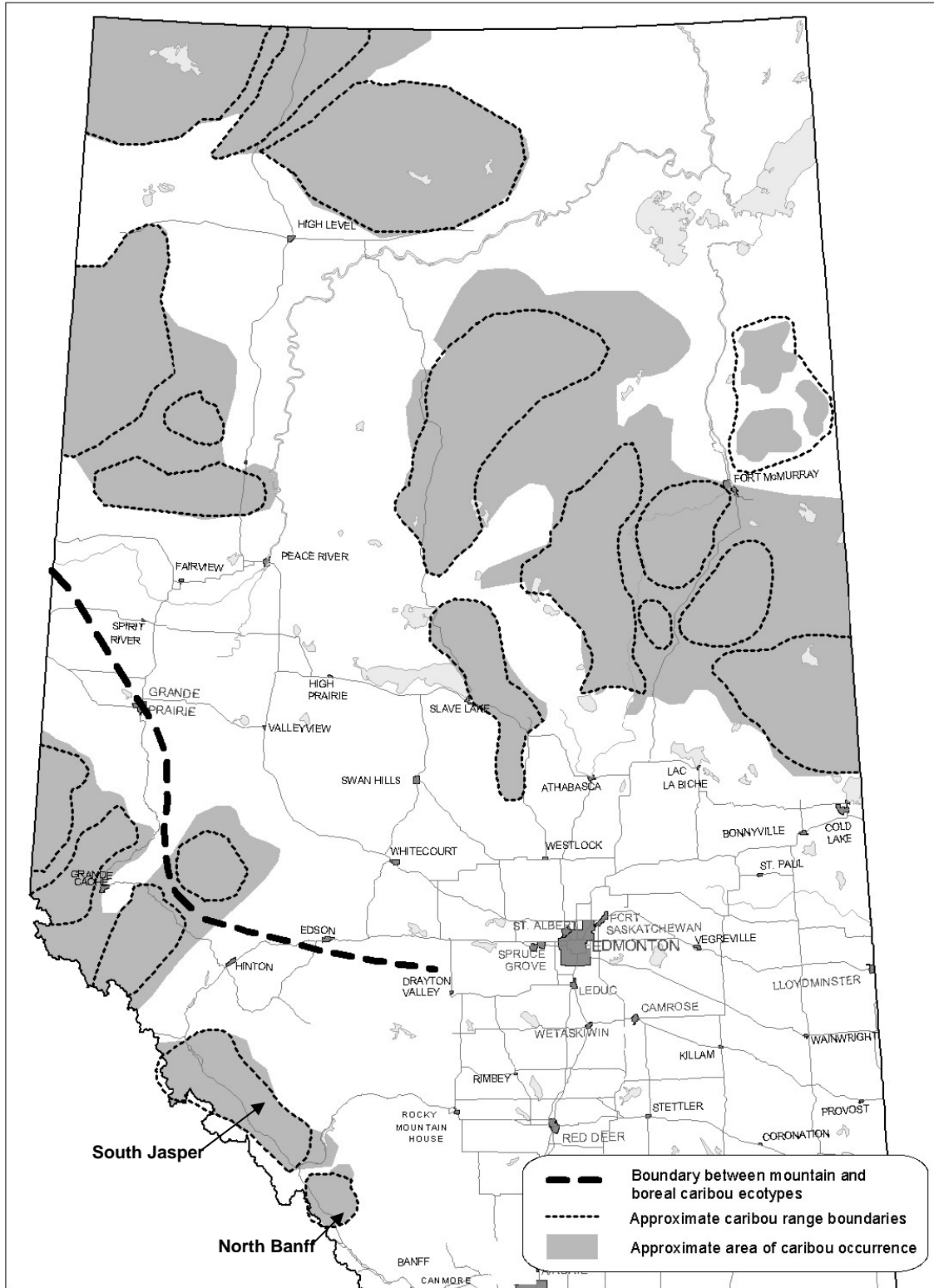
Map 44. Approximate range boundaries and area of occurrence for the South Jasper and North Banff woodland caribou herds. (taken from Alberta Woodland Caribou Recovery Team 2005)

The Recovery Plan recommends actions be taken immediately to stabilize woodland caribou populations within their current ranges and support expansion into unoccupied portions of their historic ranges, where possible. Habitat planning targets for caribou winter range in west-central Alberta are still under development, and once completed, consultations with the West-Central Range Planning Team will help refine targets for the R11 FMU. In the interim, however, R11 forest management activities will focus on ensuring the area of mature and old forest is within the natural range of variation (see Indicator 1.1.2) under which caribou populations would have evolved. Clustering of prescribed burn and harvest treatments will help emulate large natural disturbances instead of many, smaller dispersed disturbances. Furthermore, this R11 FMP will adopt the approach taken by Parks Canada (2006) that stresses the importance of heterogeneity of fire frequency on the landscape. Lower elevation montane habitat that is susceptible to mountain pine beetle historically experienced shorter fire cycles than the higher elevation subalpine habitats important to caribou. Thus, prescribed burns within the area of potential caribou occurrence will focus on low elevation, south-facing slopes and avoid high elevation, north-facing slopes to provide areas that allow caribou to spatially separate themselves from wolves, elk, moose, and deer. Prescribed burns planned along the western boundary of R11 will be coordinated with those planned by Parks Canada.

Forecast: Caribou evolved with fire as the dominant disturbance agent on the landscape: when a large-scale fire rendered a given area unsuitable by incinerating the lichen, caribou use patterns would shift to alternate areas within their range. Hence, forest management activities within R11 can maintain habitat suitable for woodland caribou, provided sufficient mature and old-growth forest remains at a particular time.

Monitoring: GIS analysis will be used to monitor the stand age distribution and area of mature and old-growth forest resulting from forest management activities and to assess caribou winter range habitat within R11 once west-central habitat planning targets are established. As there are currently no populations in R11, population monitoring will default to surveys conducted by Parks Canada. Any results from these activities will be reported in the five-year Stewardship Report.

Response: Strategies to return the stand age distribution and area to within the natural range of variation will be adjusted in subsequent FMPs if the target is not achieved.

Indicator 1.16.1

Value: Biodiversity - Wildlife Species Diversity

Objective: Maintain habitat capable of supporting long-toed salamander populations.

Indicator: Location of potential breeding ponds and lakes (i.e., ideally large, shallow, permanent, and fishless).

Target: Information on whether long-toed salamanders exist and breed in the identified ponds and lakes.

Current Status: One of only two salamander species native to Alberta, the long-toed salamander is typically found in montane regions with most populations clustered in mountain passes and associated river valleys (Graham and Powell 1999). The permeable substrates and high soil moistures found along montane valley bottoms often create ideal terrestrial and breeding habitat for long-toed salamanders. Breeding habitat consists of large, shallow lakes with abundant aquatic vegetation and marshy fringes; deep lakes may be used if adjacent wetlands provide shallow, vegetated areas for egg-laying (Graham 1997). The absence of predatory fish such as rainbow trout also appears to be an important feature of breeding ponds and lakes. Closed-canopy lodgepole pine and Douglas-fir characterize the upland terrestrial habitat used by long-toed salamanders, while balsam poplar and willow are found in lowland areas. Graham (1997) found that salamanders in west-central Alberta primarily used well-drained areas with a thick litter layer in close proximity to relatively permanent waterbodies. Most salamanders within the study area were found within 250 m of the breeding pond, although some adults travelled up to 750 m from a suspected breeding pond.

There are no known long-toed salamander populations within the R11 FMU despite the presence of montane river valleys and passes. However, a comprehensive survey of suitable R11 habitat has never been completed. *The General Status of Alberta Wild Species 2005* (ASRD 2006) lists long-toed salamanders as 'sensitive' because of their isolated populations focused in mountain pass riparian areas and their vulnerability to potential habitat destruction and alteration associated with industrial, recreational, and transportation development. Accordingly, field inventories of suitable habitat should be conducted as finances permit to determine if populations exist within R11, and potential long-toed salamander habitat should be considered when conducting forest management activities in the interim.

The Foothills Model Forest developed a Habitat Suitability Model for year-round habitat of long-toed salamanders within the Lower Foothills, Upper Foothills, Montane, and Subalpine Natural Subregions of Alberta (Graham et al. 1999). Habitat Suitability Models predict the suitability of a habitat for a given species based on an assessment of how life history characteristics relate to habitat attributes such as habitat structure, habitat type, and spatial arrangement between habitat features. Although the Foothills Model Forest model incorporates distance from nearest pond with a known long-toed salamander population,

alterations to the model may allow its application to determine potential habitat within the R11 FMU.

Forecast: not applicable

Monitoring: The results of any field surveys for long-toed salamanders will be summarized in the Stewardship Report.

Response: Prescribed burn and harvest plans will be adapted if they will impact a pond or lake where long-toed salamanders have been identified.

Indicator 1.17.1

Value: Biodiversity - Sensitive Sites

Objective: Maintain integrity of sensitive sites.

Indicator: Identified sensitive sites (e.g., nationally and provincially significant Environmentally Significant Areas, selected Special Features, mineral licks, major game trails, rocky outcrops, den sites, fish spawning, rearing, and over-wintering areas).

Target: Complete protection of sites sensitive to burning or harvesting (sites not sensitive to such treatments will not require the same degree of protection).

Current Status: Numerous habitat features and sites within R11 may be considered sensitive from a wildlife perspective. These could include mineral licks, den sites, raptor nests, hibernacula, major game trails, rocky outcrops, fish spawning, rearing, and over-wintering areas (e.g., Watercourse Code of Practice Class A sites), nationally and provincially significant Environmentally Significant Areas (ESA), and selected Special Features. The locations of such sites and features are maintained through a variety of sources including ANHIC databases, Fisheries and Wildlife Management Information System (FWMIS), ESA reports, and local knowledge (see Appendix III for a description of ESAs and Special Features in R11). Inventories and databases receive ongoing input from government staff, researchers, non-governmental representatives, and consultants or contractors who identify sensitive features during fieldwork.

Sites considered sensitive to either burning or harvesting (e.g., raptor nests) will be avoided wherever possible when developing prescribed burn and harvest plans. If complete avoidance is not possible, adverse impacts will be mitigated by following the guidelines for buffers around wildlife features (e.g., two 'sight distances' for major game trails) as directed by the Alberta Timber Harvest Planning and Operation Ground Rules (Alberta Environmental Protection 1994). In general, the nature and amount of protection required will vary by the type of sensitive site. Sites that are not sensitive to management treatments (e.g., cliffs serving as escape terrain for bighorn sheep) will not be avoided during plan development and implementation.

Forecast: Although complete protection of sites sensitive to burning or harvesting is targeted, there may be limited loss of sites if they cannot be avoided. Overall, a loss of no more than 10% of known sensitive sites will be tolerated, and the integrity of features responsible for the designation of ESAs will not be compromised.

Monitoring: Pre- and post-treatment comparisons of burn or harvest boundaries with GPS locations of sensitive sites will monitor success in avoiding or minimizing the impacts on such sites. The results will be reported in Stewardship Reports.

Response: Locations of sensitive sites will be added to inventories and databases as they are reported.

Indicator 1.18.1

Value: Biodiversity - Genetic Diversity

Objective: Conserve genetic diversity by maintaining genetic variation of tree species.

Indicator: Inventory of whitebark and limber pine stands and stored seed.

Targets: 80% of identified populations/individual trees will be maintained (see Indicator 1.4.1) and viable stored seed inventory.

Current Status: Populations of a given species that contain a wide variety of genetic combinations can better adapt to changing environmental conditions than populations with relatively little genetic diversity that may be performing well under current conditions. Such genetic diversity may be maintained within populations of a given species remaining in their original habitat or within gene banks. The former is preferred as the populations continue to evolve in response to natural evolutionary processes; however, storing representative samples in gene banks may be necessary in cases where a natural population is threatened.

The Alberta Forest Genetics Resource Council is working with Sustainable Resource Development and Tourism, Parks, Recreation, and Culture to develop a gene conservation strategy that will protect the natural genetic variability of Alberta tree species. The strategy focuses on on-site or in-situ conservation by identifying areas where genetic variability can be protected in wild forest populations, determining the number of trees to be protected for each species, and delineating necessary buffer zones to protect the wild trees. Seed zones have been identified within which seed for reforestation can be collected and freely deployed without any significant loss of adaptation and growth potential. At this time, the seed zones are closely aligned with the Natural Subregions of Alberta (Map 9). Off-site or ex-situ conservation of species in seed banks such as those at the Alberta Tree Improvement and Seed Centre will sometimes be required to supplement on-site efforts. Furthermore, the *Standards for Tree Improvement in Alberta* provide instructions on how to ensure sufficient genetic variability in artificial reforestation of harvested areas (ASRD 2005).

Both whitebark pine and limber pine are species on ANHIC's Tracking and Watch List and are seriously threatened by an exotic rust (white pine blister rust), fire suppression activities, and mountain pine beetle. An inventory on the location and status of these two pine species within Alberta has been developed, though it is not yet considered complete. Genetic conservation efforts for whitebark pine and limber pine within R11 will focus on maintaining existing individuals and populations in their current habitat (see Indicator 1.4.1), recognizing that these are pioneer species which require fire disturbance. The ASRD Genetics and Tree Improvement Section also maintains a seed inventory for these species. The R11 strategy for conserving the genetic diversity of common tree species will be to allow natural reforestation processes in harvest or prescribed burn treatment areas, thereby avoiding the introduction of new seed stock.

Whitebark pine cones and seed

Forecast: Regeneration of whitebark and limber pine occurs shortly after a disturbance and subsequent seed dispersal into the disturbed area by Clark's nutcracker. Accordingly, these species should respond positively to prescribed burns within their habitat, provided seed source trees and dispersal agents (i.e., birds) remain. As white pine blister rust infestation generally proves fatal for the individual tree, population resilience also depends upon the presence of rust-resistant trees that can act as seed sources.

Monitoring: Permanent sample plots will be established and monitored every 10 years in 25% of the identified whitebark and limber pine stands found in the planned burn or harvest areas (see Indicator 1.4.1 for details). The seed inventory will also be evaluated every 10 years. If rust-resistant trees are discovered in the field, efforts should be made to protect these trees and collect seed for storage. Results of the PSP monitoring and the inventory evaluations will be reported in the Stewardship Reports.

Response: If natural regeneration is not successful after fire disturbance, a planting program can be implemented. Burn or harvest plans will also be adjusted based on the 10-year surveys. If the Manager of the Genetics and Tree Improvement Section determines that the seed inventory is low, a seed collection plan will be developed.

Indicator 2.1.1

Value: Ecosystem Integrity and Productivity

Objective: Maintain natural disturbance patterns at the landscape level.

Indicator: Area disturbed per decade by natural subregion.

Target: Periodic disturbance rate of 50% of the median reported fire cycle for each natural subregion (Source: Appendix III in Tymstra et al. 2005). See Table 25 for disturbance targets for both forested and vegetated non-forest areas in R11.

Table 25. Target treatment rates per decade for the forested and vegetated non-forest (i.e., herbaceous and shrubby meadow) areas of the R11 FMU.

Natural Subregion	Forested Area (ha)	Vegetated Non-forest Area (ha)
Alpine	378	168
Subalpine	7966	746
Montane	1387	178
Upper Foothills	3579	322
Lower Foothills	24	8

Current Status: Fire currently occurs at a very low rate in the R11 Forest Management Unit. Over the past twenty years, less than 8500 hectares of young forest have been created by natural disturbance and prescribed burning (Table 26). This is less than a third of that expected based on the longest reported fire cycles and only 15% of the median reported fire cycles. As a result, the landscape disturbance rate has moved towards a much longer fire cycle than is natural (Table 27). This reduction in disturbance rate has resulted in a significant loss of young forest, an important component of Alberta's natural-disturbance-adapted ecosystems.

Table 26. Forested area disturbed in each natural subregion in the R11 FMU between 1987 and 2006.

Natural Subregion	Area (ha)
Alpine	484
Subalpine	4368
Montane	960
Upper Foothills	2408
Lower Foothills	0

Table 27. Current disturbance rate compared to the median and range of natural fire cycles reported in Appendix III, Tymstra et al. (2005).

Natural Subregion	Median Reported Fire Cycles	Range of Reported Fire Cycles	Disturbance Cycle Expected From Recent Disturbance
Alpine	278 yrs	220 – 333 yrs	863 yrs
Subalpine	123 yrs	90 – 300 yrs	897 yrs
Montane	88 yrs	41 – 300 yrs	509 yrs
Upper Foothills	78 yrs	37 – 106 yrs	464 yrs
Lower Foothills	96 yrs	52 – 111 yrs	No recent disturbance

Prescribed burning and harvesting will be used to return the ten-year disturbance rate in each natural subregion to 50% of the median reported fire cycle. The target is set at 50% of the median reported fire cycle in each natural subregion to allow a substantial buffer for an overachievement of these targets through large wildfires or other means, while remaining within the natural range of fire cycles reported throughout the province. Calculating disturbance rates over a ten-year period will also allow flexibility in planning to take advantage of appropriate environmental conditions, as well as to adapt to additional wildfire and other natural disturbance events that may result, for example, from global warming.

Forecast: Ten-year disturbance targets have been developed for each natural subregion, based on reported natural fire cycles and the amount of each subregion within the FMU. If these targets are met, the fire cycle will shift closer to the natural range of variation (Table 28). While the disturbance cycles for the Alpine, Subalpine, and Montane Natural Subregions are expected to fall within the reported range of fire cycles, disturbance cycles for the Upper and Lower Foothills Natural Subregions will be substantially closer to the reported range, but will remain marginally longer than desired.

Table 28. Forecasted disturbance cycles (fire plus mechanical disturbance) for each natural subregion in the R11 FMU.

Natural Subregion	Forecasted Disturbance Cycle Based on Treatment Targets Alone	Forecasted Disturbance Cycle Based on Treatment Targets Plus Recent Disturbance Rates
Alpine	553 yrs	337 yrs
Subalpine	246 yrs	193 yrs
Montane	176 yrs	131 yrs
Upper Foothills	156 yrs	117 yrs
Lower Foothhills	192 yrs	192 yrs

Monitoring: The area disturbed within each natural subregion will be calculated using a Geographic Information System. These data will be compared to the targets and reported in the Stewardship Report. The role of global warming in R11 fire cycles will require review and monitoring as relevant data become available.

Response: If the targets are not met, recommendations for plan amendments will be made in the Stewardship Report. Options will include adjusting treatment planning and implementation activities or adjusting targets. The current targets are based on the best available information on fire regimes in each natural subregion found in the R11 FMU (Tymstra et al. 2005). Prior to the next FMP update, a detailed fire regime study should be conducted to provide further guidance for target adjustments.

Indicator 2.1.2

Value: Ecosystem Integrity and Productivity

Objective: Maintain natural disturbance patterns at the landscape level.

Indicator: Disturbance via natural processes where appropriate.

Target: Identification of natural fire zones for different Head Fire Intensities.

Current Status: Much of the R11 FMU is in Prime Protection Zone as delineated by the *Eastern Slopes Policy* where landscape management activities are largely limited to wildlife habitat improvement and fire suppression. Timber harvest can only occur for the purposes of protecting merchantable timber in other zones or protecting other values at risk. Accordingly, prescribed fire will be used to achieve several of the landscape and ecosystem objectives outlined in this FMP. However, the use of prescribed fire requires fuel management activities such as the establishment of strategic fuel breaks and fire doors (i.e., as with fire doors in a building that block spread of fire to other areas, landscape treatments can decrease spread of wildfires). Specifically, this could include creating large cutblocks, conversion of conifer stands to less flammable deciduous and mixedwood stands, and thinning of conifer stands. The establishment of fuel breaks and fire doors may also allow the delineation of natural fire zones where natural fire processes are permitted and suppression activities are limited.

The current policy of the Forestry Division of Alberta Sustainable Resource Development is aggressive initial attack of all wildfires before they reach 2 ha in size. If a wildfire escapes initial attack, an Escaped Fire Analysis Strategy is completed describing values at risk, potential for fire spread under current and forecast conditions, acceptable limits of spread, control objectives, required resources, and estimated costs. Wildfires may occur in areas planned for prescribed burns or in areas where FMP objectives could be met if limited suppression was exercised (i.e., natural fire zones). Natural fire zones containing more options for acceptable limits of spread and acceptable range Head Fire Intensities (HFI; numerical ranking of difficulty of control for specific fuel types) will be identified within the R11 landscape as fire doors and fuel breaks are created. Escaped Fire Analysis Strategies can then take into account these natural fire zones.

Robert Anderson

Washout Creek prescribed burn

Forecast: The identification of natural fire zones will depend upon the successful establishment of fire doors and fuel breaks on the landscape.

Monitoring: Fire reports will identify the resources committed to a given fire, area burned, etc. Summary statistics on number of fires and area burned each year will be reported in the five-year Stewardship Report.

Response: If natural fire zones are not delineated and all wildfires are actively suppressed, FMP targets for area disturbed (Indicator 2.1.1) may not be met. Additional prescribed burns would then be required.

Indicator 2.1.3

Value: Ecosystem Integrity and Productivity

Objective: Maintain natural disturbance patterns at the landscape level.

**Indicator:** Fire intensity.

Target: Distribution of Head Fire Intensity ranks across the landscape.

Current Status: Head Fire Intensity (HFI) is the predicted intensity, or energy output, of the fire at the front or head of the fire and is one of the primary methods by which fire managers estimate the difficulty of controlling a fire. Areas with high fuel buildup will be susceptible to high intensity fires under the appropriate weather conditions. Fire suppression activities within R11 over the past several decades have produced an older forest age class structure containing a fuel buildup in many areas and thus a prevalence of high HFI ranks (Map 45 to Map 47). High and extreme Head Fire Intensity ranks can have an adverse impact on water and soils if entire watersheds burn under these conditions. Prescribed burn and harvest activities within R11 will lessen such impacts by creating a distribution of lesser HFI potential on the landscape during spring, summer, and fall periods.

Forecast: Harvesting and burning (both prescribed fires and wildfires) will reduce the forest age structure and fuel loads. This should contribute to a subsequent reduction in the number of high HFI ranks on the landscape.

Monitoring: The 90th percentile Head Fire Intensity ranks will be recalculated at 5, 10, 20, and 50-year intervals to ensure that proposed harvesting and prescribed fire activities are resulting in an even distribution of the full range of HFI ranks on the landscape during spring, summer, and fall periods. As prescribed burn and harvest activities are completed, HFI ranks can be recalculated on a more frequent basis. Maps and charts will be used to display spatial and class distribution changes over time, with 2005 as the baseline for comparison. The Spatial Fire Management System and its associated models will be the primary GIS-based tools used to calculate HFI ranks and produce maps for the R11 landscape. Results will be presented in the Stewardship Report.

Response: If the desired distribution of HFI ranks is not achieved, prescribed burn or harvest plans will be adjusted.
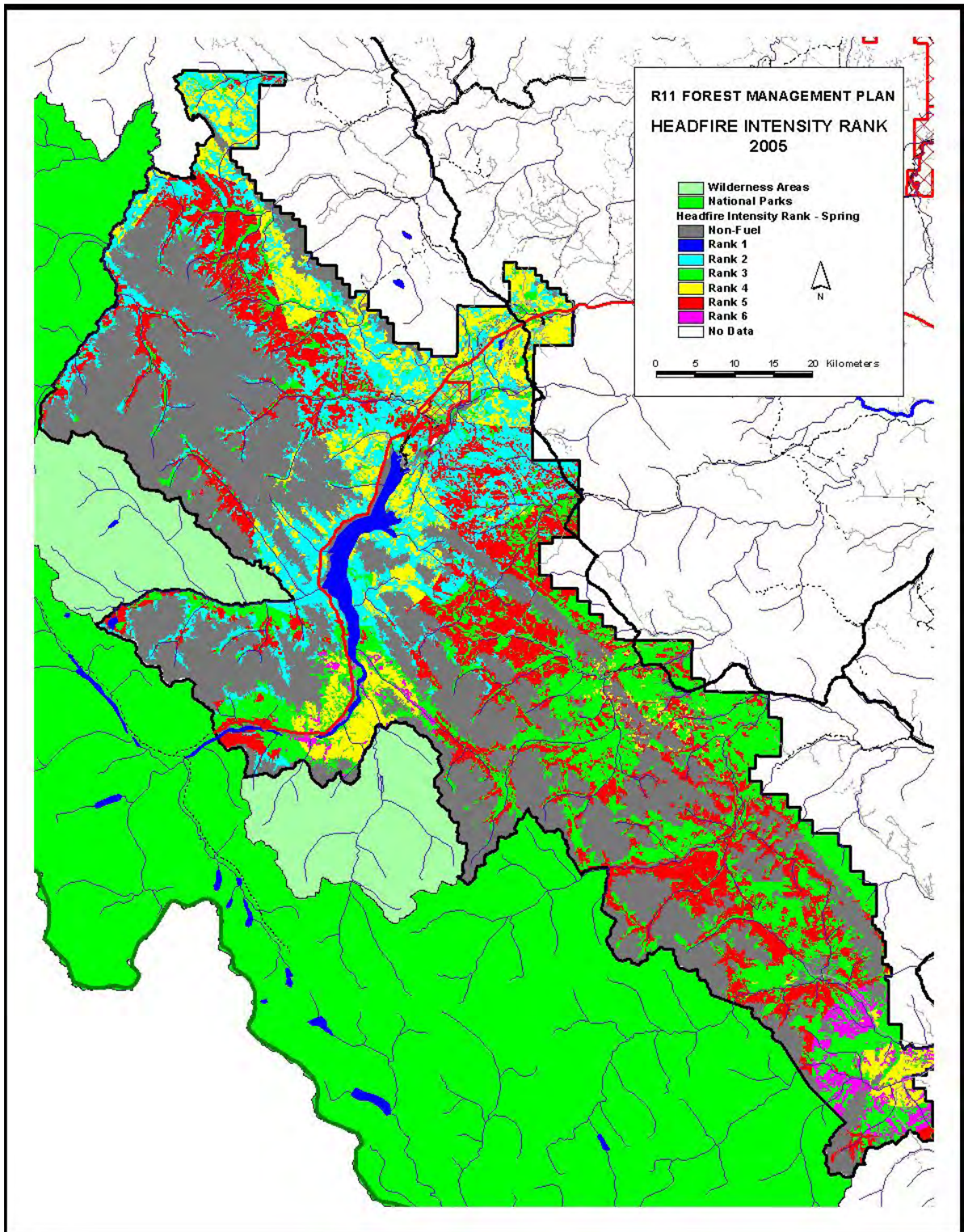
Map 45. Head Fire Intensity ranks for the R11 FMU in spring 2005. Ranks range from a smouldering, creeping ground fire (Rank 1) to a conflagration with extreme fire behaviour (Rank 6).
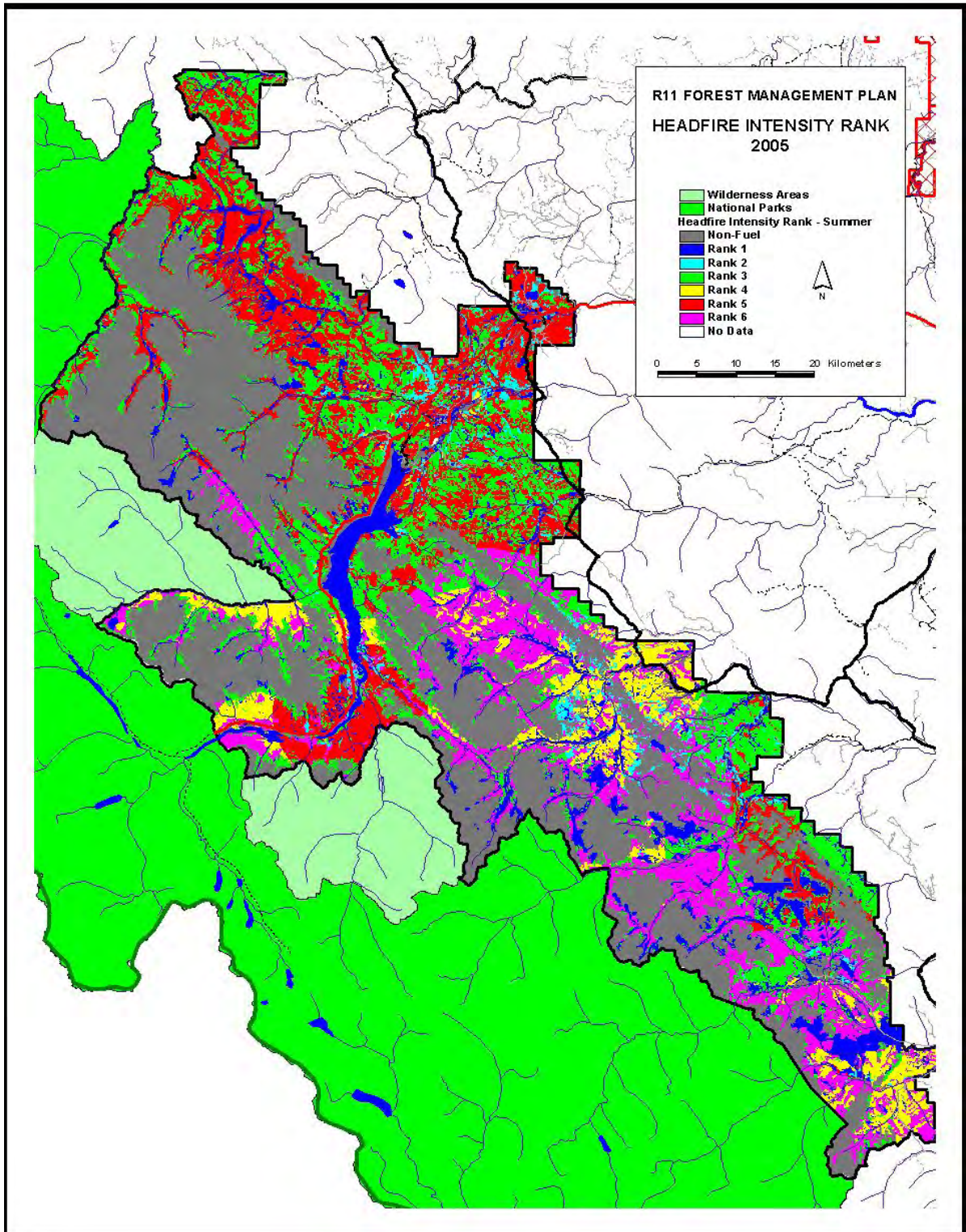
Map 46. Head Fire Intensity ranks for the R11 FMU in summer 2005. Ranks range from a smouldering, creeping ground fire (Rank 1) to a conflagration with extreme fire behaviour (Rank 6).
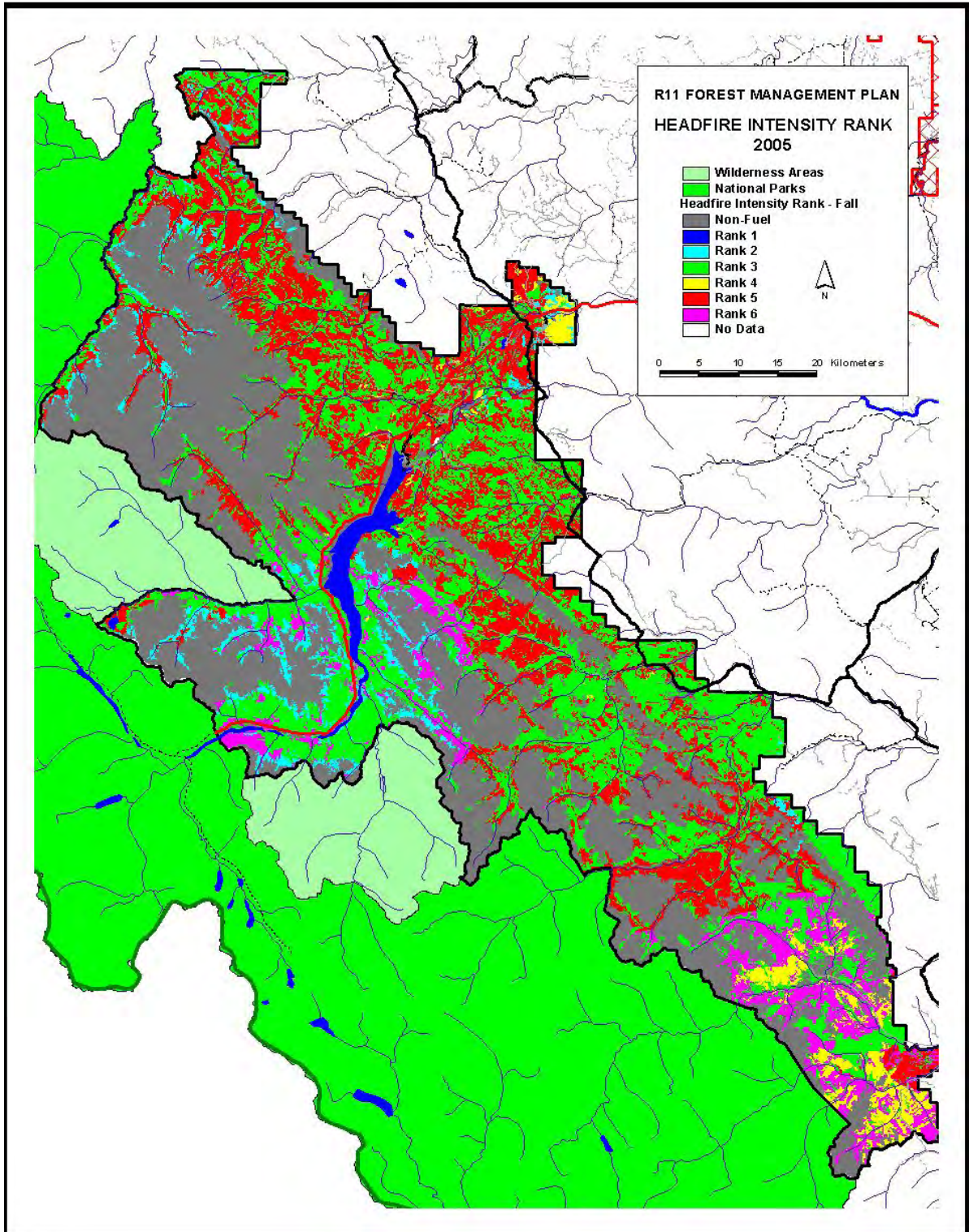
Map 47. Head Fire Intensity ranks for the R11 FMU in fall 2005. Ranks range from a smouldering, creeping ground fire (Rank 1) to a conflagration with extreme fire behaviour (Rank 6).

Indicator 2.2.1

Value: Ecosystem Integrity and Productivity

Objective: Allow natural reforestation processes in disturbed areas.

Indicator: Area burned or harvested and left for natural regeneration.

Target: 90% of burned or harvested areas will be left for natural regeneration.

Current Status: Commercial timber harvest in Alberta normally requires reforestation under the authority of the Timber Management Regulation. However, the forested landbase in R11 is not committed to nor contributes to the Annual Allowable Cut of any operator, and the reforestation requirement can be waived with proper justification. Several benefits may accrue by leaving disturbances to go through natural reforestation processes including fewer financial costs, regeneration of trees and other plant species carrying genes specifically adapted to that area, less potential for introduction of non-native weed species, and longer duration before crown closure providing enhanced forage for ungulates. Accordingly, natural reforestation processes will be permitted in disturbed areas within R11: the Director of Forest Management Branch, through approval of this plan, has waived the regulatory reforestation requirement. Additional reforestation may be desirable to protect social values in select areas, and thus a target of 90% accounts for limited artificial reforestation in such cases.

Eight year old Thompson Creek burn undergoing natural regeneration

Forecast: not applicable

Monitoring: The total area of prescribed burn, natural burn, or harvest will be compared to the area in leave-for-natural condition using GIS analyses. Results will be summarized in the Stewardship Reports.

Response: If >10% of the burned or harvested areas are artificially reforested, investigations will determine the reason. Reforestation targets may need to be adjusted in subsequent FMPs to protect social values.

Indicator 2.3.1

Value: Ecosystem Integrity and Productivity

Objective: Track loss of forest landbase to other uses.

Indicator: Amount of change in forest landbase, including oil and gas, seismic, mining, roads, commercial, urban, acreages.

Target: Minimal loss of forest landbase.

Current Status: Landbase losses to resource sectors, public infrastructure development, or private development are usually outside the control of ASRD. Under the Public Lands Act, however, ASRD can encourage the integrated management of public lands through the use of operating and development conditions on dispositions. The use of conditions can regulate certain aspects of the activity to ensure environmental sensitivities of the site are protected. Special operating conditions may be applied to the sale of public land parcels by registering caveats on the land title that protect riparian buffers adjacent to Crown-owned watercourses. Although ASRD cannot control all losses to the forested landbase, tracking conversions will monitor long-term trends. In the short term, the department will also ensure all disposition applications use the existing footprint of roads and clearings wherever possible and include conditions to reclaim the forested landbase upon their abandonment.

Forecast: not applicable

Monitoring: Areas coming in and out of forest landbase are usually tracked by using inventory cover labels. Traditional tracking may be difficult as the existing AVI in the R11 FMU is only current to 1994 and 1997, and the management unit is low priority for inventory updates. ASRD will attempt to track all removals through applications, but has no means of tracking land coming back into forest production. Forest cover and landuse inventories will be updated as resources permit. Stewardship Reports will summarize any data on landbase conversions.

Response: not applicable

Indicator 2.4.1

Value: Ecosystem Integrity and Productivity

Objective: Maintain soil productivity by preventing soil compaction.

Indicator: Compliance with Sundre Forest Products Operating Ground Rules.

Target: Complete compliance with Sundre Forest Products Operating Ground Rules, with 90% of harvesting conducted under winter conditions.

Current Status: Maintenance of soil productivity is a key factor in maintaining a resilient forest condition. Research conducted by the Alberta Research Council has shown the impacts of heavy machinery traffic on soil physical properties include compaction, reduction in pore space, reduction in water infiltration rates, and shifts in drainage class. These impacts can directly hinder root development of seedlings in the short term and are particularly pronounced when harvesting is conducted during moist soil conditions. See Appendix 4.1 in Westbrook and Devito (2002) for complete summary of harvesting impacts on soil properties.

To protect soil productivity, the R11 Forest Management Plan will adopt Sundre Forest Products Operating Ground Rules as the standard: soil and water protection practices are very comparable to the existing Provincial Operating Ground Rules. The Operating Ground Rules do not require harvest in winter conditions; however, ASRD will attempt to conduct all harvest operations in winter conditions when soils are most likely to be dry or frozen.

Forecast: Most harvesting in R11 will be conducted under competitive permits, where ASRD can specify time of harvest. Thus, winter harvest can likely be achieved most of the time; exceptions may arise if coordination of activities with adjacent timber operators dictate adjustment of harvest schedules to achieve joint roading and reclamation.

Monitoring: Field inspection reports and audits will be used to monitor timing of harvest and compliance with the OGR.

Response: Immediate remedial action will be taken to correct harvesting operations that do not comply with the OGR.

Indicator 3.1.1

Value: Forest Health

Objective: Recognize role of all native forest health agents and climate change.

Indicator: Current inventory and distribution of native forest health agents.

Target: Accurate reporting and mapping of native forest health agents.

Current Status: Native forest health agents include insects and diseases that are natural residents of forest ecosystems. When populations are at endemic levels, the effects of these agents are neutral or even beneficial in forest renewal by removing weakened or old trees. Management strategies are usually only required when population outbreaks occur or when other values such as merchantable timber are threatened.

ASRD surveys the R11 Forest Management Unit annually for the presence of insects, disease, and natural disturbance events. The type, cause, and extent of all disturbance agents are mapped and tabulated annually. Table 11 lists the native forest health agents currently present in the R11 FMU. Over the last five years, there has been no significant tree mortality caused by native insects or disease within the R11 FMU. See Indicators 3.3.1 and 3.3.2 for objectives and management directly related to mountain pine beetle.

Forecast: species-specific

Monitoring: Annual aerial surveys are typically conducted from late June to early September to assess location, area disturbed, severity, possible causal agent, and host tree species for insect and disease disturbances. Any significant disturbances are mapped and the disturbance agent ground truthed and verified. These data are compiled and

Daniel Lux

Mountain pine beetle

maintained at the Forest Health Section in Edmonton and are available on the ASRD website (http://www.srd.gov.ab.ca/forests/health). In addition, an inventory of forest health agents will be maintained by the Forest Health Section to ensure all native forest health agents are represented. Summaries will be completed for the Stewardship Report at the end of the five-year reporting period. GIS data coverages that track insect and disease events will be updated regularly.

Response: Any significant increase in insect and disease activity will trigger further evaluation as to the cause, including the relative role of climate change and treatment activities in insect or disease distribution changes. Prescribed burn and harvest plans can be adjusted if determined to be contributing to the increase in insect or disease populations or if necessary to control an agent.

Indicator 3.1.2

Value: Forest Health

Objective: Recognize role of all native forest health agents and climate change.

Indicator: Current inventory and distribution of non-native forest health agents.

Target: No increase in incidence of non-native forest health agents.

Current Status: Non-native forest health agents are insects or diseases that are introduced into an area that is beyond their natural range of occurrence and become pests in the new environment. Non-native species may have few natural controls within these new ecosystems, which can often lead to outbreak populations and can decimate native species. For example, white pine blister rust is a European pathogen that was introduced to both the east and west coasts of North America in the early 1900's and has subsequently had significant impacts on native white pine populations.

ASRD surveys the R11 Forest Management Unit annually for the presence of insects, disease, and natural disturbances. The type, cause, and extent of all disturbance agents are mapped and tabulated annually. Currently, no non-native forest insects or diseases have been found within the R11 FMU (but see Indicator 3.2.1 for non-native, invasive plants); however, annual monitoring will continue to ensure any occurrences are identified.

Forecast: not applicable

Monitoring: Annual aerial surveys are typically conducted from late June to early September to assess location, area disturbed, severity, possible causal agent, and host tree species for insect and disease disturbances. Any significant disturbances are mapped and the disturbance agent ground truthed and verified. These data are maintained at the Forest Health Section in Edmonton and are available on the ASRD website (http://www.srd.gov.ab.ca/forests/health). At each five-year monitoring period, the inventory and maps of all forest health surveys will be compiled and analyzed to identify any occurrence of non-native forest health agents. Summaries will be completed for the Stewardship Report. GIS data coverages that track insect and disease events will be updated regularly.

Response: Any occurrence of a non-native forest health agent will trigger immediate development of a management plan to include surveys, control, and monitoring under the responsibility of ASRD Forest Health Section or the Federal Department of Agriculture.

Indicator 3.2.1

Value: Forest Health

Objective: Prevent introduction of non-native, invasive plant species.

Indicator: Current inventory and distribution of non-native, invasive plant species (i.e., noxious and restricted weeds).

Target: No increase in incidence of non-native, invasive plant species (i.e., noxious and restricted weeds).

Current Status: Non-native, invasive plants (i.e., noxious and restricted weeds) are typically very adaptable, very aggressive, and have a high reproductive capacity. Impacts of noxious and restricted weeds on ecosystems can include out-competing native or desired species, displacing native, threatened, and endangered species, impeding the successful reclamation of disturbed sites, delaying forest succession, and altering wildlife habitat. The control or eradication of noxious and restricted weeds within forested areas is regulated by the *Weed Control Act* and *Directive 2001-06: Weed Management in Forestry Operations*.

ASRD surveys the R11 FMU annually for the presence non-native, invasive plants. Currently, oxeye daisy, scentless chamomile, tall buttercup, wild caraway, and white cockle have been identified within or immediately adjacent to R11 (Map 30). Management plans are in place to survey, control, and monitor these populations, under the responsibility of the Forest Health Officer for ASRD. The final component of non-native, invasive plant management in R11 is prevention. Specific practices include use of native seed for any required reclamation work, public education, and participation in co-operative programs.

Monitoring: ASRD conducts annual forest health surveys of the R11 forests from which the location, extent, and type of all non-native, invasive plants are mapped and tabulated. These data are maintained in the Forest Health Section in Edmonton. At each five-year monitoring period, the inventory and maps of all non-native, invasive plants will be compiled and analyzed to identify the extent of the infestations. Results will be summarized in the Stewardship Report. GIS data coverages that track non-native, invasive plant infestations will be updated regularly. The effectiveness of control or eradication measures will also be monitored through field inventories and inspections.

Response: Any increase in the extent of non-native, invasive plants will trigger a new, more aggressive management plan to include surveys, control, and monitoring under the responsibility of ASRD Forest Health Section or the Federal Department of Agriculture.

Indicator 3.3.1

Value: Forest Health

Objective: Reduce the impact of mountain pine beetle.

Indicator: Stand Susceptibility Index.

Target: 75% reduction in the area of highly susceptible stands currently projected in 20 years.

Current Status: Although mountain pine beetle (MPB) has not yet been detected within R11, this species is spreading eastward into Alberta through most of the major mountain passes. The mature and old growth lodgepole pine stands in the FMU are at risk of infestation if measures are not taken to reduce their susceptibility. Three major factors define a stand's likelihood of mountain pine beetle attack and subsequent mortality: (1) Mountain Pine Beetle Stand Susceptibility Index, (2) climate suitability, and (3) proximity to existing beetle populations (risk).

Daniel Lux

Pine trees under attack by mountain pine beetle

1. The Stand Susceptibility Index is one tool used by ASRD to identify stands that are most susceptible and/or would incur the most significant damage given a mountain pine beetle infestation. The index is based on the Shore/Safranyik Susceptibility Rating System (Shore and Safranyik 1992) that measures a stand's capacity to produce beetles in the event it is attacked. One component in this analysis is the pine rating, a factor of the percentage of susceptible pine basal area, stand age, and stand density. This relative measure ranges from 0 to 100 where stands rated as 100 have conditions most conducive to MPB production.
2. The climate suitability is a relative measure of the likelihood of MPB undergoing a one-generation per year life cycle. Higher ranked stands are those where MPB populations will grow rapidly if not controlled.
3. Risk is an assessment of the probability that an area will be attacked based on existing MPB populations. The general criteria for risk assessment are as follows:
    i. **High:** areas adjacent to existing MPB populations or in the direct pathway of logical MPB corridors.
    ii. **Moderate:** areas that are not in the direct path of current MPB flight patterns, but are likely to experience MPB populations in the next 5-7 years.
    iii. **Low:** areas not expected to experience significant MPB pressure for the next 7 years or areas that have already experienced a MPB outbreak and there is limited opportunity for prevention.
    For ease and planning purposes, all areas within the R11 will be ranked as moderate.

The *Mountain Pine Beetle Action Plan for Alberta* (Government of Alberta 2006b; online at http://www.srd.gov.ab.ca/forests/pdf/MPB%20Action%20Plan.pdf) describes targets as well as control and prevention strategies to reduce the amount of susceptible stands across the landscape. Specifically, the target is to reduce the number of Rank 1 and Rank 2 stands to 25% of their currently projected level in 20 years. Rank 1 stands provide the best habitat for MPB to reproduce and spread to other stands, and are typically comprised of large, old pine, are close to existing MPB populations, and/or are in areas that are climatically suitable for beetle development (Government of Alberta 2006c). Rank 2 stands have a lower pine component, lower climate suitability, and/or greater distance from existing MPB populations, and thus are lower priority. The ranking system for pine stands is shown in Table 29.

Table 29. Pine stand ranking system for Prevention (Pine) Strategy FMP planning and implementation (taken from Government of Alberta 2006c).

Climate Factor (per stand)	Pine Rating				Risk
	0 to 30	31to 50	51to 80	81to 100	
Very Suitable 1.0	Rank 1	Rank 1	Rank 1	Rank 1	High
	Rank 2	Rank 1	Rank 1	Rank 1	Moderate
	Rank 2	Rank 2	Rank 1	Rank 1	Low
Highly Suitable 0.8	Rank 1	Rank 1	Rank 1	Rank 1	High
	Rank 2	Rank 2	Rank 1	Rank 1	Moderate
	Rank 2	Rank 2	Rank 2	Rank 1	Low
Moderately Suitable 0.5	Rank 2	Rank 1	Rank 1	Rank 1	High
	Rank 2	Rank 2	Rank 2	Rank 1	Moderate
	Rank 3	Rank 2	Rank 2	Rank 2	Low
Low Suitability 0.2	Rank 2	Rank 1	Rank 1	Rank 1	High
	Rank 3	Rank 2	Rank 2	Rank 2	Moderate
	Rank 3	Rank 2	Rank 2	Rank 2	Low
Very Low Suitability 0.1	Rank 3	Rank 2	Rank 2	Rank 2	High
	Rank 3	Rank 3	Rank 2	Rank 2	Moderate
	Rank 3	Rank 3	Rank 3	Rank 3	Low

Currently there are 54,341 ha of Rank 1 and Rank 2 stands within the R11 FMU (Map 29). Prescribed burning and harvesting will target these stands.

Forecast: Mountain pine beetles will not attack burned or downed wood or young regenerating stands. Thus, if all proposed prescribed burns and harvest blocks are carried out to completion, 18,607 ha of Rank 1 and Rank 2 stands will be removed, representing a 66% reduction in the area of highly susceptible stands.

Monitoring: Completed burn and harvest area boundaries will be overlaid on the mountain pine beetle susceptibility rating map and the results summarized in the Stewardship Report.

Response: If the number of highly susceptible stands is not reduced at the five-year reporting period, a new schedule and timeframe for the prescribed burn and harvest activities will be implemented to target the highly susceptible stands.

Indicator 3.3.2

Value: Forest Health

Objective: Reduce the impact of mountain pine beetle.

Indicator: Stand age distribution.

Target: Current stand age distribution within the natural range of variation. See Indicator 1.1.2.

Current Status: Although mountain pine beetle has not yet been detected within R11, this species is spreading eastward into Alberta through most of the major mountain passes. The mature and old growth lodgepole pine stands in the FMU are at greatest risk of infestation as the beetle preferentially attacks these age classes. Fire suppression activities have shifted the distribution of forest stand ages outside the natural range of variation, specifically there are fewer younger stands and more mature and old growth stands than historically present in the FMU. Specific treatment actions planned in this FMP will be directed at creating a stand age distribution within the natural range of variation. For further details, see Indicator 1.1.2.

Indicator 4.1.1

Value: Watershed Integrity

Objective: Maintain flow quantity.

Indicator: Annual flow.

Target: No increase in annual flow projections greater than 15% on third-order streams.

Current Status: As a forested landscape recovers from disturbance, the regeneration of forest vegetation decreases the disturbance impact on the surrounding watershed and hydrologic regime. ECA stands for 'Equivalent Clearcut Area' and describes the hydrologic recovery of a disturbed area relative to the water use of a similar-sized mature area. For example, the water use of a 100 ha juvenile stand recovering on the site of a stand that was harvested in 1973 might be 75% of the water use of a mature stand and thus is equivalent to an area with 75 ha mature forest and 25 ha new clearcut (Silins 2003). The ECA-Alberta model, based on this concept, provides a framework for evaluating the cumulative disturbance condition of landscapes or watersheds using specific data related to hydrologic recovery of provincially common forest stand and site types as well as regional streamflow and precipitation data (Silins 2003). The model also incorporates procedures for simulating annual water yield and stream flows.

Stream order is a measure of the relative size of streams within a watershed or landscape, ranging in Alberta from small first-order perennial streams with no tributaries up to the eighth-order Slave River. First-order streams are non-branching headwater channel segments, second-order streams are formed by the union of two first-order streams, third-order streams by the union of second-order streams and so on. Watershed classification can follow a similar hierarchical pattern with first-order watersheds delineating the area drained by a given first-order stream, second-order watersheds delineating the area drained by a given second-order stream, etc.

For this R11 Forest Management Plan, ASRD delineated the FMU into third-order watersheds (Map 10, Table 2), but did not yet analyze the impacts of proposed treatments on those watersheds. Preliminary watershed analyses on the larger watersheds in R11 using ECA-Alberta indicated that if all treatments were done in a single year, the impact to those watersheds would be an increase of less than 3% in the annual flow. As the analyses of smaller watersheds occur, the increase will get larger; however, the treatments will be spread out over a period of years, so the flow increases will not accumulate as rapidly. Analyses of annual flow in third-order watersheds will be completed in future iterations of the plan.

Forecast: Historical watershed analyses from other FMAs rarely show annual flows above the 15% threshold due to forestry activities. Annual flow increase in R11 as a result of treatment activities will be addressed in the next iteration of this plan with a more detailed analysis.

Monitoring: Models will be re-run after treatment activities, particularly prescribed burn treatments that are larger than planned. Results will be presented in Stewardship Reports.

Response: The chosen response to increases in annual flow projections greater than 15% will be detailed in the next version of the plan after the analyses of third-order watersheds are completed. However, the response will likely entail a reduction in the number or magnitude of treatment activities within a given watershed.

Indicator 4.2.1

Value: Watershed Integrity

Objective: Maintain flow quality.

Indicator: Roads and watercourse crossings.

Target: All roads and watercourse crossings meet or exceed Sundre Forest Products OGR standards.

Current Status: Forest management activities such as road construction, harvesting, and site preparation have been shown to alter water quality, primarily through elevated sediment inputs, elevated water temperatures, decreased dissolved oxygen, and elevated dissolved nutrient levels. Accordingly, various management practices have been developed to minimize the impacts of forest management activities on watercourses and associated riparian areas. Protection of watercourses and water quality is required by the provincial *Timber Harvest Planning and Operating Ground Rules* (AEP 1994), the *Code of Practice for Watercourse Crossings* under the provincial *Water Act*, and the federal *Fisheries Act*. This R11 Forest Management Plan will adopt Sundre Forest Products Operating Ground Rules as the standard.

Road and watercourse crossing construction practices in the Sundre Forest Products Operating Ground Rules are very comparable to existing Provincial OGR. Examples of road and crossing practices in the OGR that conserve water quality include avoiding known springs or seepage areas during road design, constructing watercourse crossings at right angles to watercourses, and reducing water and sediment movement along ditches using vegetated buffers, rock and log obstructions, or sediment control structures. The indicator regarding soil protection (2.4.1) also directs road construction to the lower class roads and frozen conditions.

Forecast: Most harvesting in R11 will be conducted under competitive permits, where ASRD can specify time of harvest, access routes, and crossing types if desired. Winter harvest can likely be achieved most of the time; however, coordination of activities with adjacent timber operators may dictate adjustment of harvest schedules to achieve joint roading and reclamation. In these cases, the Operating Ground Rules will be followed.

Monitoring: Field inspections and audits will be used to monitor compliance with the OGR and timing of harvest. Existing water quality monitoring within the North Saskatchewan watershed is summarized in North Saskatchewan Watershed Alliance (2005), though Alberta Environment focuses its efforts on major rivers especially near communities. Additional watershed quality monitoring may be requested from Alberta Environment if deemed necessary.

Response: Immediate remedial action will be taken to correct road and crossing construction, maintenance, or reclamation operations that do not comply with the OGR or that are creating impacts on water quality.

Indicator 4.2.2

Value: Watershed Integrity

Objective: Maintain flow quality.

Indicator: Maintenance of stream buffers.

Target: Sundre Forest Products OGR for stream buffers met or exceeded in harvest areas.

Current Status: Riparian vegetation adjacent to watercourses fulfills several key ecological functions, including stabilizing stream banks and channels, regulating temperature and light effects in the watercourse, regulating water flow regimes, filtering runoff before it enters the watercourse, providing riparian habitat and linkage corridors between other habitats for terrestrial wildlife, and providing long-term recruitment of coarse woody debris and nutrient inputs for aquatic biota. Thus, maintenance of stream buffers is an accepted practice to moderate the impacts of forest management activities on water quantity and quality as well as riparian values. Sundre Forest Products Operating Ground Rules buffers based on stream classification will be followed in all harvested areas within the R11 FMU. The OGR also include other protection measures such as locating log decks outside riparian or water source areas.

Forecast: Achievement of buffer retention is anticipated on 100% of harvest areas.

Monitoring: The inspecting Forest Officer will conduct regular reviews, and any deviation from the approved Annual Operating Plan will be documented.

Response: Immediate remedial action will be taken to correct, where possible, harvesting operations that are not adhering to the OGR.

Indicator 4.2.3

Value: Watershed Integrity

Objective: Maintain flow quality.

Indicator: Bared soil surfaces.

Target: No bared soil surfaces created by harvest operations.

Current Status: Similar to the potential water quality impacts of roads and watercourse crossings, bared soil surfaces resulting from forest management activities can also release sediment into nearby streams thereby degrading water quality and aquatic habitat. The indicators regarding soil protection (2.4.1) and roads and watercourse crossings (4.2.1) direct road construction to the lower class roads and frozen conditions. This will minimize the bared areas created by construction activities. Conducting harvesting activities under dry or frozen conditions as well as retaining some downed woody debris and stand structure will further protect the duff layer, maintain the snowpack, and encourage runoff infiltration rather than overland flow.

Forecast: Most harvesting in R11 will be conducted under competitive permits, where ASRD can specify time of harvest. Winter harvest can likely be achieved most of the time; however, coordination of activities with adjacent timber operators may dictate adjustment of harvest schedules to achieve joint roading and reclamation. In these cases, the Operating Ground Rules will be followed.

Monitoring: The inspecting Forest Officer will conduct regular reviews, and any deviation from the approved Annual Operating Plan will be documented.

Response: Immediate remedial action will be taken to correct, where possible, harvesting operations that are creating bared soil surfaces.

Indicator 4.2.4

Value: Watershed Integrity

Objective: Maintain flow quality.

Indicator: Area of unsalvaged blowdown.

Target: No salvage of merchantable blowdown in riparian areas.

Current Status: Long-term recruitment of coarse woody debris into streams from adjacent riparian vegetation creates pool and complex cover habitats for fish and other aquatic organisms, provides nutrient inputs into the system, stabilizes stream banks and channels, and traps sediment and organic matter (Harmon et al. 1986). Coarse woody debris within watercourses also helps discourage motorized traffic and associated sedimentation. Accordingly, merchantable blowdown occurring in riparian areas within R11 will not be salvaged (note that there may be limited salvage of merchantable burn or blowdown in non-riparian areas as per Indicator 1.3.1). Localized variance may be required if blowdown contributes to excessive fuel hazard or safety concerns.

Robert Anderson

Recruitment of coarse woody debris from a burn along Corona Creek

Forecast: not applicable

Monitoring: Stream buffer widths will be identified from air photos or GPS boundaries of harvest blocks and burns and compared to the boundaries of salvage areas. Results will be reported in the five-year Stewardship Reports.

Response: Immediate remedial action will be taken to correct, where possible, harvest operations that are salvaging blowdown from riparian areas.

Indicator 4.3.1

Value: Watershed Integrity

Objective: Support Watershed Alliances.

Indicator: Communications with Watershed Alliances.

Target: Referral of plan to Red Deer and North Saskatchewan Watershed Alliances.

Current Status: The North Saskatchewan and Red Deer River Watershed Alliances are non-profit partnerships of interested stakeholders working together to protect the ecological integrity of their respective watersheds. These alliances provide a forum for information exchange among those working toward sustainable use and management of water supplies; support public education and communication-related initiatives on issues impacting the watersheds; and promote a watershed approach to environmental, cultural, social, and economic decision-making and actions within their respective communities. Membership is diverse and includes representatives from government, agriculture, industry, environmental groups, local stewardship groups, municipalities, educational institutions, interested citizens, etc.

The North Saskatchewan Watershed Alliance participated in the initial stakeholder meetings during the development of the R11 Forest Management Plan. As well, an Alberta Environment employee who also represents the Alliance attended the public Charrette planning session to help draft the plan. The R11 FMP was made available for public review prior to approval, and the approved copy will be made available to the public, including the Watershed Alliances.

Forecast: not applicable

Monitoring: Correspondence with Watershed Alliances will be documented and reported in the Stewardship Report.

Response: not applicable

Indicator 5.1.1

Value: Science-based Decision Making

Objective: Ensure stakeholders and managers are informed by science so they can understand trade-offs and make defensible decisions; employ scientific thresholds and checkpoints; make ecosystem-based decisions; and adhere to planning standards.

Indicator: Implementation of current research findings in R11.

Targets: Continual monitoring and implementation of research findings relevant to R11; Current communications systems in place to monitor research initiatives.

Current Status: ASRD has a specialist who reviews and guides research initiatives related to forest and land management. All related research is scrutinized for relevancy, applicability, and scientific procedures. Furthermore, ASRD is a partner and key financial supporter of two particularly relevant bodies, the Foothills Model Forest (http://www.fmf.ca/index.html) and the Sustainable Forest Management Network (http://www.sfmnetwork.ca/), and also provides significant funding to many Canadian universities when their research may be applicable in Alberta. FMF grizzly bear research products have already been utilized, and this work will continue as models are refined. Similarly, statistics from the FMF Highway 40 North project have been calculated in the ecosystem biodiversity Indicator 1.1.1, as this project is recognized as being closely aligned with the objectives of the R11 FMP. Recently completed and ongoing research will be discussed at regular stakeholder meetings (e.g., after the completion of five-year Stewardship Reports) to ensure all parties remain informed of research initiatives and findings and their implications in the management of R11.

Radio-collared bighorn sheep along Hwy 11

Forecast: The R11 FMU has the potential to adopt new research strategies relatively easily. Results from the Foothills Model Forest research will likely continue to be a major driver in planning and treatment activities conducted in R11.

Monitoring: ASRD will continue to monitor findings from all research, most notably research to which the Alberta government is a significant contributor.

Response: Current research findings that result in small-scale changes to treatment activities will be implemented immediately and reported in the five-year Stewardship Report. Research findings that would require a significant change in management direction will be considered in the subsequent FMP.

Indicator 6.1.1

Value: Domestic Grazing

Objective: Maintain trails open to manage livestock and consider cow locations during seasonal use.

Indicator: Location of cow trails and season of use.

Targets: No increased use of riparian areas as a result of prescribed burn or harvest treatments; Consultation with affected disposition holders prior to treatments.

Current Status: ASRD Land Division and Forestry Division policy directive 2006-1 on Integration of Grazing and Timber Activities and the Grazing and Timber Integration Manual (ASRD 2006b) outline procedures to promote the successful integration of grazing with timber harvest and reforestation on public lands. In particular, grazing interests should be considered in the development of a forest management plan and resulting harvest sequence for a given FMA or FMU. Domestic grazing in R11 is limited with the FMU containing portions of only six grazing dispositions, concentrated primarily along the southeastern boundary (Map 34). Few prescribed burns are scheduled for this area although harvest activities are planned. Operating Ground Rule stream buffers will be retained, and expanded if required, to discourage cattle from entering riparian areas. Consultation with the affected disposition holders will occur prior to treatment activities to address issues such as the timing of operations and associated movement of cattle, location of high-use cattle trails, maintenance of access to forage and water resources, damage to existing fences, introduction of weeds, damage to riparian areas, and overgrazing or damage to regenerating cutblocks.

Forecast:

Monitoring: All communications with affected disposition holders will be documented, and a summary of activities addressing range management concerns will be prepared for the Stewardship Report.

Response:

Indicator 7.1.1

Value: Economic Opportunities

Objective: Maintain or increase the economic potential of the R11 area without damaging the overall appeal for users.

Indicator: Number of tourism-related operators in the R11 area.

Target: Number of tourism-related operators in the R11 area is maintained or increased.

Current Status: In addition to personal recreation and enjoyment, the stunning natural beauty of the R11 FMU attracts visitors from afar, resulting in the potential for local economic returns from tourism. Development applications by tourism-related operators desiring to operate on public lands and requiring long-term tenure, permanent structures, public review, or integration with existing land uses may be subject to ASRD's Alberta Tourism Recreational Leasing Program process. Furthermore, operators based in county-administered sub-divisions, hamlets, and development nodes must comply with municipal requirements for development permits. However, tourism-related operators without facilities do not require any type of permitting. ASRD recognizes there are many such operators, but no agency tracks their activities. Comprehensive assessment of this indicator is thus difficult using existing provincial or municipal government data (e.g., limit on the number of Alberta Tourism Recreation Leasing permits, no geographical identifier on municipal development permits). The R11 plan has addressed tourism generally in Indicator 10.2.1, and until there is a method to track and report all tourist-related operators, monitoring through other indicators must suffice. Planned treatment activities may result in aesthetic impacts (Indicator 9.3.1) or temporary closure of some recreational areas when hazard trees create a public safety concern (Indicator 15.1.1), but a public education program will help communicate the ecological rationale behind the treatments (Indicator 13.1.1).

Indicator 7.1.2

Value: Economic Opportunities

Objective: Maintain or increase the economic potential of the R11 area without damaging the overall appeal for users.

Indicator: Client impact, financial impact for operators, and economic impact on local economy.

Target: Positive client feedback.

Current Status: Many tourism-related operators rely on the access, fish and wildlife, and aesthetic resources within the R11 FMU when providing accommodation, guiding and outfitting services, or other recreational experiences for clients. The economic returns that operators and other local businesses receive can support the local economy. The success of tourism-based businesses, however, require positive client experiences, which are often influenced by factors outside the operators' control such as weather, scenery, frequency of encounters with wildlife or other tourists, forest management activities occurring on the landscape, etc.

Government of Alberta

Wagon train crossing the Panther River

Planned harvest and prescribed burn treatment activities may result in aesthetic impacts (Indicator 9.3.1) or temporary closure of some recreational areas when hazard trees create a public safety concern (Indicator 15.1.1): this has the potential to result in temporary impacts on clients and operators. A public education program will help communicate the ecological rationale behind the treatments (Indicator 13.1.1), and operators will be encouraged to help educate clients on the benefits of the management activities (e.g., increased ungulate forage, reduced risk of mountain pine beetle infestation).

The impact of R11 treatment activities on tourism-based operators and their clients will be difficult to assess using existing government-maintained datasets, though many operators may individually record client feedback and maintain financial records. Thus monitoring the impacts of treatment activities on tourism clients, operators, and the local economy will require further investigation into targets that both reflect the indicator and are measurable. In the interim, general visitor numbers and feedback will be monitored as outlined in Indicator 10.1.2

Indicator 8.1.1

Value: Wildfire Threat

Objective: Integrate fire management objectives with overall landscape management objectives (i.e., balance the level of risk of wildfire with the responsibility of other parties, such as developers and adjacent forest companies, to participate in their own risk reduction).

Indicator: Vegetation management zone map.

Target: Appropriate vegetation management zone map developed.

Current Status: The R11 Forest Management Plan is based upon the natural disturbance paradigm: management activities that emulate natural disturbances will create a landscape similar to one that would have existed without human intervention thereby conserving biotic resources contained therein. Furthermore, the *Eastern Slopes Policy* directs that much of the R11 FMU is in the Prime Protection Zone where resource extraction activities are prohibited and preservation of environmentally sensitive terrain and valuable ecological and aesthetic resources is the foremost concern. Management activities are limited to those that protect or improve watershed, fisheries, or wildlife resources. Given these underlying conditions, participants in the public Charrette planning session outlined a vegetation management zone map that identifies zones within the R11 FMU designated for a given management treatment (Map 48). The four management zones are as follows:

- Fire Only – prescribed fire will be the only management type used
- Fire > Mechanical – prescribed fire is the preferred management type; however, mechanical treatments (e.g., harvesting, brush cutting) may be used in some circumstances including preparatory work in advance of prescribed fire treatments
- Mechanical > Fire – mechanical treatment is the preferred management type for logistical or social reasons; however, prescribed fire may be used given the appropriate conditions
- Mechanical Only – mechanical treatment will be the only management type used

These zones are compatible with both the natural disturbance paradigm and the *Eastern Slopes Policy* and represent the integration of fire management objectives with landscape management objectives. Specifically, prescribed fire will be the primary tool used over much of the FMU to reduce wildfire threat by returning the stand age distribution to within its natural range of variation. In areas where the risk associated with the use of prescribed fire is deemed too high (i.e., near infrastructure or adjacent FMAs), mechanical treatments will be used, recognizing that harvesting will be the most common mechanical treatment used on the landscape.

Forecast: not applicable

Monitoring: GIS analysis will be used to overlay prescribed burn and mechanical treatment boundaries on the vegetation management zone map to ensure the proper treatment type is used in each zone. Results of the mapping exercise will be reported in the five-year Stewardship Report.

Response: Planned treatment types will be adjusted if they are not compatible with the vegetation management zone map.
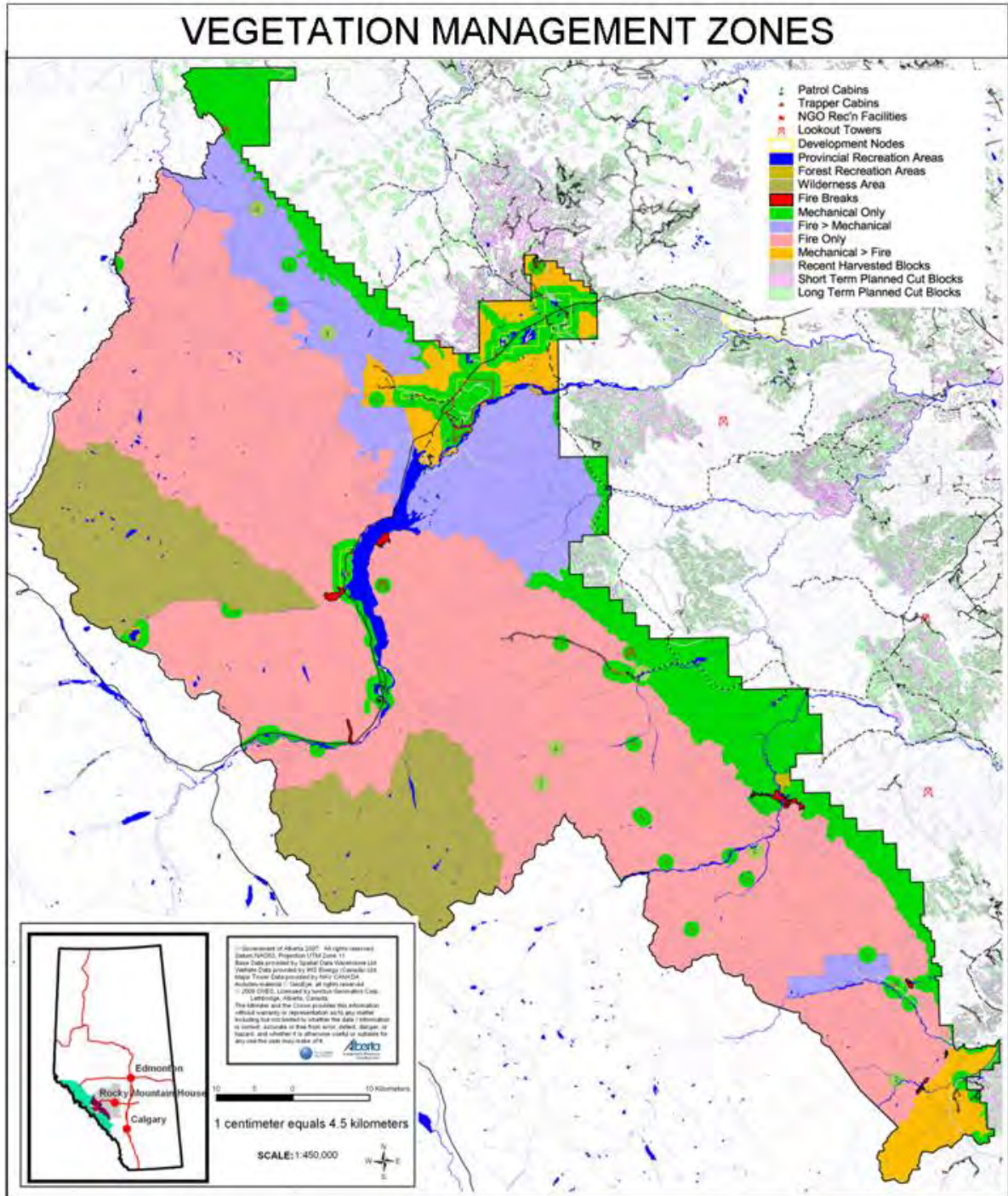
Map 48. Vegetation Management Zones where particular management treatments will be used within the R11 FMU.

Indicator 8.1.2

Value: Wildfire Threat

Objective: Integrate fire management objectives with overall landscape management objectives (i.e., balance the level of risk of wildfire with the responsibility of other parties, such as developers and adjacent forest companies, to participate in their own risk reduction).

Indicator: Number of FireSmart initiatives.

Targets: FireSmart Program in place for all communities and infrastructure in the R11 Forest Management Unit; FireSmart Landscape in place for the R11 Forest Management Unit.

Current Status: As one component of ASRD Forestry Division's wildfire prevention strategy, FireSmart programs encourage proactive planning to reduce negative impacts of wildfire. Three zones have been delineated to assist planning at different scales:
1. FireSmart Wildland Urban Interface Zone – comprises the area where infrastructure and human developments meet or are interspersed with combustible vegetation.
2. FireSmart Community Zone – usually encompasses a 10-kilometer radius around the community extending from the FireSmart Wildland Urban Interface Zone.
3. FireSmart Landscape Zone – extends beyond the FireSmart Community Zone overlapping multiple jurisdictions at a broad landscape level. This zone focuses on mitigating the likelihood of large, high intensity, high severity fires.
Initial FireSmart planning often begins with the Wildland Urban Interface Zone and proceeds to the increasingly broader levels.

The Nordegg FireSmart Wildland Urban Interface Plan was approved in spring 1998. A fuel reduction project has occurred: existing initiatives for vegetation control will be continued. The Nordegg FireSmart Community Zone Plan, covering the Nordegg Townsite, Shunda-Goldeye and Bighorn Canyon Development Nodes, and the Bighorn Reserve, was approved in September 2005, and a detailed project plan was approved for the area immediately west of the Nordegg townsite as identified in the Community Zone Plan. Commercial fuel reduction harvesting is ongoing in this area. A FireSmart program will be prepared for the Whitegoat Lakes Development Node in 2006 and ultimately for all communities and infrastructure in the R11 FMU. Furthermore, a FireSmart Landscape will be implemented in R11 (see results of the Landscape Fire Assessment in the Landscape Description chapter).

Forecast: not applicable

Monitoring: The number of new and ongoing FireSmart initiatives will be tallied annually and recorded in the Stewardship Report.

Response: not applicable

196

Indicator 8.2.1

Value: Wildfire Threat

Objective: Reduce the threat of large, high intensity, catastrophic wildfires.

Indicator: Fire behaviour potential.

Target: 5% reduction of high and extreme fire behaviour classes over a 20-year period.

Current Status: Fire behaviour is defined as the manner in which fuel ignites, flame develops, and fire spreads and exhibits other related phenomena as determined by the interaction of fuel, weather, and topography (Merrill and Alexander 1987). Wildfire threat assessments examine fire behaviour potential, in combination with fire occurrence risk, values at risk, and suppression capability, to ascertain which component is dominant in the wildfire threat. Current fire behavior potential classes in R11 have been analyzed for spring, summer, and fall periods using Alberta's Wildfire Threat Assessment Rating Model, based on 90th percentile historic weather, fuels, and topography. The current status is displayed spatially on Map 18 to Map 20 and graphically in Figure 9 to Figure 11. Prescribed burn and harvest treatments will be used to reduce the amount of area falling within the high and extreme fire behaviour classes.

Forecast: Fire behavior potential classes have also been analyzed over 10, 20, and 50 year periods based on fuel type changes resulting from the identification and sequencing of proposed prescribed burn and harvest treatment units.

Monitoring: Fire behaviour potential classes will be reanalyzed at 10-year intervals based on actual burns and other treatments completed. Results will be summarized and presented in Stewardship Reports.

Response: The sequence and number of harvest or prescribed burn plans will be adjusted if the target is not met.
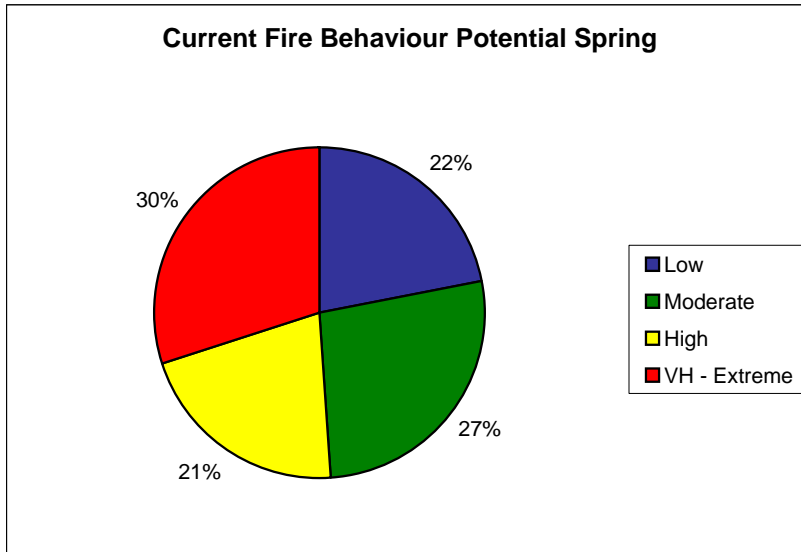
Figure 9. Current percentage of the R11 FMU within each fire behaviour potential class during the spring season.
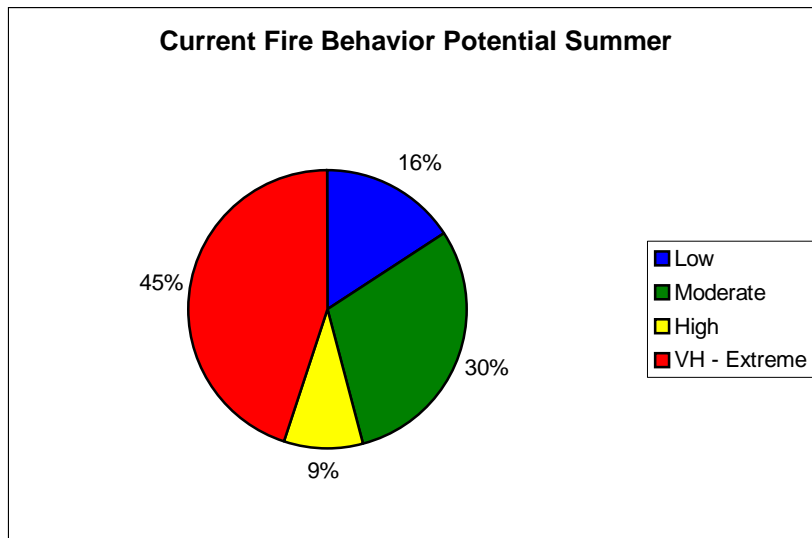

Figure 10. Current percentage of the R11 FMU within each fire behaviour potential class during the summer season.
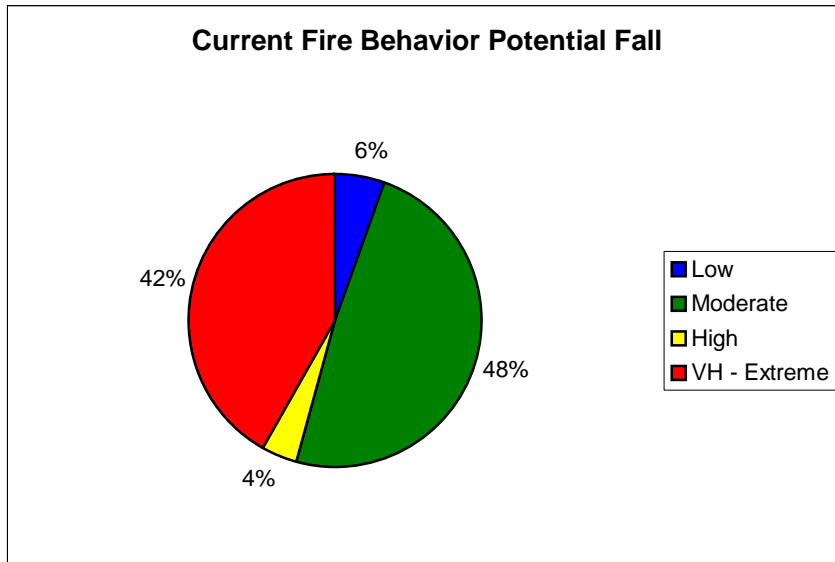
Figure 11. Current percentage of the R11 FMU within each fire behaviour potential class during the fall season.
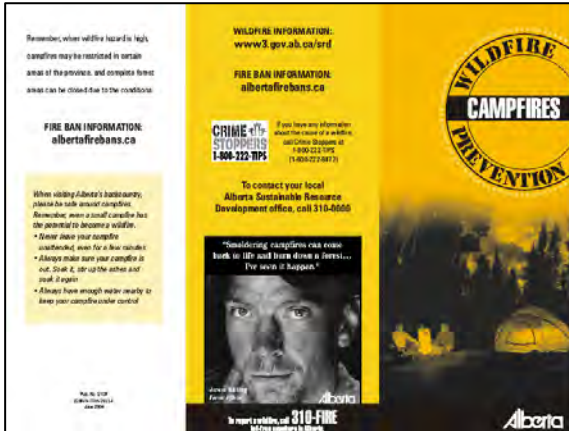
Indicator 8.2.2

Value: Wildfire Threat

Objective: Reduce the threat of large, high intensity, catastrophic wildfires.

Indicator: Number of human-caused wildfires.

Target: Number of human-caused wildfires at or below levels indicated in ASRD Forestry Division Standard Operating Procedures performance measures.

Current Status: Human-caused wildfires account for almost 50% of the wildfires and 30% of the area burned in Alberta over the past ten years. Within the R11 Forest Management Unit, there were on average 21 human-caused wi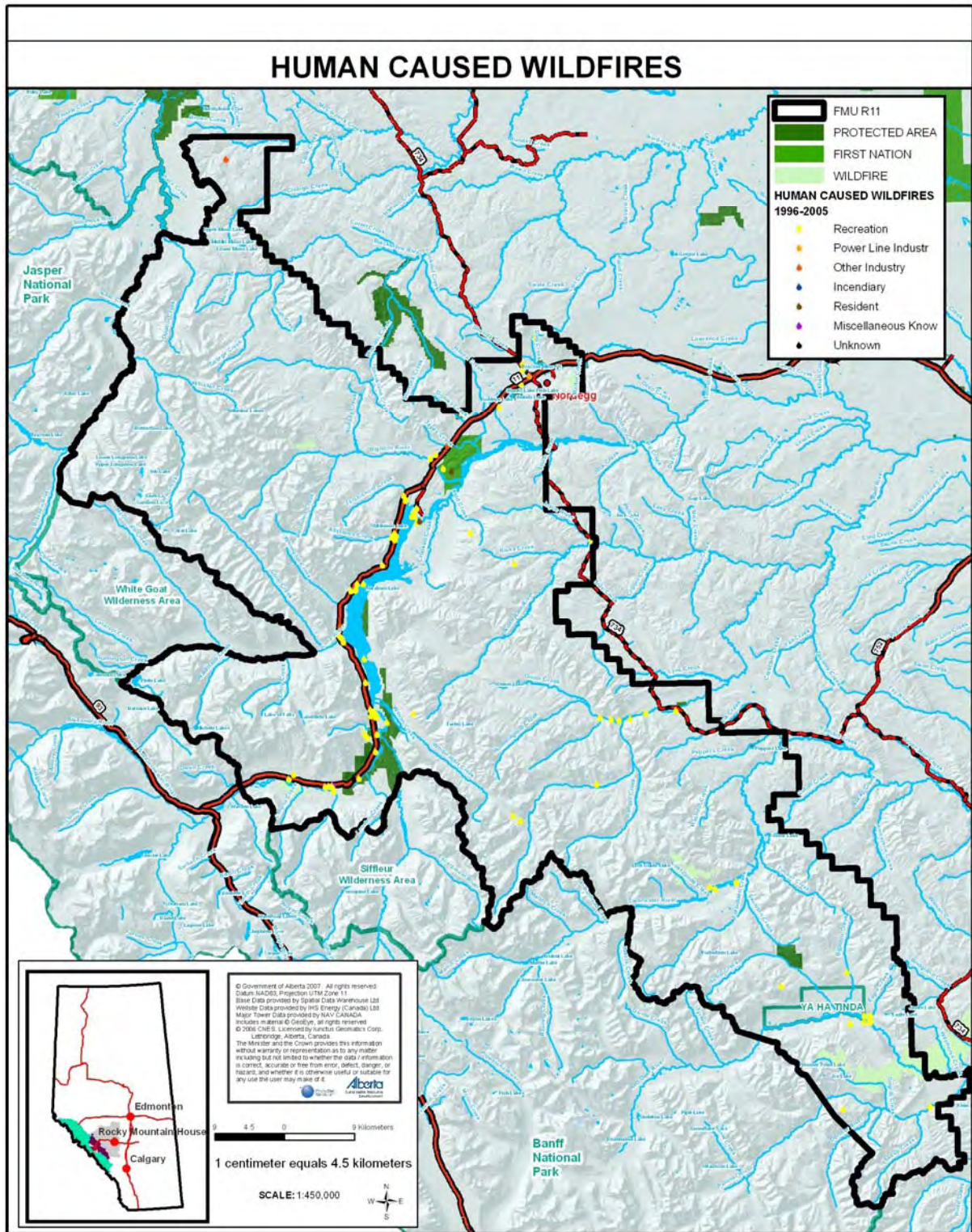ldfires between 2001 and 2005 (Figure 12, Map 49). Ignition sources for such wildfires commonly include abandoned campfires, discarded cigarette butts, off-highway vehicles, debris burning, and power lines. Alberta Sustainable Resource Development, Forestry Division's Standard Operating Procedures describe performance measures for each Wildfire Management Area. The 2005 performance measure target for the Clearwater Wildfire Management Area, of which R11 represents 25% of the area, is 110 human-caused fires per year. Accordingly, the target assigned to the R11 FMU based on proportion of total area is 27 human-caused fires per year. Education, engineering (e.g., fuel modification, prescribed fire), and enforcement represent the three approaches used by Forestry Division to prevent human-caused wildfires, and these approaches will be supported within the R11 FMU. For example, utility companies have Fire Control Agreements with ASRD that require annual submission of maintenance plans and reporting of work completed to ensure lines are safe from hazard trees. Furthermore, the use of FireSmart techniques will be promoted to utility companies operating within R11, and a newly developed power line hazard assessment will be included in applications starting in 2006.

Forecast: not applicable

Monitoring: The number of human-caused wildfires will be compared annually to Forestry Division Standard Operating Procedures performance measures and reported at five year intervals in the Stewardship Report.

Response: Additional strategies to reduce the number of human-caused wildfires will be developed in subsequent FMPs.

Map 49. Distribution of human-caused wildfires in the R11 FMU between 1996 and 2005.
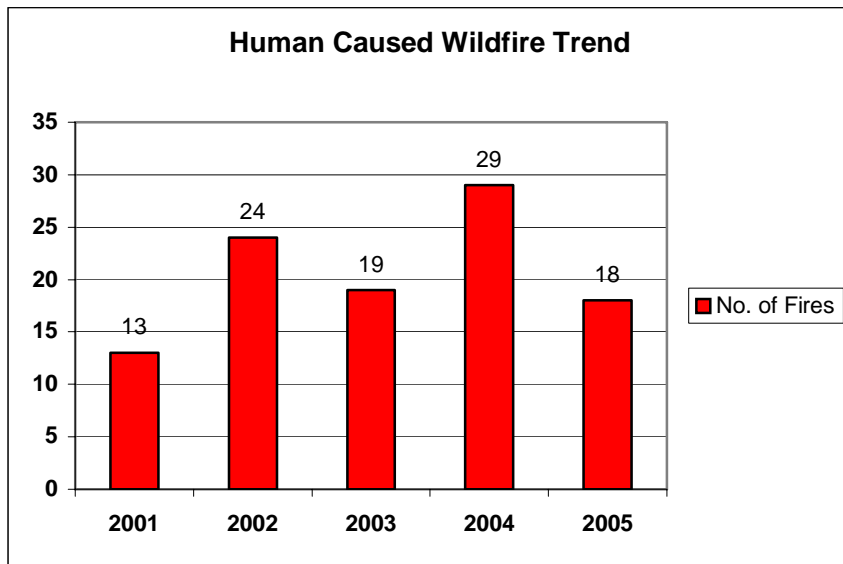
Human Caused Wildfire Trend

Figure 12. Annual number of human-caused wildfires in the R11 FMU. Prior to 2001, abandoned, smouldering campfires were not recorded as wildfires and thus such data are not presented here.

Indicator 8.2.3

Value: Wildfire Threat

Objective: Reduce the threat of large, high intensity, catastrophic wildfires.

Indicator: Area burned outside containment areas.

Target: No hectares burned outside containment areas.

Current Status: Fuel management activities, such as the establishment of strategic fuel breaks and fire doors to block the spread of fire, will help reduce the threat of large, high intensity wildfires. Fuel breaks and fire doors will be established in the R11 Forest Management Unit through prescribed fire and mechanical treatments and could include creating large cutblocks, converting conifer stands to less flammable deciduous stands, thinning stands, and clearing understory. Specific containment areas within the R11 FMU will be outlined once fuel breaks and fire doors are established. In the event of wildfires escaping initial attack, containment areas and limits of acceptable fire spread will be identified through the Escaped Fire Analysis Strategy process for each individual fire. Prometheus, the Canadian Wildland Fire Growth Model, will be used to help determine landscape features that could function as barriers to fire spread or where additional containment lines should be developed.

Forecast: The identification of containment areas will depend upon the successful creation of fire doors and fuel breaks on the landscape.

Monitoring: GIS analysis will be used to determine the area burned outside of established containment areas, and results will be reported in the Stewardship Report. Wildfire growth modeling will be conducted periodically after harvest, prescribed burn, or natural wildfires to reconfirm optimal arrangement of containment areas. Maps of wildfire growth models after disturbances will also be produced.

Response: Harvest or prescribed burn timing and sequence may be adjusted based on the results of the wildfire growth modeling.

Indicator 8.3.1

Value: Wildfire Threat

Objective: Protect values at risk within and adjacent to the R11 area.

Indicator: Presuppression Plans developed for communities, Development Nodes, and high-use areas.

Targets: Completion of Nordegg Presuppression Plan by 2007 fire season; Completion of Development Node Presuppression Plans as development occurs.

Current Status: Values at risk are natural resources and man-made improvements or developments that have measurable or intrinsic worth, and which could potentially be destroyed or otherwise altered by fire in any given area. Examples of values at risk include human lives; communities; transportation, telecommunication, and building infrastructure; sensitive watersheds and soils; and natural resources, such as terrestrial and aquatic biota, recreation areas, and cultural or historical areas. ASRD Forestry Division uses Presuppression Plans to identify how values at risk may be protected in the event of a wildfire. ASRD and Clearwater County developed a draft Presuppression Plan for Nordegg in 2006, and a final version compliant with the new Presuppression Planning Standard is anticipated by March 2007. Plans for other high-use areas of the R11 Forest Management Unit including Development Nodes will be completed as development occurs. FireSmart Community Zone Plans will also contribute to protection of values at risk.

2006 Eastbush Mountain fire near Nordegg

Monitoring: A record of Presuppression Plans completed and in progress will be included in the five-year Stewardship Report.

Forecast: not applicable

Response: not applicable

Indicator 8.3.2

Value: Wildfire Threat

Objective: Protect values at risk within and adjacent to the R11 area.

Indicator: Disposition referral process.

Target: Referral process implemented by fall 2007.

Current Status: Dispositions to use the public lands are issued by ASRD Forestry Division under the Public Lands Act and include leases, licenses, or permits for surface access for oil and gas, recreation, livestock grazing, sand and gravel extraction, and industrial development. Applications may be referred to staff in other divisions that may have an interest in the parcel of land under question (e.g., referred to wildlife biologist if the area contains colonial nesting birds, species at risk, etc.), and conditions may be placed on the disposition to ensure protection of specific features or resources. ASRD is currently developing a process for referral of industrial, commercial, and recreational lease applications on public lands within FireSmart Community Zones to the Forestry Division. Consultative Notations are being placed on Community Zones to ensure approvals contain FireSmart-related operating conditions.

Forecast: not applicable

Monitoring: not applicable

Response: not applicable

Indicator 9.1.1

Value: Inherent Value

Objective: Maintain cultural values and treaty rights.

Indicator: Integrity of traditional sites, burial grounds, ceremonial locations, etc.

Target: Complete protection of all traditional sites, burial grounds, ceremonial locations, etc

Current Status: The Government of Alberta has a duty to consult with First Nations where land management and resource development have the potential to adversely impact First Nations treaty rights and traditional uses of Crown lands. ASRD consultations regarding forest management activities are therefore guided by the *Government of Alberta's First Nations Consultation Guidelines on Land Management and Resource Development* (Government of Alberta 2006a), and protection of archaeological, palaeontological, and historical resources is provided under the *Historical Resources Act*.

Many traditional sites within R11 requiring protection are already identified; however, the consultation process continues to identify additional sites. Some identified sites are not used by local First Nations: efforts will be made to identify the users, and protect the sites accordingly. The location of identified traditional sites will be compared to planned treatment boundaries. If the planned treatment boundaries encompass a site, additional consultation efforts will engage the individual First Nations or Aboriginal bands associated with each site to determine if prescribed fire or timber harvest will compromise those sites. Not all cultural features will be impacted by prescribed burning or harvesting, in which case the site-specific level of protection will be evaluated in operational plans.

Forecast: The number of identified traditional sites receiving protection and the degree of protection required will depend upon the results of consultations with affected First Nations. Identified sites not associated with a particular band will be protected from harvest, but may be burned over if no loss of historic value will result.

Monitoring: Communications and consultations with affected First Nations will be documented. Management activities will be reviewed with consulted parties to ensure adequate protection was achieved. The five-year Stewardship Report will summarize consultative and protective activities; however, no specific site locations will be reported in public documents.

Response: If a review of treatment activities and the impacts on associated traditional sites reveals that protection levels were inadequate, additional consultations will be conducted to determine alternative protection methods for future treatments.

Indicator 9.1.2

Value: Inherent Value

Objective: Maintain cultural values and treaty rights.

Indicator: Number and diversity of cultural stakeholders involved in R11 planning.

Target: Representatives from local First Nations participating in stakeholder meetings.

Current Status: The Government of Alberta has a duty to consult with First Nations where land management and resource development have the potential to adversely impact First Nations treaty rights and traditional uses of Crown lands. ASRD consultations regarding forest management activities are therefore guided by the *Government of Alberta's First Nations Consultation Guidelines on Land Management and Resource Development* (Government of Alberta 2006a), and protection of archaeological, palaeontological, and historical resources is provided under the *Historical Resources Act*.

Invitations to attend the preliminary R11 planning meetings were extended to 61 stakeholder groups, based on the list of stakeholders derived from the *Bighorn Backcountry Access Management Plan* process. O'Chiese First Nations, Sunchild First Nations, and Stoney First Nations were among those invited. O'Chiese First Nations were the only group to attend the initial meetings, and none of the invitees chose to attend the Charrette planning session. First Nations are kept informed of the process through regular discussions with ASRD. The consultation process is most valuable at the operational level in identifying sites of importance and how those sites should be respected. ASRD is aware of some sites not used by local First Nations: efforts will be made to identify the users and include them in consultations.

Forecast: Regular consultation efforts with local First Nations stakeholders will continue to help identify historical sites and resources. The engagement of additional representatives will depend on individual or band interest in the process.

Monitoring: Consultation efforts with those First Nations potentially affected by R11 management activities will be documented. The five-year Stewardship Report will summarize consultative and protective activities.

Response: ASRD will attempt to engage additional cultural stakeholders if sufficient representation is not achieved. Additionally, the adequacy of consultations and activities directed at protecting traditional sites will be reviewed with First Nations.

Indicator 9.2.1

Value: Inherent Value

Objective: Allow continued use of forest for non-timber products such as mushrooms, medicinal plants, berries, etc.

Indicator: Known incidences of non-timber product use.

Target: Continued and enhanced use of non-timber products in the R11 FMU.

Current Status: Non-timber forest products are items of biological origin other than wood derived from forests and can include such products as mushrooms, berries, medicinal plants, floral greenery, cones, moss, and maple syrup. The suite and extent of non-timber product use in the R11 FMU is currently unknown. Consultation processes during detailed planning of harvest or prescribed burns are extensive, and should identify areas of non-timber resource use. As these areas are identified, their location will be housed in a GIS. Protection of such areas will depend on the nature of the resource, as many are likely disturbance-dependent. No restrictions on the use of these non-timber products are expected.

Morel mushroom

Forecast: Restoring disturbances to the landscape will result in a continued and renewed availability of non-timber products that are disturbance-dependent (e.g., mushrooms).

Monitoring: Feedback from stakeholders will be important in evaluating the ongoing availability of non-timber resources. A summary of information collected on the suite of products originating from the R11 FMU will be presented in the five-year Stewardship Report.

Response: Future harvest and prescribed burn plans will be adjusted if the use of the R11 forest for non-timber products is significantly impaired.

Indicator 9.3.1

Value: Inherent Value

Objective: Maintain aesthetic qualities of the landscape where possible.

Indicator: Visual impact and buffer width.

Target: No increase in proportion of negative comments about aesthetic appeal of changed viewscape.

Current Status: Diverse topography and stunning scenery draw visitors from both near and afar to the R11 FMU. Aesthetic qualities of the landscape, however, are difficult to quantify due to the wide variety of personal preferences. For example, comments received by ASRD on one cutblock ranged from "it's nice the trees are gone so we can see the mountains" to "visual buffers should have been left to screen the view of the cutblock". Nonetheless, visibility of landscape features from particular viewpoints can be depicted: Map 36 in the Landscape Assessment shows the result of an analysis conducted to assess visibility from Highway 11.

An altered visual landscape is a necessary side effect resulting from the use of prescribed burns and harvesting to emulate natural disturbance patterns and processes. Although not every treatment area in R11 will require aesthetic consideration, several high-use viewpoints and travel corridors must be assessed for visual impacts. A treatment area that is determined to be highly visual will not be removed from the scheduled treatment. Rather, planning will strive to include design features that minimize visual impacts and extended views. Harvest blocks will be designed using retention patches, visual screening, or topography to prevent prolonged views, while travelling on a highway for example. Block edges will also be irregular in design to simulate natural disturbance event boundaries. Prescribed burns, usually viewed as more natural and thus preferred over harvesting, will also be assessed for visual impacts, and if required, the burn plan will address screening requirements. Public education will play a key role in fostering acceptance and appreciation for the ecological benefits arising from the changed viewscape. Communication activities may range from presentations that show a computer simulation of visual impact from key viewpoints to pamphlets explaining fire and harvest ecology. See Indicator 13.1.1 for more details.

Forecast: ASRD has done some initial modelling to assess the visual impacts of burns from several Highway 11 vantage points, namely Banff east boundary, Siffleur Falls parking lot, Whitegoat Lake, and Baldy Lookout. The following graphics simulate the view of a burn and its regeneration from the Siffleur Falls parking lot (Photo 1 to Photo 4). For this exercise, the following worst-case visual situations were incorporated: snow on the ground, removal of foreground screening, and a complete burn.

Photo 1. Photograph of actual view from Siffleur Falls parking lot before a proposed prescribed burn treatment.

Photo 2. Simulated view from Siffleur Falls parking lot before the prescribed burn treatment.
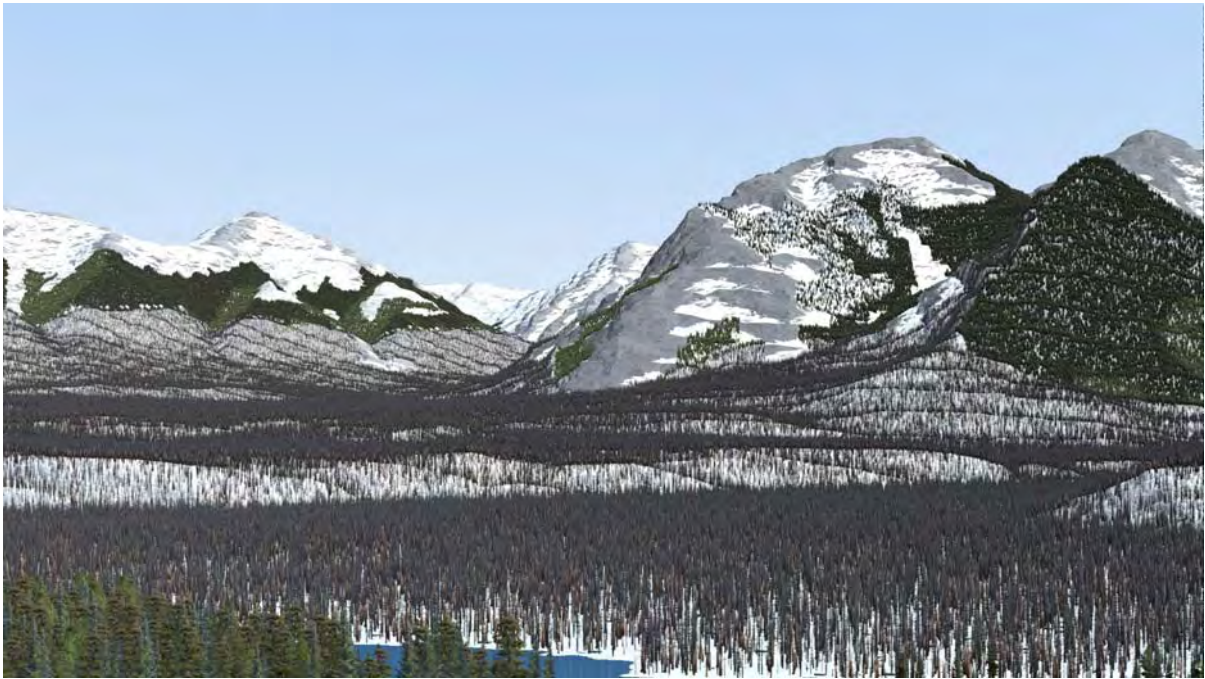
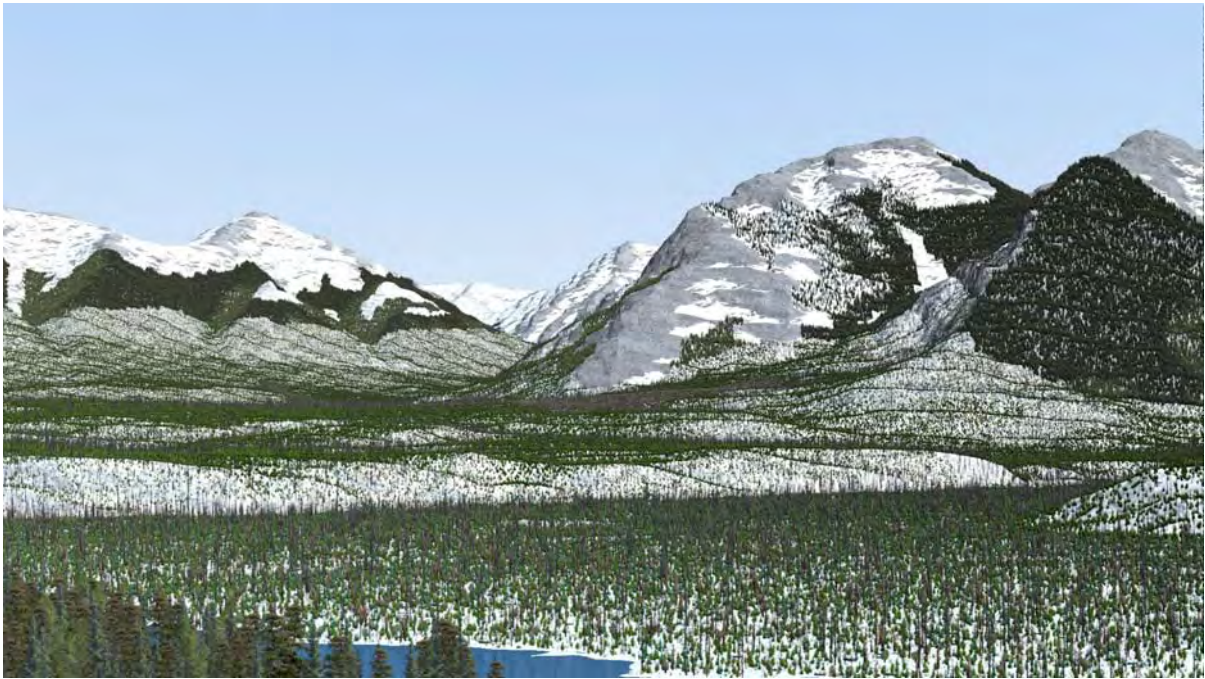Photo 3. Simulated view from Siffleur Falls parking lot immediately post burn.

Photo 4. Simulated view from the Siffleur Falls parking lot 20 years post burn.

Monitoring: Visual quality will be included on the visitor survey questionnaire distributed by Guardians, and annual responses monitored. A summary will be included in the Stewardship Report.

Response: If the proportion of negative comments regarding visual quality rise, ASRD will revisit the visual needs.

Indicator 9.4.1

Value: Inherent Value

Objective: Minimize changes to air quality as a result of prescribed burn treatments.

Indicator: Number of smoke-filled days in high use areas.

Target: Less than five consecutive smoke-filled days per year in high-use areas as a result of prescribed burn treatments.

Current Status: Reduction in air quality is one concern the public may voice in opposition to prescribed burning activities. Smoke emission and dispersion is influenced by several factors including the amount and type of fuel available, fire behaviour, topography, and current atmospheric conditions. For instance, the intense heat of a large canopy fire can produce a convection column that lifts the smoke and disperses it in the upper atmosphere, while a understory burn may produce less but low-lying smoke. Fire managers typically only initiate prescribed burns in high-use areas under conditions conducive to good vertical venting. Smoke plume and emission models exist that can be used to assist prescribed burn planners in determining the optimal conditions for smoke dispersion. For example, the Canadian Wildland Fire Information System uses the Atmospheric Dispersion Index, a numeric rating of the atmosphere's capability of transporting pollutants away from their sources. Factors such as the height of the cloud ceiling, stability of the atmosphere (i.e., amount of mixing that occurs between layers), height to which smoke will rise, and wind speed and direction are used to calculate this index. Within the R11 Forest Management Unit, Forestry Division staff will consider smoke dispersion when conducting prescribed burns in high-use areas and will attempt to have less than five consecutive smoke-filled days each year.

Forecast: Models and indices are important tools in predicting factors such as fire behaviour and smoke dispersion, yet a level of uncertainty always remains. Ignitions can occur when the proper scenarios arise; however, large prescribed fires may burn for multiple days or weeks and thus experience various wind and atmospheric conditions in the ensuing days. These conditions and their influence on smoke dispersion cannot be anticipated in all situations.

Monitoring: The visibility distance from the nearest fire tower will be recorded each day during all prescribed burn activities, and data will be summarized in the Stewardship Report. The number of smoke-related complaints received by the Forestry Division will be monitored for each prescribed burn occurring in a high-use area.

Response: Adjust subsequent prescribed burn plans to reduce the size of proposed burn units such that the unit can be burned over fewer days (i.e., smoke produced on less days). This requires an increase in the number of proposed units to ensure the total treatment area remains the same.

Indicator 10.1.1

Value: Recreational Opportunities

Objective: Maintain infrastructure and recognize volunteer efforts to maintain or replace infrastructure.

Indicator: Location of staging areas, washrooms, bridges, campgrounds, trails, roads.

Target: No impact to infrastructure from treatments.

Current Status: With the *Bighorn Backcountry Access Management Plan* in place, significant resources in the form of volunteer hours and funding have been directed to trails and facilities in R11. The locations of recreational infrastructure and trails have been identified, and ASRD staff monitors sites. Prescribed burn and harvest plans will be reviewed with regard for infrastructure and developments. When recreational infrastructure falls within a planned prescribed burn or harvest boundary, damage will be avoided wherever possible during the implementation of the treatment. Those volunteer groups responsible for particular developments (if known) will be consulted prior to prescribed burns or harvest, and synergies for future trail work will be explored.

Forecast: Complete protection of recreational infrastructure is anticipated.

Monitoring: Monitoring of trails and infrastructure is done through a multistakeholder monitoring group established under the *Bighorn Backcountry Access Management Plan*.

Response: In the event infrastructure cannot be protected, volunteer groups will be consulted and options for replacement or upgrading infrastructure will be provided.

Indicator 10.2.1

Value: Recreational Opportunities

Objective: Maintain tourism appeal (i.e., for snowmobiles, off-highway vehicles, hiking, camping, hunting, fishing, berry picking) and opportunities to enhance personal health and wellness.

Indicator: Annual number of visitors and visitor feedback on quality of experience including aesthetics, general enjoyment, and opportunities to promote personal wellness.

Targets: Visitor trends follow trends in other jurisdictions (e.g., Banff); No decline in proportion of positive visitor feedback.

Current Status: The Bighorn Backcountry has long been valued for the recreational opportunities it provides, including snowmobiling, quadding, hiking, mountain biking, skiing, camping, hunting, fishing, berry picking, and photography. However, there is no definitive measure of visitor use within the R11 Forest Management Unit. Several options were explored for use in tourism tracking including traffic and tourist information booth counts, commercial trail riders data, volunteer backcountry travel registration, and trail counter data.

Traffic counts from Banff National Park as well as tourist information booth counts from Nordegg were investigated to determine the level of correlation, anticipating that a strong correlation would be an indicator of tourist numbers. Traffic counts from Banff East Gates on Highways 1 and 11 and visitor counts at the Nordegg Heritage Centre tourist information booth vary from year to year and location to location (Figure 13 to Figure 15), with no apparent correlation among these counts.
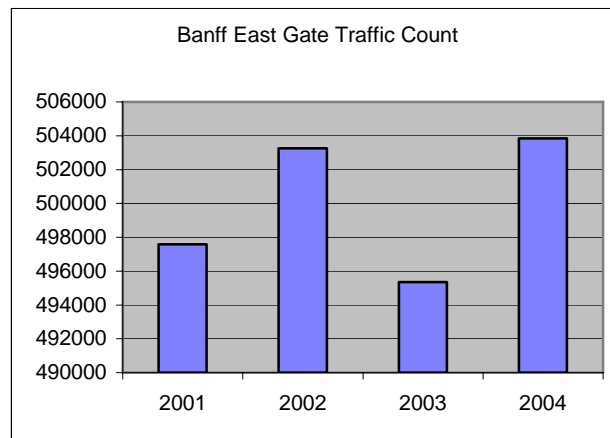

Figure 13. Traffic counts from the Banff National Park East Gate on Highway 1.
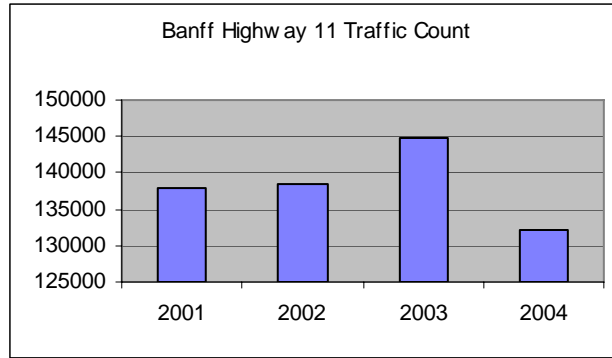
Figure 14. Traffic counts from the Banff National Park East Gate on Highway 11.
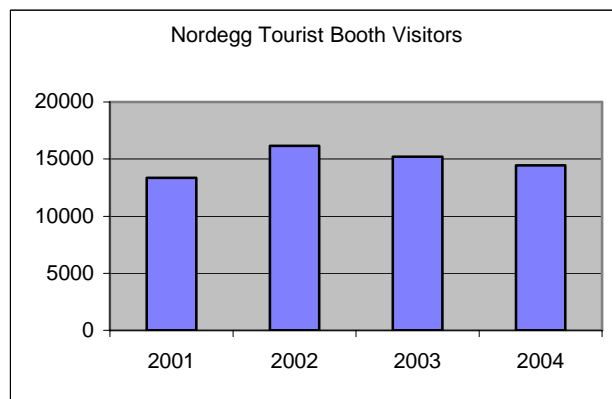

Figure 15. Visitor counts from the Nordegg Heritage Centre tourist information booth.

Data from the commercial trail riders (CTR) in and around the R11 FMU also demonstrates significant year to year variability (Figure 16). Backcountry travellers are asked to voluntarily register at the Nordegg Ranger Station, providing another source of visitor data (Figure 17). As with the CTR data, this information is not exclusive to R11, but can be attributed largely to R11. Trail counter data has also been collected for the *Bighorn Backcountry Access Management Plan*. After review of the data, however, inconsistent counter dates (i.e., not complete years) make establishing year-to-year trends difficult. Nonetheless, trail counters are recognized as an important tool and will be used to assess local impacts on trail usage following treatment activities.
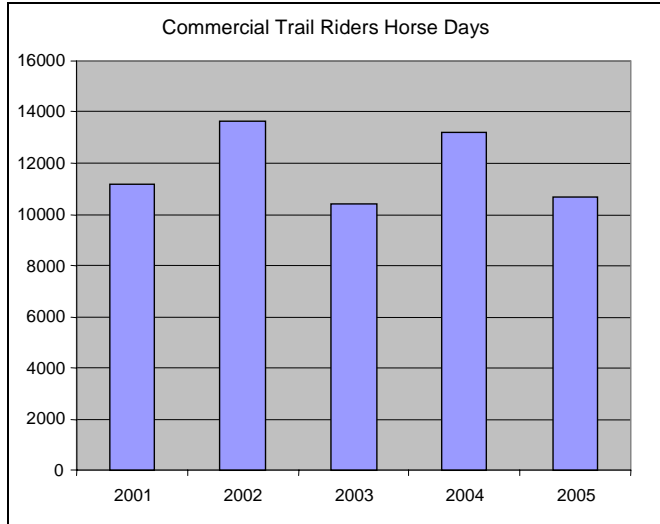
Figure 16. Number of commercial trail riding "horse days" in and near the R11 FMU.
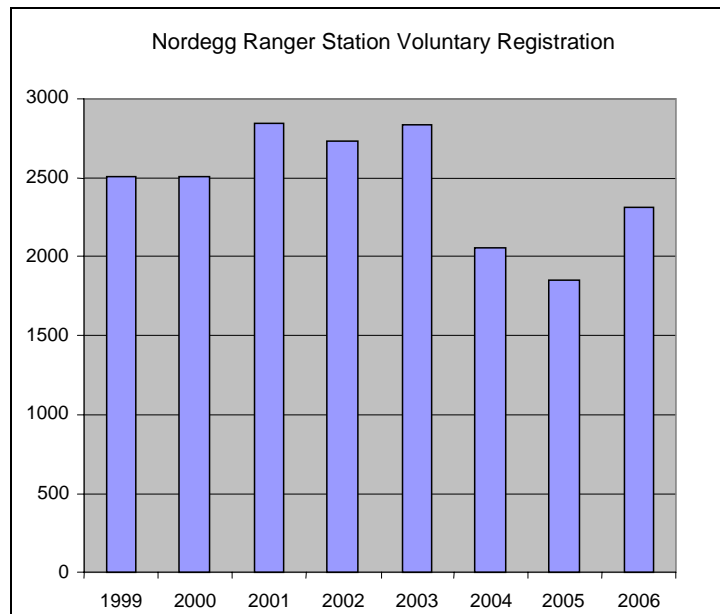
Figure 17. Backcountry travel voluntary registration at the Nordegg Ranger Station.

In addition to tracking the visitor numbers, visitor feedback will be obtained from surveys focusing on the quality of the experience including aesthetics, general enjoyment, and opportunities to promote personal wellness. These surveys will be distributed to visitors by backcountry guardians. Visitor counts and feedback will serve as a proxy measure of tourism appeal; however, it may be necessary to look for an indicator that better reflects the objective of maintaining appeal and opportunities for personal health and wellness.

Forecast: Visitor trends from the data sources examined show high annual variability. While outside forces can have a large influence on visitor trends, perhaps the most valuable

tool will be the trail counters, employed both prior to and following burn or harvest treatments to gauge local-level responses.

Monitoring: Data described above are collected by ASRD or other agencies and are readily available. The Stewardship Report will include summaries of these data, as well as trail counter information as it gets refined.

Response: A clear downtrend in visitor numbers or quality of experience will be investigated for causal factors.

Indicator 11.1.1

Value: Access

Objective: Adhere to a "no new access" policy in the R11 area while maintaining existing access.

Indicator: Kilometres of permanent trails or roads open to public by use type.

Target: 4190 km of permanent access open to public for the following use types: foot access, equestrian, mountain biking, snowmobiles, off-highway vehicles, on-highway vehicles.

Current Status: Access in the R11 FMU is governed by the *Bighorn Backcountry Access Management Plan*, and any proposed changes are agreed upon by a multistakeholder monitoring group. The target was derived from the amount of trails currently in existence in the Bighorn Backcountry. In total, 4190 km of identified trails are on record in the Bighorn Backcountry, with 2059 km of motorized trails and 2131 km of non-motorized trails. Associating the number of kilometres with each type of trail user becomes problematic, however, as non-motorized use is not restricted to trails. The general breakdown is as follows:

- Foot access: no timing restrictions; not limited to identified trails.
- Equestrian: 21 km of timing-restricted trails; not limited to identified trails.
- Mountain biking: no timing restrictions; not limited to identified trails.
- Snowmobiles: 2059 km of trails, including some timing restrictions.
- Off-highway vehicles: 2059 km of trails, including some timing restrictions.
- On-highway vehicles: no identified trails for on-highway vehicles.

ASRD will continue to coordinate the Bighorn Backcountry Recreational Trail Monitoring Program to determine the condition of select trails (i.e., frequency and intensity of erosion and rutting events, extent of trail braiding, adequacy of stream crossings, presence of noxious or restricted weeds). Currently, over two dozen organizations, families, and individuals have adopted trails or sections of trail through the Adopt-A-Trail program, and are thus responsible for inspecting the trail at least once a year and conducting basic trail maintenance (e.g., removal of litter and fallen trees, erosion control). If trail conditions deteriorate despite monitoring and volunteer steward efforts, trail closures may be made from time to time by the Bighorn Steering Committee, in consultation with the Bighorn Standing Committee. Although the kilometres of open trail will fluctuate as per the steering committee recommendations and will be
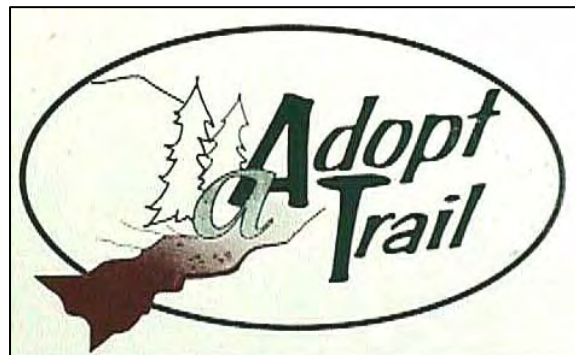
monitored accordingly, such closures are not necessarily related to R11 forest management activities. However, new industrial road access may be necessary to conduct harvesting activities as outlined in this plan. This access will be temporary and restrict users (e.g., via gates) wherever possible and will be reclaimed upon completion of harvest.

Forecast: Any new access created during harvesting activities in R11 will be temporary and restricted wherever possible. Prompt reclamation should minimize the likelihood of new permanent access within the FMU.

Monitoring: The Bighorn Steering Committee will monitor open and closed trails in R11. Any new access, for the purposes of the R11 FMP or otherwise, will be maintained as a GIS data layer. Stewardship reporting will include a summary of industrial access created and reclaimed.

Response: Trails suffering from abuse and lack of maintenance will be closed as per the Bighorn Steering Committee recommendations. Failure to reclaim any new access created for R11 forest management activities will be examined and addressed promptly.

Indicator 12.1.1

Value: Community Integrity

Objective: Protect community appeal for local residents by encouraging economic potential, providing quality recreational opportunities, and protecting private infrastructure and property.

Indicator: Economic growth.

Target: Tax base of Clearwater County for R11 area is maintained or increased.

Current Status: Fish and wildlife populations, stunning viewscapes, and other natural resources contained within the R11 FMU hold economic potential for local residents, particularly those employed within the tourism and recreation sector. Treatment activities implemented through this forest management plan should ensure that this aspect of community integrity is maintained. Furthermore, ASRD will support the completion and implementation of Development Node plans to promote economic growth in R11. Currently however, Clearwater County does not have geographically explicit data available to report on the economic growth indicator or tax base target chosen through the Charrette planning session. Until such time as this information is available, Indicator 10.2.1 will serve as a measure of economic health, recognizing that it only deals with the tourism component of economic growth.

Indicator 12.1.2

Value: Community Integrity

Objective: Protect community appeal for local residents by encouraging economic potential, providing quality recreational opportunities, and protecting private infrastructure and property.

Indicator: Local user feedback on quality of recreational experiences including aesthetics and general enjoyment.

Target: No decline in proportion of positive user feedback.

Current Status: The R11 FMU supports a relatively small permanent population, however the value of the FMU may be greater for local residents who enjoy the landscape and its resources on an ongoing basis than for visitors who use it on a relatively temporary basis. Quality recreational opportunities were identified in the Charrette process as a particular concern to residents. Incorporating aesthetic concerns into treatment planning (Indicator 9.3.1), maintaining existing recreational infrastructure (Indicator 10.1.1), and limiting the amount of linear access available to recreational users (Indicator 11.1.1) should help ensure the landscape features and developments local users hold in high regard are not degraded and contribute to community appeal in perpetuity.

Currently, ASRD does not have baseline data on recreational user feedback, positive or negative, from either residents or visitors. User surveys will be created and distributed annually by backcountry guardians and businesses to R11 users as a method of establishing a benchmark and monitoring trends. These surveys will address the quality of R11 experiences including aesthetics, general enjoyment, and opportunities to promote personal wellness, and will ask users to identify themselves as either visitor or local resident.

View over the Blackstone/Wapiabi FLUZ

Forecast: Temporary displeasure is to be expected from some users of the R11 FMU as treatments are initiated and viewscapes change. However, regeneration of treatment areas as well as ongoing communication and public education efforts should help mitigate any long-term negative impacts on recreational experiences.

Monitoring: Feedback from user surveys will be summarized and reported in the Stewardship Report.

Response: A downtrend in positive comments will be reviewed for the root cause.

Indicator 12.1.3

Value: Community Integrity

Objective: Protect community appeal for local residents by encouraging economic potential, providing quality recreational opportunities, and protecting private infrastructure and property.

Indicator: Integrity of personal property in or near treatment areas.

Target: Complete protection of private property during treatment activities.

Current Status: Although the use of prescribed fire was supported as a primary forest management tool in R11, residents and business owners alike naturally desire protection of their private infrastructure and property during treatment activities. Landscape-level FireSmart planning for the protection of personal property was incorporated as an important objective of this forest management plan (see Objectives 8.1, 8.2, and 8.3). FireSmart Community Zone Plans have been or will be developed and implemented for communities and development nodes within R11 (Indicator 8.1.2). Trappers will also be encouraged to implement fuel management precautions around their cabins (e.g., thinning, pruning, and removal of dead and downed fuels).

Individuals with private property near treatment areas will be consulted during operational planning of prescribed burn or harvest activities. There are instances of private property, primarily trappers' cabins, on Crown lands that are not in the formal record. The location of most structures or property not previously identified through local knowledge will be discovered during fieldwork phase of operational planning. Locations of all property will be incorporated into a GIS system for use during planning exercises.

Forecast: Identification of all infrastructure is critical to achieving complete protection during treatment activities. Prescribed fires will only be conducted under the conditions outlined in the burn plan when the likelihood of achieving associated objectives, including infrastructure protection, is the greatest. Complete protection of infrastructure during harvesting will be possible.

Monitoring:

Response:

Indicator 13.1.1

Value: Information and Education

Objective: Communicate the rationale behind and benefits resulting from burn and harvest treatments in R11.

Indicator: Activities demonstrating communication and education.

Target: Ongoing and timely multi-pronged communication and public education program.

Current Status: Given the high profile of the Bighorn Backcountry, public education and information dissemination will play key roles in garnering public support for this FMP by communicating to R11 users the rationale behind and benefits resulting from burn and harvest treatments. Communication with the public is an ongoing process within ASRD and typically takes the form of personal communication, presentations, websites, signage, newspaper articles, and pamphlets. Examples of related program areas where ASRD has been increasing public awareness include the mountain pine beetle awareness, FireSmart planning, and responsible recreational use of public lands (e.g., Shifting Gears, Respect the Land).

R11 presentations were made, often in conjunction with Mountain Pine Beetle Management Strategy presentations, to counties, towns, trappers, fish and game associations, outfitters, rotary clubs, National Parks staff, and internal staff prior to approval of the R11 plan. Additional future presentations may be given to school programs, community organizations, field tours, or at public meetings and open houses. The ASRD website will house a page specifically for the R11 FMU where the approved forest management plan and Stewardship Reports will be available. Background information on concepts integral to this plan including natural range of variation, fire ecology, and harvest ecology may also be available on the R11 website as will links to related websites such as the *Bighorn Backcountry Access Management Plan* site. Static displays may be created adjacent to main routes highlighting the potential increase in wildlife encounters resulting from treatment activities. Finally, an R11 information pamphlet will be made available at area accommodations and campgrounds. In addition to communication of the complete plan, most burns or harvest treatments will require individual communication strategies. High profile burns will have extensive consultation processes, and will be well advertised and promoted.

Forecast: not applicable

Monitoring: All communication activities will be documented, including presentations, distribution of printed materials, and use of electronic media. Feedback from participants in programs and presentations will also be recorded on an ad hoc basis. Activities and feedback will be summarized in the five-year Stewardship Report.

Response:

Indicator 14.1.1

Value: Multi-Agency Cooperation

Objective: Employ a multi-jurisdictional approach to managing fire and pests at both the planning and operational levels.

Indicator: Harmonized plan objectives across agency boundaries.

Targets: Timely and meaningful consultation with stakeholder agencies; Refer to targets identified in management plans for embedded or adjacent protected areas.

Current Status: Collaboration among resource and land management agencies promotes a more comprehensive approach to landscape-level management issues including wildfire risk and pest invasions (e.g., mountain pine beetle) that transcend jurisdictional boundaries, and allows efficient use of available expertise, finances, and logistical resources. The R11 Planning Team included two representatives from Alberta Tourism, Parks, Recreation, and Culture. The areas under ATPRC management are covered by separate management plans, aspects of which do not align well at this time with the R11 FMP objectives (e.g., use of fire for ecosystem restoration). The Planning Team will continue to work towards a resolution for the next iteration of the R11 plan. Parks Canada representatives also participated in the public Charrette planning session, and were key contributors in the natural disturbance work upon which much of this plan is based. Finally, Sundre Forest Products Inc. (a division of West Fraser Mills Ltd.), the FMA holder sharing the longest boundary with the R11 FMU, has been in regular communication about the FMP. These strong working relationships will continue into plan implementation.

ASRD representatives will also contribute to the North Saskatchewan Watershed Alliance Integrated Watershed Management Plan, adjacent area plans (e.g., coordinating prescribed burn plans along the National Park boundaries with Parks Canada), and emergency response plans (where the presence of a forest protection duty officer and resources on standby often places ASRD in the role of coordinating agency).

Forecast: not applicable

Monitoring: R11 stakeholder agencies will meet regularly to monitor implementation of the R11 Forest Management Plan. Planning consultations with stakeholder agencies and adjacent land managers will be documented and reported upon in the five-year Stewardship Report.
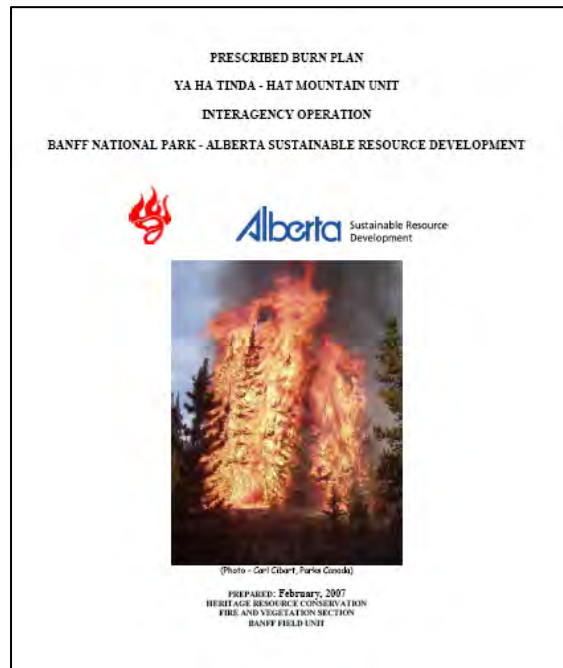
Response:

Indicator 14.1.2

Value: Multi-Agency Cooperation

Objective: Employ a multi-jurisdictional approach to managing fire and pests at both the planning and operational levels.

Indicator: Joint operations among agencies when implementing fire and pest management treatments.

Target: Participation in joint treatments with other agencies.

Current Status: Collaboration among resource and land management agencies promotes a more comprehensive approach to landscape-level management issues including wildfire risk and pest invasions (e.g., mountain pine beetle) that transcend jurisdictional boundaries, and allows efficient use of available expertise, finances, and logistical resources. Banff National Park and ASRD have been cooperating on the Upper Saskatchewan prescribed burn planning during the FMP development, and have cooperated in the implementation of a prescribed burn around the Ya Ha Tinda ranch. Sundre Forest Products Inc. (a division of West Fraser Mills Ltd.), the FMA holder sharing the longest boundary with the R11 FMU, has been in regular communication about the plan. R11 harvest operations along the eastern side of the FMU will be coordinated with Sundre Forest Products operations to minimize the amount of open roads. Strong working relationships with these and other adjacent land managers have been established during the plan development, and will continue into implementation.

Forecast: not applicable

Monitoring: Regular meetings will be held with stakeholder agencies and adjacent land managers to coordinate operational plans wherever possible.

Response:

Indicator 14.2.1

Value: Multi-Agency Cooperation

Objective: Ensure protection of timber adjacent to the R11 FMU is achieved through complementary fire and pest management plans.

Indicator: Number of adjacent forest companies with a fire and pest management plan.

Target: All adjacent FMA holders with a fire and pest management plan that is compatible and integrated with the R11 FMP.

Current Status: All forest companies, including the adjacent FMA holders, include a forest health section in their Detailed Forest Management Plan which addresses their strategies towards various insect and disease issues. ASRD has been meeting regularly with National Parks, Alberta Tourism, Parks, Recreation, and Culture, and the four adjacent FMA holders regarding mountain pine beetle in particular. Each company is responsible for developing a strategy for reducing the amount of susceptible pine, with companies at various stages of strategy development. In addition, all adjacent forest companies are required to submit an annual Forest Protection Plan, primarily dealing with wildfire risk. Companies share location of camps, fire fighting resources, road status, and other information to assist with rapid response to wildfires. Strong working relationships with adjacent land managers have been established during the R11 FMP development; ASRD will likewise provide input during the FMP review process for adjacent FMAs.

Forecast: not applicable

Monitoring:

Response:

Indicator 14.3.1

Value: Multi-Agency Cooperation

Objective: Share data, information, and resources among stakeholder agencies.

Indicator: Awareness among stakeholder agencies of other available agencies, resources, or services and initiatives in the R11 area.

Targets: Current and accessible list of all available agencies, resources, or services and initiatives in the R11 area; Regular communication among agencies to discuss new initiatives and opportunities to maximize utility of data and resources.

Current Status: Efficient use of expertise, data, finances, and logistical resources requires that stakeholder agencies are aware of resources, services, and initiatives available through other organizations. ASRD takes advantage of opportunities offered by other agencies to stay abreast of research and policies through, for example, participation in information sessions offered by the Foothills Model Forest and Banff National Park to share science-based research findings. A process will be developed to ensure that all R11 stakeholder agencies remain informed and may include a web-accessible list of agencies and initiatives in the R11 area, stakeholder information-sharing meetings, etc. Furthermore, GIS data coverages will be updated regularly and made available to other agencies, subject to data sharing agreements and security of sensitive information.

Forecast: not applicable

Monitoring: Communications with and data requests from stakeholder agencies will be documented. Joint agency projects will also be reported in the Stewardship Report.

Response:

Indicator 15.1.1

Value: Public Safety

Objective: Ensure public safety along existing trails through burned and harvested areas.

Indicator: Identification and mitigation of risk trees in burned and harvested areas.

Target: Mitigation of all risk trees along existing trails running through burned and harvested areas.

Current Status: Trees remaining within or adjacent to either burned or harvested areas may be weakened and thus prone to structural failure and uprooting. Growth pattern, habitat, hardness of wood, rate of growth, root type, species, size of affected part (limb, trunk, whole tree, etc.), and presence of structural defects (forks, decay, cankers, leaning, etc.) can contribute to failure potential. When these trees have the potential to impact people, property, or infrastructure in the event of a failure, they are considered risk or hazard trees. Hazard rating systems are a common method to ensure that pertinent, consistent criteria are used to evaluate the relative hazard of a tree. Rating systems typically incorporate some measure of the degree of tree defect (e.g., presence of vertical cracks, >50% of base is charred, etc.) and a measure of risk (i.e., likelihood and value of loss if the tree fails). Mitigation measures can include removal, pruning or selective branch removal, topping, and temporary closure of areas with high risk. Within R11, current fuel management project plans address hazards along existing trails within the project area. Boundaries of completed harvest and burn units can be compared using GIS to the location of all trails receiving heavy foot traffic, and plans to identify and mitigate all risk trees can subsequently be developed.

Forecast: The length of trails affected by prescribed burning or harvesting activities will depend on the spatial location of treatment units, while the ability to mitigate hazard trees will depend on fiscal realities.

Monitoring: The annual number of kilometres of trail undergoing hazard reduction work will be noted in Stewardship Report.

Response: Any public complaints regarding hazard trees will trigger an investigation and, if necessary, action to mitigate the risk.

4   Operational Plan

As part of the Charrette planning session, the Planning Team asked participants to develop a conceptual operation plan that would satisfy the VOITs outlined previously. Given the overarching management approach of emulating natural disturbance patterns and processes, Charrette participants used the large-scale maps from the Landscape Description section to delineate areas of the R11 FMU where specific vegetation management techniques should be applied (Map 50). The mapping exercise focused on dissecting the FLUZ according to the preferred disturbance method (i.e., landscape-level decisions) rather than identifying specific areas to disturb (i.e., stand-level decisions). Prescribed fire was selected as the primary tool for creating disturbance in R11, although the stakeholder participants agreed mechanical clearing methods, primarily harvesting, should be used for safety purposes around such areas as communities, development nodes, and adjacent FMAs. Government land managers will be charged with identifying specific areas to be treated using these tools as well as the timing of those treatment events, following the direction provided in this plan and the VOITs. Government staff will conduct prescribed burn treatments, while commercial operators and equipment will be contracted to conduct mechanical treatments.

Four vegetation management zones were defined for the R11 FMU: fire only, fire>mechanical, mechanical>fire, and mechanical only. These zones are described below.

1. Fire
   - Use prescribed burning and creation of limited fuel breaks to control natural fire events.
   - No large-scale mechanical clearing permitted.
2. Fire>Mechanical
   - Use primarily prescribed burning, with limited mechanical techniques, such as commercial thinning or pile and burn techniques, used in site preparation or creation of firebreaks.
3. Mechanical>Fire

Robert Anderson

Mechanical clearing of bog birch

   - Use primarily mechanical techniques to emulate natural disturbance, with prescribed fire used in limited circumstances.
   - Ensure both mechanical and prescribed burn treatment events retain a minimum 15% residual structure (avg: 29-49%).
   - Situate cutblocks using the same principles as the prescribed burns to the meet the objectives of the VOITs rather than choosing stands based on economic reasons.
4. Mechanical
   - Employ commercial forestry techniques to emulate natural disturbance.
   - Use in areas around infrastructure (excluding roads) and recreational sites.
   - Use existing FireSmart plans and some minimum standards such as a 150-m thinned zone around campsites.
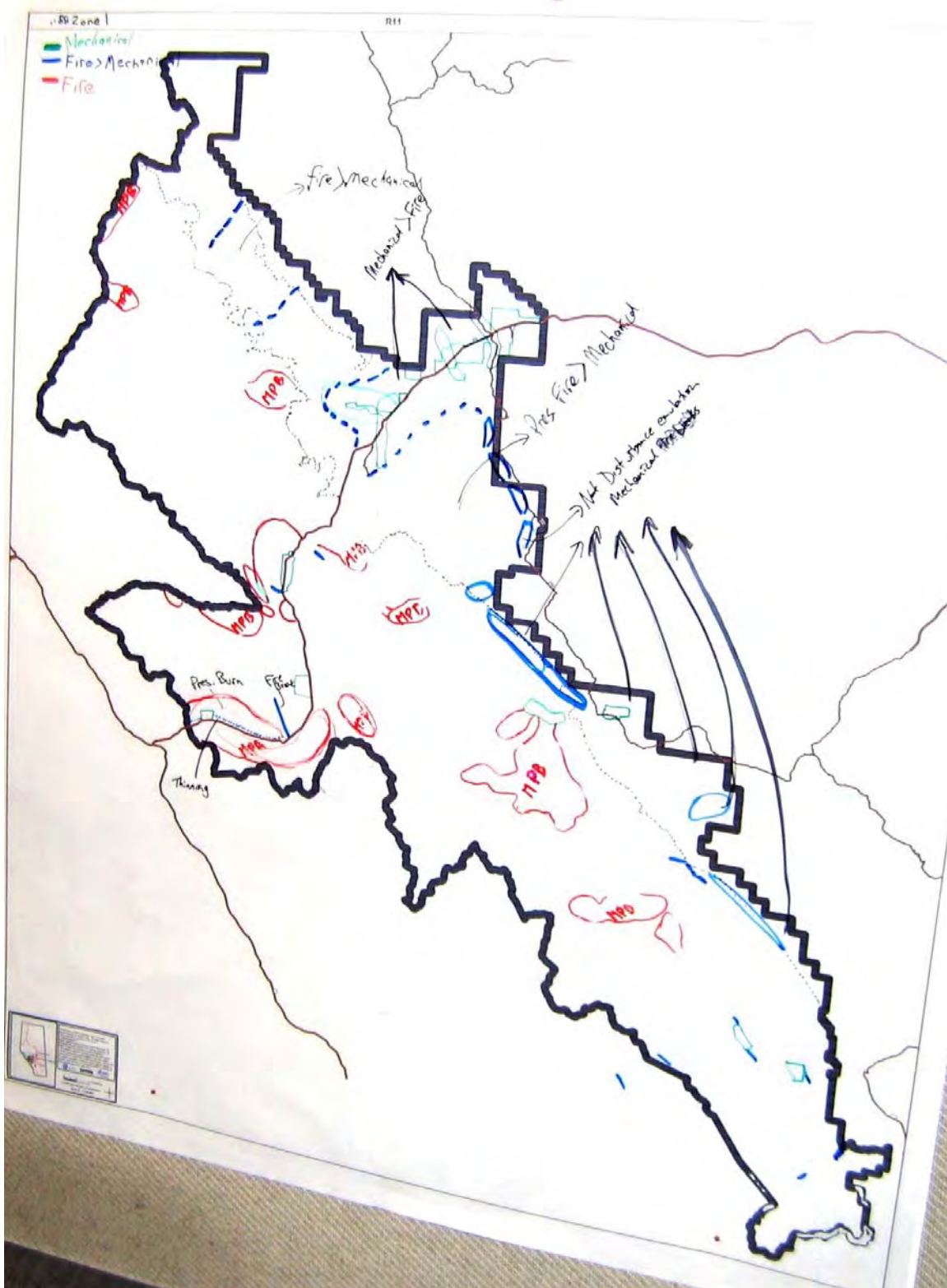
Map 50. Conceptual operating plan map produced by Charrette participants outlining the general areas to be treated using specific vegetation management techniques.

A vegetation management zone map was then prepared by the Planning Team based on these zone definitions, the conceptual map, and guidance provided by the *Eastern Slopes Policy* (Map 51). In general, prescribed fire will be the management tool of choice, with mechanical techniques employed east of the first range and mechanical techniques exclusively in the corridor along the Forestry Trunk Road from the North Saskatchewan River to south of the North Ram River. The Charrette participants provided specific detail on how to apply disturbance treatments in each FLUZ as follows:

1. Upper Clearwater/Ram
   - No mechanical clearing will be permitted as this is a Prime Protection Zone.
   - Use prescribed burning and limited fuel breaks (pile and burn) to contain natural fire events to the zone.
   - This zone should be identified as a natural fire zone.
2. Kootenay Plains (strip of Zone 4 on the highway)
   - Use mechanical thinning along the highway to limit fire spread, but permit burning up the slopes into the Prime Protection Zone.
3. Blackstone/Wapiabi
   - Fire>Mechanical
   - Create firebreaks using mechanical techniques.
   - Use prescribed burning to disturb the majority of area.
4. Panther Corners and Dormer/Sheep
   - Use prescribed burning over the majority of area.
   - Create firebreaks using mechanical techniques.
   - The absence of natural firebreaks along Sheep and Burnt Timber Creeks before the adjacent FMA may limit the opportunities for prescribed fire within these drainages.
5. Kiska/Wilson
   - Due to the large geographical spread of this zone, it was subdivided into three zones with varying disturbance techniques. Existing infrastructure will be protected with FireSmart plans.
     i. Nordegg region west to Abraham Lake and north of Highway 11
     - Mechanical>Fire
     ii. South of Highway 11 to North Ram River
     - Fire>Mechanical
     - Create many smaller firebreaks using mechanical techniques.
     - Use prescribed burning over the majority of area.
     iii. South of North Ram River
     - Mechanical
     - Emulate natural disturbances using mechanical techniques.
     - Use prescribed fire on the headwaters of the various drainages (e.g., Elk Creek, Peppers Creek) and particularly in the area locally known as "The Wall".

VEGETATION MANAGEMENT ZONES
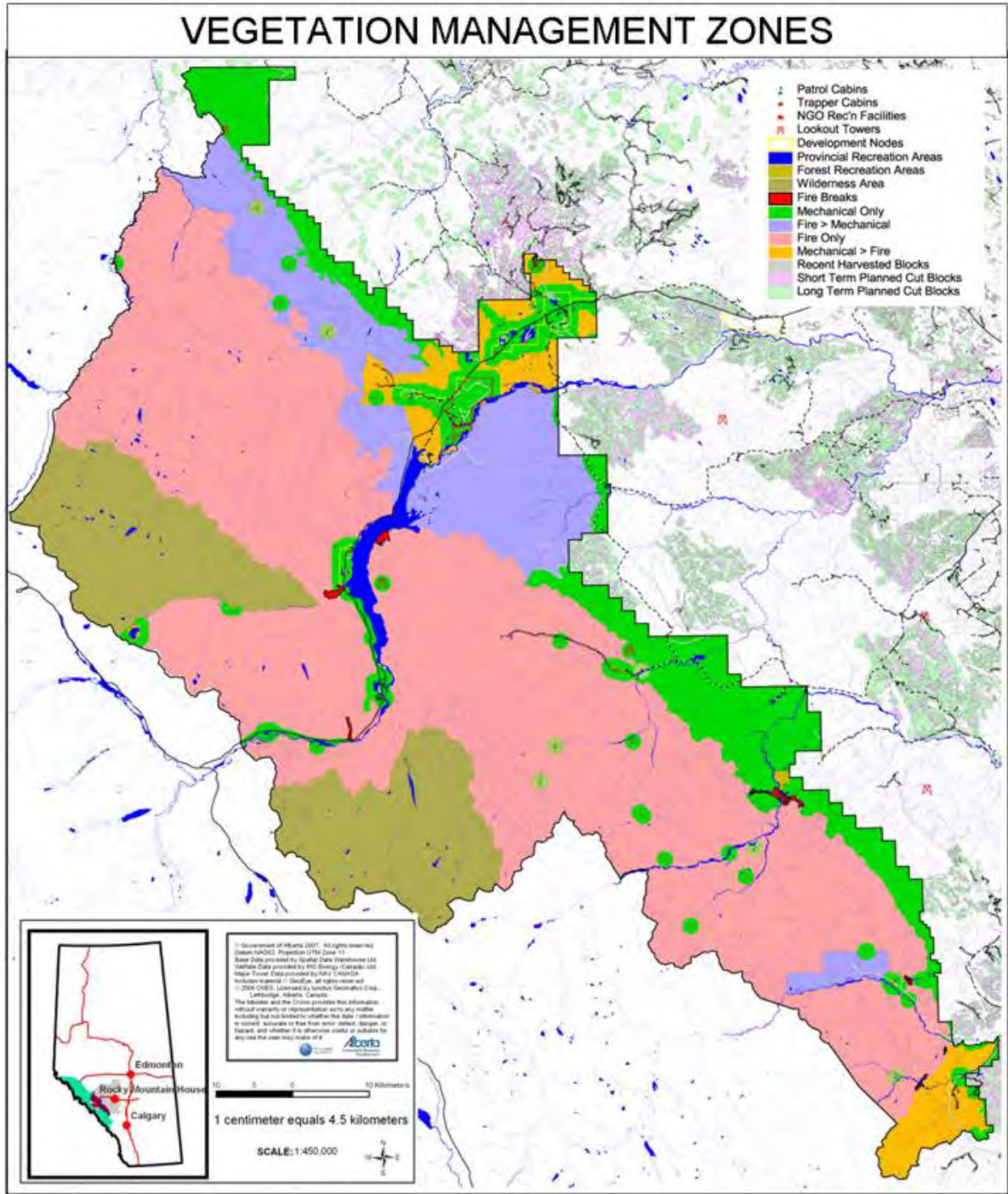
Map 51. Vegetation management zones for the R11 FMU delineated based on the results of the Charrette mapping exercise.

The vegetation management zone map, detailed FLUZ directions, original concept map, and information from associated field reviews were synthesized to develop feasible operational boundaries (Map 52). The boundaries of areas targeted for mechanical treatment via harvesting were proposed based on merchantability of forest stands and existing access or planned access development by adjacent FMA holders, while prescribed burn boundaries were determined using geographic features and natural barriers on the landscape. The priority status of a given treatment will be determined by factors such as coordination with adjacent land managers (e.g., joint prescribed burns with Banff National Park) and the local mountain pine beetle hazard rating. Proposed treatments will be conducted within 50 years and may be completed sooner. Furthermore, they may be broken into smaller treatment units for logistical reasons: as described in Indicator 1.1.1, a series of associated treatments must occur within a 10-year period to be considered a single disturbance event. For this R11 Forest Management Plan, the Planning Team ended operational planning at this stage. Further development of individual prescribed burns or timber harvest treatments carries a responsibility to conduct both stakeholder/public consultation and detailed planning as defined by ASRD's Prescribed Burn Manual and Timber Harvest Planning and Operating Ground Rules[1].

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[1] Note that as the Provincial Operating Ground Rules are gradually being replaced with FMA-specific OGR, the R11 Forest Management Plan will adopt Sundre Forest Products OGR as the standard during the development and implementation of treatment activities. Soil and water protection measures as well as road and watercourse crossing practices are very comparable to the existing Provincial OGR.

PROPOSED OPERATIONAL BOUNDARIES
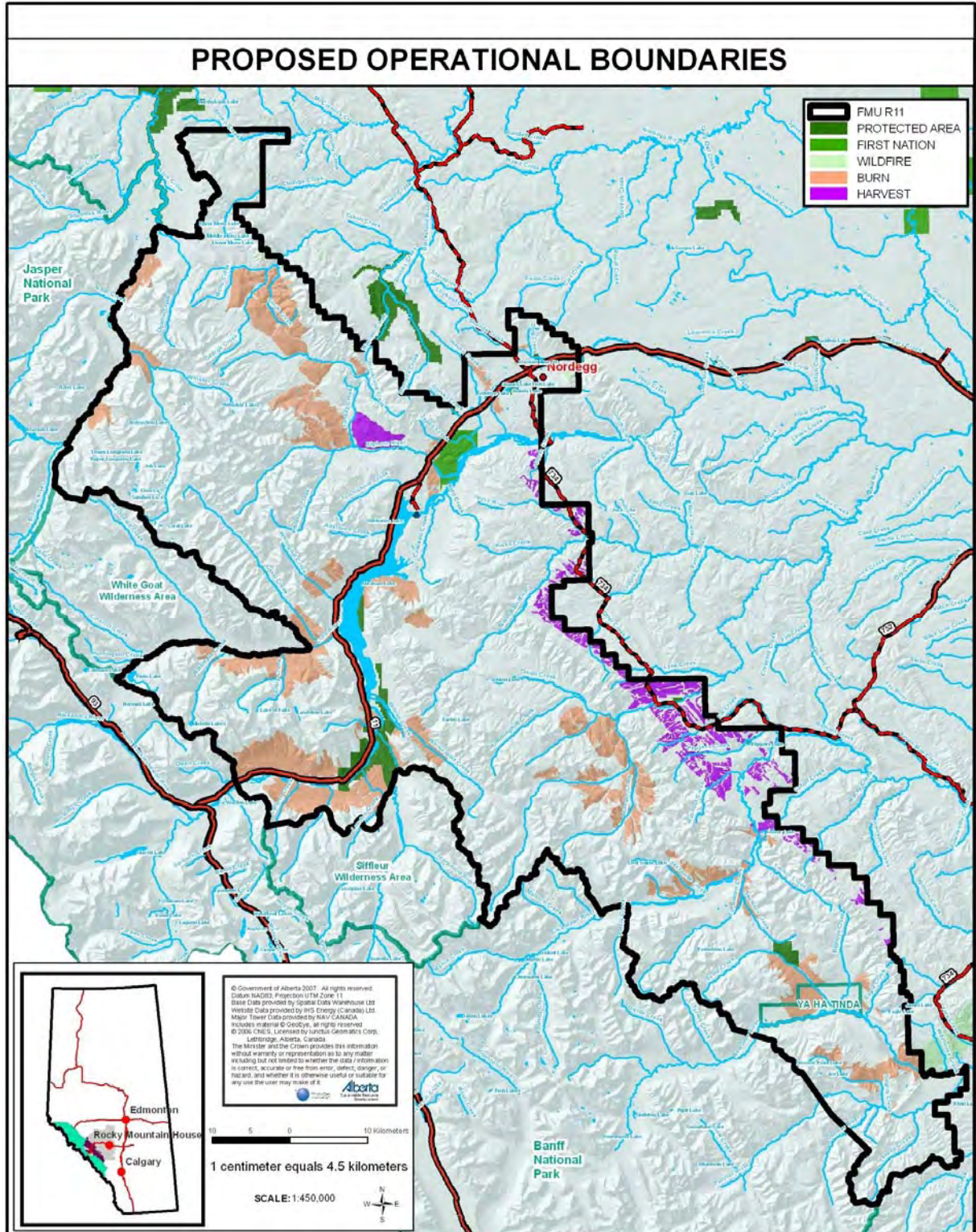
Map 52. Proposed operational treatment boundaries in the R11 FMU

5   Monitoring and Reporting Process

Upon approval of this R11 Forest Management Plan, ASRD Clearwater Forest Area will assume primary responsibility for administering, implementing, monitoring, and reporting on forest management activities detailed herein. Check lists will be developed to ensure all relevant operational issues are addressed prior to treatment activities (e.g., have grazing allotment holders within or adjacent to the treatment area been informed of planned activities; are there known bull trout spawning streams within the planned treatment area, etc.) Protocols will also be developed to detail the processes, procedures, and reporting requirements necessary to track treatment activities and results.

One explicit criterion from outset of the R11 planning process was that supporting data for any indicator must be derived from existing government initiatives or programs. Consequently, monitoring data will also come from these existing sources, although additional monitoring methods and schedules (i.e., timing and frequency) may be desirable for some objectives and indicators: financial and logistical constraints and department mandates will dictate whether this is possible. Aerial ungulate surveys, permanent sample plots, AVI updates, and field inspections are examples of programs that will contribute to monitoring forest management activities proposed in this plan. Annual summaries or field inspection reports may be prepared for several indicators, but Stewardship Reports prepared at five-year intervals will function as the primary mechanism for documenting monitoring results.

The five-year Stewardship Report is a formal compilation of monitoring results and current status of the landbase as well as an assessment of progress made in fulfilling objectives and targets contained within the FMP and provides a measure of public accountability on management effectiveness. The Stewardship Report will identify and explain differences between planned and actual activities; summarize the outcome of monitoring activities; assess the suitability of plan indicators as they relate to management objectives; describe progress made in implementing management strategies; assess variance from planned targets and responses and discuss implications; discuss emerging resource management issues or trends; outline challenges encountered in plan implementation; summarize recently completed and ongoing research and its application within the FMU; and outline public involvement initiatives.

Ecosystems within the R11 FMU can change due to factors beyond planned management activities. Scientific knowledge and models upon which some indicators are based can change with newly acquired information and data. Management practices can change with shifts in social values or with the development of new technologies. Forest management planning must be dynamic to accommodate these changes. The analysis of monitoring data and plan indicators and targets every five years provides an opportunity to consider how such factors may influence the FMP and planned activities within the FMU. While major revisions will occur at the end of the plan's 20-year lifespan, minor amendments may be appropriate sooner. Potential modifications will be described as necessary in the Stewardship Report along with details on acceptable variance, implementation schedule, monitoring procedure, and relationship to the operational plan.

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7 Glossary

The primary references used to compile this glossary are as follows:

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Acceptable variance – The range of performance results that are deemed to be acceptable outcomes for a given target.

Aeolian deposits – A variety of deposits or sediments that are deposited by wind and consist of sand or dust (loess).

Age-class – A distinct group of trees or portion of growing stock recognized on the basis of age. (6)

Age-class distribution – Intervals into which the age range of trees, forests, stands, or forest types are divided for classification and use. (2)

Alberta Vegetation Inventory – A system for describing the quantity and quality of vegetation present. It involves the stratification and mapping of the vegetation to create digital data according to the AVI Standards Manual and associated volume tables. (1)

Allowable cut – The volume of wood that may be harvested, under management, for a given period. (6)

Bared soil – Any soil where the organic layers and vegetation have been removed. (2)

Biodiversity – The variety, distribution, and abundance of different plants, animals, and microorganisms; the ecological functions and processes they perform; and the genetic diversity they contain at the local, regional, or landscape levels of analysis. Biodiversity has five principal components: (1) genetic diversity, (2) taxonomic or species diversity, (3) ecosystem diversity, (4) functions or ecological services, and (5) abiotic matrix within which the above exists. Also known as biological diversity. (2)

Blowdown – A tree uprooted or sheared off by the wind. Also known as windthrow.
Brunisolic soil – Very poorly developed soil with a thin topsoil layer.

Buffer – A band of forest left relatively undisturbed so as to protect some element of the environment, such as a mineral lick or streambank; in experiments, refers to the strip of untreated area between adjacent treated areas. (6)

Burn prescription – A written statement and/or list defining the objectives to be attained from prescribed burning, as well as the burning conditions under which the fire will be allowed to burn, generally expressed as a acceptable ranges of the various parameters, and the limit of the geographic area to be covered. (4)

Burn probability – The probability, as expressed by a percentage, that a given area of flammable fuel will burn in a given period of time. Modelling of burn probability is based on historic ignition patterns and weather inputs.

Canopy – The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees. (6)

Canopy closure – (1) The progressive reduction of space between crowns as they spread laterally, increasing canopy density. (2) The point in time when crowns in a young stand begin to touch and interact. (6)

Climate – The long term or integrated manifestation of weather.

Coarse filter management – Conservation of land areas and representative habitats with the assumption that the needs of all associated species, communities, environments, and ecological processes will be met. (2)

Coarse woody debris – The standing and downed dead wood in a forest. (6)

Colluvial – Pertaining to loose sediment deposits usually found at the base of a cliff or slope brought there mainly by gravity.

Compaction – The transfer of wheel pressure to soils causing collapse of large air-filled pores, a type of disturbance where the tire imprint is often invisible under the duff layer. (2)

Committee on the Status of Endangered Wildlife in Canada – Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild Canadian species, subspecies, and separate populations suspected of being at risk. COSEWIC bases its decision on the best up-to-date scientific information and Aboriginal traditional knowledge available. All native mammals, birds, reptiles, amphibians, fish, molluscs, butterflies and moths, vascular plants, mosses, and lichens are included in its current mandate.

Coniferous – Cone-bearing trees with needles or scale-like leaves.

Connectivity – A measure of how well different areas (patches or a landscape) are connected by linkages, such as habitat patches, single or multiple corridors, or stepping stones of like vegetation. (5)

Corridor – A physical linkage connecting two areas of habitat and differing from the habitat on either side. Corridors are used by organisms to move around without having to leave the preferred habitat. The functional effectiveness of corridors depends on the type of species, the type of movement, the strength of edge effects, and its shape. (2)

Deciduous – Tree and shrub species that lose their leaves annually.

Desired future forest – A spatially explicit projected range of conditions of the forest landscape 100+ years into the future. The range of conditions defines the goal toward which forest management will be directed. (2)

Disturbance event – The general area affected by a single episode of disturbance where at least 20% of the vegetation is killed. This includes natural disturbance events such as wildfire and anthropogenic disturbances such as timber harvesting and prescribed burning.

Duff layer – The layer of loosely compacted, decaying debris underlying the litter layer on the forest floor.

Ecological Reserves – Samples of functioning ecosystems protected for scientific research, education and heritage appreciation. Road access and facilities are not developed in Ecological Reserves. (3)

Ecosystem – The sum of the plants, animals, environmental influences, and their interactions within a particular habitat. (6)

Emulate – To try to equal or surpass, especially by imitating.

Even-aged – Of a forest, stand, or forest type in which relatively small age differences exist between individual trees. The differences in age permitted are usually 10 to 20 years. (6)

Exotic – An introduced, non-native species.

Fauna – The animals of a particular region, habitat, or geological period.

Fine filter management – Specific management for a single or few species rather than broad management for a habitat or ecosystem. (5)

Fire cycle – The number of years it would take to burn over an area equivalent to the entire area of interest. (4) The fire cycle may be expressed as the burn rate or percentage of a given landscape burned each year.

Fire frequency – The average number of fires that occur per unit of time at a given point. (4)

Fire return interval – The average number of years between the occurrence of fires at a given point. (4)

Fire season – The period(s) of the year during which fires as likely to start, spread, and do damage to values-at-risk sufficient to warrant organized fire suppression. The fire season is usually further divided on the basis of seasonal flammability of fuel types (e.g., spring, summer, and fall). (4)

Fire severity – A general term that most commonly describes the combined effects of flaming combustion and smouldering combustion on either a wildfire or prescribed fire site as manifested in various fire behaviour characteristics (e.g., fire intensity, flame height and length, residence and burn-out times). This is often inferred after the fact from fire impacts on the atmosphere, flora, fauna, soil, water, fire management, and society. (4)

Fire size – The total area burned and size class distribution for a given area.

FireSmart Community Zone – A variable 10 kilometer radius around the community extending from the FireSmart Wildland Urban Interface Zone. A unique data set will be gathered for this zone for community protection planning to provide a fundamental linkage between FireSmart Communities and FireSmart Landscapes. (2)

FireSmart Landscape Zone – This zone extends beyond the FireSmart Community Zone overlapping multiple jurisdictions at a broad landscape level. This zone focuses on mitigating the likelihood of large, high intensity, high severity fires. Fire, Forest and Land Management planning is are integrated and designed to reduce the negative ecological, economic and social impacts of wildfire while maximizing the positive attributes of wildfire. (2)

Fire suppression – All activities concerned with controlling and extinguishing a fire after its detection.

Fire type – The class of wildland fire based on the fuel layer(s) involved in the combustion process (ground, surface, and crown).

Flora – The plants of a particular area or period of time.

Fluvial – Pertaining to land shaped or produced by river action.

Forb – A herbaceous plant with broad leaves, excluding the grass-like plants (e.g., buttercup, sunflower).

Forest health – A condition of the forest; a forest is considered healthy if it can sustain itself to meet the specific forest land management objectives of today or in the future. (2)

Forest Land Use Zone – Areas of land for which legislative controls exist to regulate motorized and/or non-motorized activities. Controls and restrictions are used to protect sensitive landscapes and resources, and to minimize conflicts between recreational activities.

Forest management activity – A coordinated set of actions designed to meet established targets and achieve stated objectives.

Forest Management Agreement – A renewable agreement between the Alberta government and a forest company that grants the company the rights and obligations to manage, grow, and harvest timber in a specified area on a sustained yield basis. (1)

Forest Management Plan – A plan that identifies the objectives and strategies for managing the forest in an area.

Forest Management Unit – A defined area of forest land located in the Green Area of the province and designated by Alberta Sustainable Resource Development to be managed. (1)

Fragmentation – The transformation of continuous natural landscapes into patches or fragments surrounded by disturbed areas. Human-induced fragmentation results from the creation of cutlines, roads, wellsites, and other types of clearings. Such disturbance is thought to be a major threat to biodiversity because of the creation of barriers to species movement as well as edge effects.

Genetic diversity – The genetic variability within a population or a species; the number and relative abundance of alleles. Genetic diversity can be assessed at three levels: diversity within breeding populations, diversity between breeding populations within any one geographic area, or diversity within the species. (2)

Geographic Information System – An information system that uses a spatial database to provide answers to queries of a geographical nature through a variety of manipulations, such as sorting, selective retrieval, calculation, spatial analysis, and modeling. (6)

Girdling – To destroy conducting bark tissue all the way around a trunk, stem, branch, or root, thus preventing the movement of nutrient-bearing fluids and photosynthetic products up or down the tree thereby causing death of the affected part.

Glaciofluvial deposits – Deposits of sediment on the bottom of rivers, deposited either by rivers or by meltwaters flowing upon, within, under, or beyond the melting glacier.

Glaciolacustrine deposits – Sand, silt and clay deposited on the bottom of huge temporary lakes that formed either due to the melting glacial ice or by the blocking out of outlets for meltwater.

Gleysolic soil – A distinctive soil that results from being saturated with water for long periods of time. This soil is not productive, and is unable to retain nutrients.

Habitat Suitability Model – Planning tool in which landscape habitat components are given a numerical value in relation to a given species' habitat preferences. A rating of 1 is considered to be optimal habitat for a species, while a rating of 0 is considered to be the least suitable habitat for a given species.

Harvest area – A specified land area with defined boundaries where timber harvesting is scheduled, or has occurred. Also known as a cut block. (2)

Harvesting – The cutting, on-site processing, and transportation actions required to remove trees from the forest in order to achieve ecological and/or financial objectives. For the purposes of this FMP, the primary ecological objective of harvesting will be the emulation of natural disturbance patterns and rates on the landscape.

Headfire Intensity (HFI) – The rate of heat energy release per unit time per unit length of fire front. Flame size is its main visual manifestation. Headfire Intensity is a major determinant of certain fire effects and difficulty of control. (4)

Herbaceous vegetation – Vegetation that is usually forbs, grasses, or leafy plants.

Hibernacula – A secure area, usually a cave or a den of some sort, used by hibernating animals while in a state of torpor.

Historical resources – Any work of nature or man that is primarily of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest, including, but not limited to, the structure or object and its surrounding site. (2)

Indicator – A variable that measures the state or condition of a specific value and for which one or more targets are set.

Insects and diseases – Biological, physiological, and environmental agents that have an adverse effect on the health of the forest. These agents include insects; nematodes; microorganisms (viruses, bacteria, fungi); parasitic plants; mammals; birds; and non-infectious disorders caused by climate, soil, applied chemicals, air pollutants and other physiographic conditions. (2)

Integrated resource management – The management of two or more resources in the same general area and period of time (e.g., water, soil, timber, grazing, wildlife, and forests). (1)

Integrated Resource Plan – A sub-regional or local plan developed by provincial government agencies in consultation with the public and local government bodies. It provides strategic policy direction for the use of public land and its resources within the prescribed planning area. It is used as a guide for resource planners, industry, and public with responsibilities or interests in the area. (2)

Intermittent stream – A stream that carries water only during some periods of a year. There is some channel development as defined in the Operating Ground Rules.

Island remnant – Partially disturbed or entirely undisturbed forested areas within a disturbed patch that are at least 0.02 ha in size with survival levels between 6-100%. These remnants may be physically isolated residuals surrounded on all sides by disturbed area, or may be located at the edge of disturbed patches.

Landscape – A heterogeneous area in which the pattern of the mosaic of local ecosystems or land uses is repeated in similar form throughout kilometres wide area. Landscapes may coincide with a climatic, physiographic, ecological, or administrative boundary. (2)

Luvisolic soil – Soil that has large organic but low humus content. Nutrients are easily washed out of the topsoil and therefore this type of soil is not as productive as the Chernozems soils.

Matrix remnants – Completely undisturbed forested areas at least 0.02 ha in size adjacent to disturbed patches but within disturbance event boundaries. So named because they are undisturbed remnants that are physically connected to the undisturbed surrounding forest matrix, these remnants may take the form of corridors or bays.

Mature – Forest that has reached rotation age or has a decreasing growth rate (2)

Mechanical treatment – A mechanized technique designed to reduce structural diversity within the forest and return the treatment area to a younger seral stage. The suite of available techniques include harvesting, thinning, pruning, mulching, and/or mowing. Mechanical techniques may be employed alone or as a pre-treatment for prescribed burning to remove smaller diameter trees, ladder fuels, shrubs, and ground litter to help keep fires within designated areas.

Merchantable – Of a tree or stand that has attained sufficient size, quality, and/or volume to make it suitable for harvesting. Does not imply accessibility, economic or otherwise. (6)

Mesic – Pertaining to conditions of moderate moisture or water supply.

Microclimate – The climate in the immediate surroundings.

Mixedwood – Forest containing both coniferous and deciduous species in the overstorey.

Monitoring – The process of checking, observing, and measuring outcomes for key variables or specific ecological phenomena against a predefined quantitative objective or standard. It

takes place after an even or process has been initiated or completed to evaluate if the anticipated or assumed results of a management plan have been or are being realized and/or if implementation is proceeding as planned. (5)

Mosaic – The landscape mosaic is the pattern of different ages and types of ecosystems distributed across the landscape.

Natural Areas – Areas protecting special and sensitive natural landscapes of local and regional significance while providing opportunities for education, nature appreciation and low intensity recreation. Facilities are limited to staging areas, trails and signs. (3)

Natural disturbance regimes – The spatial and temporal characteristics of natural disturbances (e.g., wildfire, blowdown, drought, flooding, disease, and insects) affecting a particular landscape over a particular time.

Natural regeneration – The renewal of a forest stand by natural seeding, sprouting, suckering, or layering. (6)

Non-vascular plants – Plants that do not have structural support conferred by vascular tissue, including algae, lichens, mosses, liverworts, and fungi.

Noxious weed – A plant designated under the Weed Regulation (AR 171/2001) of the Weed Control Act. (2)

Objective – A broad statement describing a desired future state or condition for a value.

Old-growth – A stand of mature or overmature trees relatively uninfluenced by human activity. (6)

Operating Ground Rules – Standards for operational planning and field practices that must be measurable and auditable and based forest management plan objectives. (2)

Organic soil – Soil primarily made up of living or once-living matter; composed of compounds mainly based on carbon. Usually refers to peat.

Overstorey – The upper canopy of a forest, typically formed by the branches and leaves of trees.

Permanent Sample Plot – A fixed or variable area plot established long-term growth-and-yield, silvicultural, or scientific study.

Permanent stream – A stream that flows continuously throughout the year.

Phenology – The study of timing of periodic phenomena, such as flowering, growth initiation, growth cessation, etc., especially as related to seasonal changes in temperature, photoperiod, etc. (6)

Pioneer species – A species adapted to early stages of natural succession or growth on newly available or disturbed sites. (6)

Planning horizon – The length of time over which a series of defined management actions occur. (2)

Prescribed fire – Any fire deliberately used within a specific land area to accomplish predetermined forest management or other landuse objectives, usually set by qualified fire management personnel according to a predetermined burning prescription. Note that in some cases, a wildfire that may produce beneficial results in terms of the attainment of land management objectives may be allowed to burn under certain burning conditions according to a predefined burning prescription, with limited or no suppression action, and as such may be considered a form of prescribed fire. Also known as prescribed burn (4)

Protected Area – An area of land and/or water especially dedicated to the protection and maintenance of biological diversity, and of natural or associated cultural resources, and managed through legal or other effective means. Industrial activities are generally excluded from such areas.

Provincial parks – Protect provincially significant natural and historical landscapes and features. A range of facilities along with interpretive and educational programs enhance opportunities for visitors to explore, understand, appreciate and respect the natural environment. (3)

Recreation Areas – Cater to a wide range of intensive recreation pursuits in natural, modified or man-made settings. Most Recreation Areas have little or no preservation value due to the levels of facility development, intensity of visitor use and frequently small size. (3)

Regeneration – The renewal of a tree crop by natural or artificial means. It may also refer to the young crop itself. (2)

Regosolic soil – Poorly developed soil that has a thin topsoil layer and does not retain nutrients well. Incompletely eroded bedrock is found in large pieces in the soil.

Restricted weed – A plant designated under the Weed Regulation (AR 171/2001) of the Weed Control Act. (2)

Right-of-way – A cleared area, usually linear, containing a road and its associated features such as shoulders, ditches, cut-and-fill slopes, or the area cleared for the passage of utility corridors containing powerlines or pipelines. (5)

Riparian area – A vegetation zone influenced by ground water where a high water table reaches and/or saturates the root zone or by surface water, and which provides important habitat for fish and/or wildlife species. The vegetation is often a transition zone between aquatic habitat and upland terrestrial habitat.

Salvage logging – Harvesting operations that area carried out to remove damaged timber following a fire, insect attack, or blowdown.

Seed bank – A place in which seeds of rare plant or obsolete varieties are stored, usually vacuum-packed and under cold conditions, to prolong their viability. (6)

Sensitive sites – Sites that have soil, water, slope, aesthetic, vegetation, or wildlife characteristics that require special protection beyond the normal precautions described in the ground rules. They may be complex if many values or issues are involved. (2)

Seral stage – A stage in forest succession; a series of plant community conditions that develop during ecological succession from a major disturbance to the climax stage. Most common
characteristics/classifications include tree species and age, and for the purposes of this FMP, the following classification will apply to pine or spruce-dominated stands: young 0-20 yrs, pole 21-100 yrs, mature 101-180 yrs, and old >180 yrs. Also known as successional stage. (2)

Silviculture – The theory and practice of controlling the establishment, composition, structure and growth of the forest in order to achieve specified management objectives. (2)

Snag – A standing dead tree from which the leaves and most of the branches have fallen. (6)

Soil productivity – The capacity of a soil to provide for growth. (2)

Spatial harvest sequence – A stand-level map depicting forest stands scheduled for timber harvesting that are feasible to be operated. Spatial harvest sequences are generally prepared for 20 years. (2)

Stand – An aggregate of trees or other growth occupying a specific site that is sufficiently uniform in age arrangement, species composition, and density as to be distinguishable within the forest and from other growth on adjoining sites.

Stand structure – The vertical and horizontal organization of the forest with features including live trees of all types and ages, standing dead trees (i.e., snags), downed logs, shrubs, and grass. The amount and type of structure stands contain changes as they age.

Stewardship Report – A report, completed at five year intervals, that identifies progress made in implementing provisions in a forest management plan; highlights of monitoring activities; potential future revisions or recommended amendments to the FMP, forest user trends, etc.

Sub-regional Integrated Resource Plan – A Cabinet approved plan incorporating a comprehensive and cooperative approach to decision making relative to the allocation and use of Crown land and resources.

Succession – The replacement of one vegetation community with another in progressive development towards climax vegetation which reaches a stable condition on a given site.

Suppression capability – The effectiveness of traditional fire suppression tactics. It is an objective evaluation of initial attack response time, access for ground support resources, water availability, and terrain which might adversely impact movement of resources. (2)

Sustainable forest management – Management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social, and cultural opportunities for the benefit of present and future generations. (2)

Sustained yield – The yield of defined forest products of specific quality and in projected quantity that a forest can provide continuously at a given intensity of management. (6)

Target – A specific statement describing a desired future state or condition of an indicator.

Timber Management Regulation – The legislative statute that describes the mechanism and regulations by which the forested lands of Alberta are managed. The Regulation is associated with the Forests Act. (2)

Timber supply analysis – Calculations/computer models with built-in assumptions regarding forest growth patterns, used to determine the annual allowable cut. (2)

Timing constraints – A restriction or limitation on when an activity may be carried out.

Treatment unit – The specific area where an individual harvesting or prescribed burn treatment is applied. Multiple treatment units may be clustered spatially and temporally to constitute a disturbance or treatment event.

Understorey – The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth. (5)

Ungulate – Any hoofed mammal including deer, elk, moose, caribou, sheep, goat, and bison.

Value – A specific characteristic or quality considered by an interested party to be important.

Values at risk – The specific or collective set of natural resources and man-made improvements/developments that have measurable or intrinsic worth and that could or may be destroyed or otherwise altered by fire in a given area. (4)

Vascular plants – Plants having well-developed vascular components capable of transporting water, sugars, nutrients, and minerals between the absorbing tissue in the roots and the photosynthesizing tissue in the leaves.

Watercourse – The bed, bank, or shore of a river, stream, creek, or lake or other natural body of water, whether it contains or conveys water continuously or intermittently. (2)

Watershed – An area of land, which may or may not be under forest cover, that drains water, organic matter, dissolved nutrients, and sediments into a lake or stream. The topographic boundary, usually a height of land, that marks the dividing line from which surface streams flow in two different directions. (5)

Wilderness Areas – Large areas that retain their primeval character, unaffected by human influences. Visitors travel on foot to experience solitude and personal interaction with nature. (3)

Wildland urban interface – The area where various structures and other human developments meet or are intermingled with the forest and other vegetative fuel types. (2)

Wildlife – Any species of amphibian, bird, fish, mammal, and reptile found in the wild, living unrestrained or free roaming and not domesticated. Some definitions include plants, fungi, algae, and bacteria. (5)

8 Acronym Summary

ACA	Alberta Conservation Association
AENV	Alberta Environment
ANHIC	Alberta Natural Heritage Information Centre
ARIS	Alberta Regeneration Information System
ASRD	Alberta Sustainable Resource Development
ATPRC	Alberta Tourism, Parks, Recreation, and Culture
AVI	Alberta Vegetation Inventory
CCFM	Canadian Council of Forest Ministers
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSA	Canadian Standards Association
CTR	Commercial Trail Riders
ESA	Environmentally Significant Area
FLUZ	Forest Land Use Zone
FMA	Forest Management Agreement
FMF	Foothills Model Forest
FMP	Forest Management Plan
FMU	Forest Management Unit
FWD	Fish and Wildlife Division
FWMIS	Fisheries and Wildlife Management Information System
GIS	Geographic Information System
GPS	Global Positioning System
HFI	Headfire Intensity
LSD	Legal Subdivision
MPB	Mountain Pine Beetle
NRV	Natural range of variation
OGR	Operating Ground Rules
OHV	Off-highway vehicle
FD	Forestry Division
PSP	Permanent Sample Plot
RSF	Resource Selection Function
SARA	Species at Risk Act
SSI	Stand Susceptibility Index
SFM	Sustainable Forest Management
WMA	Wildfire Management Area
WMU	Wildlife Management Unit
VOIT	Value, objective, indicator, target

Appendix I.

Preliminary Stakeholder Input: Values Identification Report

Alberta
SUSTAINABLE RESOURCE
DEVELOPMENT

Sustainable Resource Development

Alberta Community Development

Preliminary Stakeholder Input
VALUES IDENTIFICATION

June 27—July 15, 2005

R11 Forest Management Plan

Table of Contents

1.0   Background Introduction

Wildfire has been suppressed over the past several decades to protect life, property, and other values derived from Alberta's forests. The resultant increased fuel load has caused concern at both a landscape level, and in the Wildland/Urban Interface. Wildland/Urban Interfaces are areas where industrial or agricultural installations, recreational developments, or homes are located within flammable natural vegetation. Ongoing fire suppression has resulted in increasing interface hazards and has impacted natural forest processes.

Alberta Sustainable Resource Development (SRD) has identified the development of a Forest Management Plan within the R11 Forest Management Unit as an urgent priority in order to address the high/extreme fire hazard within this area.

Recognizing the Partners in Protection/FireSmart initiative, developed by an Alberta-based coalition of professionals representing national, provincial, and municipal associations and government departments responsible for emergency services, land-use planning, and forest and resource research and management, SRD decided to develop a Forest Management Plan based largely on stakeholder input and provincial planning guidelines. It was determined that meaningful upfront public involvement was essential to the overall creation of the Plan.

In addition to minimizing the high risk of unplanned, uncontrolled wildland fires, there is also a high risk of pine beetles migrating to and infesting Alberta forested lands. The impact of a pine beetle infestation would further compound the fire hazard.

Rocky Mountain House SRD staff formed a planning team consisting of individuals representing various government departments and agencies to lead in and manage the development of a Forest Management Plan. Team members include:

Project Leaders:

- Kevin Gagne, Senior Forester, Sustainable Resource Development
- Daniel Lux, Forest Health Officer, Sustainable Resource Development

Team Members:

- Anne Murphy, GIS Technician, Sustainable Resource Development
- Jim Allen, Wildlife Biologist, Sustainable Resource Development
- Gary Mandrusiak, Fire Prevention Officer, Sustainable Resource Development
- Myles Jensen, District Team Leader, Community Development
- Yvette Choma, Administrative Support, Sustainable Resource Development
- Rita Stagman, Administrative Support, Sustainable Resource Development
- Stephen Wills, Forest Planner, Sustainable Resource Development

- Robert Anderson, Habitat Coordinator, Alberta Conservation Association

- Ksenija Vujnovic, Heritage Protection Specialist, Community Development

In order to gather useful, timely and cost effective stakeholder and public input, the planning team researched various multi-stakeholder processes. After careful consideration and communication with major stakeholders in the area, the planning team proposed that a Charrette input gathering process would be appropriate. A public Charrette is an effective method of obtaining multi-stakeholder input on planning initiatives. It is a collaborative process that harnesses the talents and energies of parties representing various disciplines and stakeholder groups to create and support a feasible plan. The public design Charrette has emerged as an alternative to the "design and present" convention often followed by those leading stakeholder processes. The "design and present" approach fosters a reactive stakeholder process, whereas a Charrette process engages stakeholders in the initial development of a plan.

The Charrette is an intensive workshop held over 2 to 3 consecutive days, providing the opportunity for participants to focus and build the momentum required to complete the process. Charrette participants work collaboratively to set objectives, indicators and targets for the various values identified as important by the stakeholders and the planning team. Participants will also be given an opportunity to apply these objectives to the R11 Forest Management Unit by participating in an initial spatial planning exercise. This will further develop their understanding of the complexity involved in creating the R11 Forest Management Plan. It will also provide for an opportunity for the participants to make recommendations on priority areas. This information will be used by land managers to further develop the overall Forest Management Plan and subsequent specific operational plans.

The Charrette process is a highly successful approach traditionally used by urban planners and more recently the US Department of Agriculture (USDA) for landscape planning. For more information, visit the National Charrette Institute website at http://www.Charretteinstitute.org/.

In addition to the Charrette event, preliminary meetings and ongoing opportunities for stakeholder input and feedback are included in the process.

1.1   Process Overview

In order to facilitate the creation of the R11 Forest Management Plan, the planning team developed a process consisting of the following stages:

- Stage 1: Stakeholder Identification

- Stage 2: Process Scope and Guideline Development

- Stage 3: Preliminary Stakeholder Input (Values Identification)

- Stage 4: Charrette Orientation Session

- Stage 5: Charrette Planning Event

- Stage 6: Evaluation

- Stage 7: Plan Approval

1.2   Stage 1: Stakeholder Identification

The intent of the process is to identify and involve key stakeholders who could be impacted by a landscape plan in the R11 planning unit. In May, 2005, a list of stakeholder groups identified as having an interest in the R11 Forest Management Unit was created. Stakeholders include the general public, environmental and other non-government organizations (NGO's) and businesses in and around the R11 landbase. The planning team determined that a number of meetings would be held with groups sharing similar interests and values. As such, groups were organized into the following clusters:

- Adjacent Land Managers

- Commercial (Accommodations/Helicopter Operators)

- Commercial (Trappers/Recreation Industrial)

- Environmental/Cultural

- Fish and Wildlife Associations

- Municipal and Provincial Governments

- Recreation

Invitation letters were sent to the various stakeholder groups explaining the process, detailing their opportunities for participation, along with a map of the R11 Forest Management Unit. (See Appendix I.)

1.3   Stage 2: Process Scope and Guideline Development

To set the stage for the process, the planning team established the minimal guidelines required from a government perspective. These guidelines will be used to guide the efforts of the participants in the process, as well as land managers when developing the Forest Management Plan.

The planning team reviewed the fire hazard ratings in the R11 Forest Management Unit and determined that the high/extreme hazard must be reduced by 5%. In addition, the planning team reviewed existing legislation and policies pertaining to the area along with FireSmart and provincial landscape planning guidelines.

The planning team determined that the following minimal guidelines must be adhered to by those participating in the development of the Plan. The Plan must:

- Adhere to existing Integrated Resource Plans (IRPs), legislation, and any existing landscape plans for the area (e.g. existing prescribed burn plans,

existing FireSmart initiatives, wilderness area plans, Bighorn Access Management Plan, and FLUZ).

- Reduce the number of high/extreme fire risk stands by 5%

- Reduce the threat of wildfires escaping to surrounding forests outside of the R11 area, the communities of Nordegg and the Bighorn Reserve, along with resorts, campgrounds, and lodges within the area

The planning team has also determined that there is a need to provide stakeholder participants with the necessary data required to effectively set objectives, indicators and targets. Therefore, existing government data will be made available to support the process. In addition, the planning team will ensure experts are available to provide information during the Charrette planning event.

It was also determined that an effective Charrette event should include no more than 15 participants. Individuals interested in participating in the process will be encouraged to submit their names indicating their interest in representing the perspectives common to their stakeholder group, along with the perspectives of other groups with similar interests and values, as identified in the Stage 3 meetings. Participants must accept and agree to adhere to the minimal guidelines set by the planning team. Stakeholders not participating in the Charrette event will be encouraged to provide input throughout the process. Progress reports will be provided.

1.4   Stage 3: Preliminary Stakeholder Input (Values Identification)

With the assistance of a facilitation team, a series of meetings were scheduled to provide an opportunity for stakeholders to:

- Learn about the R11 Forest Management Planning Process

- Provide input and ask questions from their stakeholder group's perspective

Separate meetings were conducted with each group to identify the important factors that should be considered when planning and implementing the R11 Forest Management Plan from their group's perspective. It was also an opportunity to ask the groups how they would ideally envision the R11 area 20 years in the future.

The intention of these preliminary meetings was to give stakeholders an opportunity to identify the values that need to be recognized and addressed when designing the R11 Forest Management Plan. It was also an opportunity for stakeholder groups with similar interests to discuss commonalities and to ask questions. This information will be used by the planning team to prepare an information package for those participating in the Charrette process. A summary

of the information collected during this Stage of the process forms the bulk of this report.

Those attending these meetings were invited to submit their name to the planning team by July 18, 2005, indicating their interest in participating in the Charrette event.

1.5   Stage 4: Charrette Orientation Session

In order to further set Charrette participants up for success, an orientation meeting will be scheduled to review the Charrette process, expectations and guidelines, and overall deliverables. Data packages will be distributed and reviewed with the participants.

1.6   Stage 5: Charrette Planning Event

The Charrette event will be held September 13-15 at the Goldeye Center near Nordegg, Alberta. One member of the planning team will participate along with those selected to represent the various stakeholder values and interests identified in Stage 3 of the process. The participating member of the planning team will be an active participant representing the planning team's and government's interest. A facilitation team will be responsible for managing the Charrette process.

Participants will collaboratively set objectives, indicators and targets for the values compiled in Stage 3 (VOITs) and any additional values brought forward by the planning team's representative. Members of the planning team and additional resource expertise will be available to respond to specific questions, to gather additional information and to help formulate indicators that are in alignment with existing government data.

Once the participants have completed the VOITs exercise, they will identify general areas on the R11 Forest Management Unit map that are rated as high/extreme fire hazard areas that they think will achieve the objectives set and remain within the process guidelines. Those providing expertise to the participants will rely on their knowledge and give an early indication whether the key objectives can be met and what method of treatment (e.g. prescribed burns, harvesting, etc.) would be most appropriate.

Upon the completion of the Charrette event, it is expected that the values of the stakeholders and the planning team will be satisfied. In addition, it is anticipated that a map identifying general areas meeting the key objectives and recommendations or priority management areas will also be completed. The work completed during the Charrette will be viewed as a conceptual plan that will be evaluated in Stage 6 of the process.

In the event that the targets set within the conceptual plan are deemed not achievable during the evaluation process, adjustments will be made by the

planning team, however, the areas identified for treatment in the Charrette conceptual plan will not be changed without additional consultation with the Charrette participants.

1.7 Stage 6: Evaluation

An evaluation process will be conducted to review and complete the conceptual plan created during the Charrette event. The planning team will review, analyze and complete the VOIT lists, geography, and data inventory to design detailed and specific areas for treatment.

Once the specific areas are outlined, all of the values will be measured using the identified indicators. The planning team will compile a final report and forward the Forest Management Plan to the Charrette participants for review.

In addition, the Plan will be posted on the SRD website and hard copies will be made available to the general public. Stakeholders identified in Stage 1 of the process will also be provided an update. Individuals or groups will have the opportunity to provide written comments to the planning team within a 30 day period. Following the 30 day period, the planning team will forward the final Plan, including the written comments received, to the Department's Executive for final endorsement.

1.8 Stage 7: Plan Approval

Departmental Executives will review the Plan and provide comments to the planning team. The planning team will make final revisions and resubmit the Plan. Once accepted by the Executive, the R11 Forest Management Plan will be forwarded to the Director of Forest Management for final approval. It is the goal of the planning team to have the Plan ready for final approval by March 2006.

Once approved, detailed operational plans will be created for each area designated for treatment within the Plan. The Plan will cover a 20 year period. Ongoing opportunities for stakeholder input will be provided throughout the implementation of the Plan.

2.0 Preliminary Stakeholder Input Summary

The following pertains specifically to the input gathered during Stage 3 of the process, Preliminary Stakeholder Input (Values Identification). As indicated in Section 1.4, the intent of these meetings was to provide stakeholders with the necessary background information regarding the R11 Forest Management Unit and the R11 Forest Management Planning process. It was also an opportunity for stakeholder groups to bring forward input and to ask questions.

The information included in this summary will be used by the planning team to prepare for the upcoming Charrette event in September. This summary is also intended to provide

each participating stakeholder group with a record of the responses to the two key questions posed by the facilitation team during each session. It is not intended to serve as a transcript or minutes of each meeting.

2.1   Meeting Participants

Within each stakeholder cluster, the following groups were invited to attend the meetings: *Note: * Indicates groups who sent a representative(s) to the meetings*

Adjacent Land Managers

- Banff and Jasper National Parks *
- Sundance Forest Industries. Ltd.*
- Sundre Forest Products
- Weyerhaeuser Co. Ltd.

Commercial (Accommodations/Helicopter Operators)

- Ahlstrom Air
- Aurum Lodge*
- Triple R Camping
- Camp Alexo
- Camp n Fun Adventures
- Cheechako Wilderness
- David Thompson Resort
- Goldeye Centre
- Icefield Helicopters
- Nordegg Resort Lodge
- Development in Progress Representative
- Ruff'n Reddy Campground Services*
- Shunda Creek Hostel*
- West County RV Rentals

Commercial (Trappers/Recreation Industrial)

- Alpenglow Adventures
- AltaLink
- Canadian Association of Petroleum Producers
- Centre for Outdoor Education*
- Dave Jensen

- Fortis Alberta Inc (Land Department)*
- Frontier Lodge
- Hela Ventures
- Husky Wilderness Adventures
- Klondike & Voyageur Adventures
- Otter Rafting
- Ron Manz
- TransAlta
- Yamnuska

Environmental/Cultural

- Alberta Wilderness Association*
- ALERT*
- Canadian Parks & Wilderness Society
- Friends of the West Country
- North Saskatchewan Watershed Alliance*
- O'Chiese First Nations
- Red Deer River Naturalists
- Red Deer River Watershed Alliance*
- Sierra Club of Canada, Prairie Chapter*
- Stoney First Nations
- Sunchild First Nations*

Fish and Wildlife Associations

- Alberta Conservation Association*
- Alberta Fish & Game Association*
- Alberta Outfitters Association*
- Alberta Professional Outfitters Society*
- Alberta Trappers Association*
- Foundation for North American Wild Sheep*
- Rocky Mountain Elk Foundation
- Trout Unlimited Canada

Municipal and Provincial Governments

- Alberta Environment*
- Clearwater County*

Recreation

- Alberta Bicycle Association
- Alberta Equestrian Federation*
- Alberta Off-Highway Vehicle Association*
- Alberta Snowmobile Association*
- Alberta Trail Riders Association
- Alberta United Recreation Society
- Central Alberta Light Horse Association
- Friends of the Eastern Slopes*

2.2   Meeting Schedule

The following schedule was followed for conducting the meetings.

- June 27, 2005 (AM)   Municipal and Provincial Governments
- June 27, 2005 (PM)   Recreational Users
- June 28, 2005 (AM)   Commercial (Accommodations/Helicopter)
- June 28, 2005 (PM)   Commercial (Trappers/Recreation Industrial)
- June 29, 2005 (AM)   Fish and Wildlife Associations
- June 29, 2005 (PM)   Environmental/Cultural
- July 05, 2005 (AM)   Adjacent Land Managers

2.3   Meeting Agenda

A common agenda was followed for each meeting. All sessions, with the exception of one were able to complete the objectives of the agenda within the allotted time. The agenda was as follows:

- Introductions
- Agenda Overview
- Alberta Sustainable Resource Development R11 Forest Management Unit Presentation
- Question and Answer Session
- Stakeholder Input

- Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

- Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

- R11 Forest Management Planning – Process Steps

- Final Comments

- Meeting Close

Participants who attended the Environmental/Cultural session were encouraged to provide a written response to the planning team regarding Question Two. Please note that Question Two was posed to each group as a meeting closing question. It was intended to set the stage for further planning and to capture any values that may have been overlooked. Feedback provided was generally not recorded under any one specific stakeholder group.

3.0 Stakeholder Input

The following is a summary of each stakeholder group's response to Questions One and Two presented during each session. Participants were asked to focus specifically on their stakeholder group's perspective when responding. During the sessions there was tremendous agreement in the responses given. In many cases, individual stakeholder groups simply added additional information and agreed with what had been presented by others during their session. This finding further validated the value of clustering similar stakeholder groups to participate together. Overall, session participants responded favourably to being able to focus on their interests in the R11 Forest Management Unit with groups sharing similar values.

3.1 Adjacent Land Managers

Session participants included representation from Parks Canada (Banff and Jasper) and Sundance Forest Industries.

Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

Parks Canada:

- Zone 2 management boundaries

- Shared responsibilities

- Joint prescribed burns

- Data sharing

- Wildlife mutual aid

- Wildlife conservation

- Visitor experience

- Protect natural region, e.g. trails

- Strategic framework for grizzly bear management, scientific threshold

- Salvage logging policy (benefit wildlife)

- Adaptive management experiment (monitoring and research, fire regimes/practices – long term range variation

- Literature regarding summer and winter range - managing human use, e.g. oil and gas, forestry

Sundance Forest Industries:

- Fire hazard

- Pine beetles (timber supply)

- Planning Standards

- Coordination of access (between forestry and oil and gas)

Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

Parks Canada:

- Diverse, healthy forest by whatever means

- Healthy wildlife populations living their traditions the trans-boundary way

- Collaborative approach

- Healthy watershed

- Access management, some resolve to manage access and human use in the area

- Adaptive management experiment with an active program to determine if objectives are being achieved

- Public data system, transparency

- Cost effective ways of achieving accountability

Sundance Forest Industries:

- More diverse age class structure to the forest

- Annual performance reporting on objectives, e.g. number of campers, beetle surveys, human fires, etc.

3.2   Commercial (Accommodations/Helicopter Operators)

Session participants included representation from Aurum Lodge, Ruff 'n Ready Campgrounds and Shunda Creek Hostel.

Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

Aurum Lodge:
- Client enjoyment (wilderness) – Bighorn Value
- Commercial site selected on value of the area (preserve unique areas)
- Tourism attraction (industry) – value
- Wilderness appeal
- Visual impact (fire being the preferred option)
- Reduce fire risk (bring back to natural forest)
- Natural environment
- Natural processes
- Watershed (environment)
- Access (no additional permanent access)
- Minimal changes (natural area versus landscape changes)
- Wildlife habitat
- Need to address infestations (e.g. beetles and mistletoe)

Ruff 'n Ready Campgrounds:
- Agreed with the other groups perspective
- Thompson Creek (old growth – thick stand) – thinning suggested

Shunda Creek Hostel:
- Visual impact - client impact (impression)
- Client use
- Financial impact
- Knowledge/education (e.g. logging, fire, etc.)
- Communication - informative
- Accepted Risk Management (wildfire, insurance) – in relation to strategic areas managed infrastructure not to be the driving force

- Visual impact of prescribed burns is often seen negatively by the public – looks like logging/clear cutting

- Generally people more receptive to burning versus logging

- Financial impact

- Communication/information

Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

General Comments:

- Like it looked 20 years ago

- Responsible usage

- Enjoyment levels of today are maintained

- Need for prescribed burns is now, we are loving the "natural environment", fire risk is also apparent

- More people using area, however resources still need to be managed

3.3   Commercial (Trappers/Recreation Industrial)

Session participants included representation from the Centre for Outdoor Education and Fortis Alberta. Input was also received from a participant representing the Caroline Snowmobile Club, Bighorn ATV Society, and a Grazing Lease Holder perspective.

Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

Bighorn ATV Society:

- Trails

- Infrastructure (bridges)

- Tourism

- Promotion of smart use of area

Centre for Outdoor Education:

- Waterways – regarding debris

- Access, existing trails re-established

- Access (foot access, ease of travel)

- Forest surrounding Centre

- Educational opportunity

- Strategic management, cut-lines
- Strategic decision making, use this as an opportunity
- Visual impact, buffers
- Communication (stakeholder process update)

Fortis:

- Damage to structures and facilities,
- Safety aspects, staff and public
- Communication, serving clients
- Existing initiatives RE Vegetation control
- Smoke density, around the power lines

Grazing Leases:

- Keep trails open so livestock can be managed
- Seasonal factors - timing of year when cattle are in the area (June 15 – October 15, related to the safety of the cattle)
- Avoid Overgrazing
- Pasture, work with oilfield, etc. regarding projects

Snowmobile Club of Caroline

- Infrastructure, bridges and signs
- Safety
- Trail system maintained, new and existing
- Visual, buffers if the health of the trees exist
- Volunteer Contributions

Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

General Comments:

- More quad trails for summer use, best way to do that – manage the traffic on busy areas by shutting down busy areas and encouraging the use of other areas. Maybe make some exceptions for hunting times, potentially create a pay for use pass for the closed areas. Create new areas opened at staggered times to promote interest that is still managed and protected.
- Snowmobile group would like to be updated on trails, etc.
- Strategic use of mechanized vehicles as we get closer to the parks

- Create tourism products that are indicative of the past and cultural re-enactment of the area

- Smaller grass roots based structures, community based local tourism rather than large US based organizations

- Preserve the culture

- Cultural immersion

- Keep it more natural – the place where "Adventure Begins" – an example of how we all work together.

- Create 2 mile buffers along the park to prevent the park areas from being damaged – foot access, mountain bikes or horses only

- Most of the area is well out of the power line area – but if we can, keep it the 'Wild West' and natural.

- Seasonal use of trails where appropriate

3.4 Environmental/Cultural

Session participants included representation from the Alberta Wilderness Association, ALERT, the North Saskatchewan Watershed Alliance, Red Deer River Watershed Alliance, Sierra Club of Canada (Prairie Chapter), and the Sunchild First Nation.

Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

Alberta Wilderness Association:

- Ecosystem Approach (Driver of process)

- Sustainability

- Fire/pests (Province-wide approach over boundary approach)

- 1973 – Eastern Slopes Policy

- Return of a Watershed Agency to plan for the Eastern Slopes

- Access (People access and fire risk – adding to the problem)

- Access eliminated/decreased not created

- Protect identified publicly owned property/areas (in policy development)

- Natural processes – Fire (versus logging or thinning)

- Fire management based on natural ecosystem processes

- Identify areas free to burn (province-wide)

- Water (top priority in Plan)

- Wildlife habitat protection

- Fire research

- FireSmart (no taxpayer money – Alberta companies and residents responsibility – regulate Smart policies

- Broad public input

ALERT:

- Adopt the Alberta Forest Conservation Strategy

- Role of this is Y to Y (Yellowstone to Yukon) connectivity (vegetation, wildlife, etc.)

- Holistic – interactive – interconnected

- Legislation required to protect Bighorn Country

- Flooding considerations

- Infrastructure protection done at community level

- Communities – education re risk

- Protection should be done outside the R11 area (e.g. responsibility of FMA holders to protect their FMAs)

- Insect infestations (recognize role) – need for discussion re climate change and fire

- Use horse or helicopter when burning (no logging)

- Allow wildfires to burn (assist with prescribed burns for ecosystem protection)

- Climate change considerations

- Kootenay Plains (spiritual, ecological, wildlife, etc.)

- Wildland Recreation Priority

- Old growth habitat (and species in these areas)

- Watershed protection

- Ecosystem protection (driver)

- Do not want Forest Management Plan (use of name R11)

- Ozone (ground level)

- Acknowledge significance of this area on Canada and beyond in planning

North Saskatchewan Watershed Alliance:

- Management of surrounding areas & the impact

- Beetles (management in and around R11)

- Understand and respect natural functions

- Natural rebalancing of watershed system (provincial scale and beyond)

- Upstream and downstream impact

- Big picture planning beyond R11

Red Deer River Watershed Alliance:

- Cumulative Process rather than site specific (area rather than boundary)

- Watershed protection

- Water flow – quality and quantity

- Flood prevention

- Wildlife corridors identified and protected

Sierra Club of Canada - Prairie Chapter:

- Wildfire, insects and disease (let it happen to the point that there is a risk to facilities and human health – minimal intervention can take place)

- Ongoing process (beyond plan – need checkpoints)

- Economic contributions (e.g. Parks)

- Natural processes run their course

- Minimal interference with natural processes

- Climate change – strategy required (integrated plan, continent-wide)

- Support ecosystem-based rather than Forest Management Plan

- Ecosystem integrity needs to be the basis for all decision-making

    Sunchild First Nation:

- Involved in planning stage from the beginning and throughout

- Expand buffers

- Due diligence

- Work together, regional and local

- Water, ceremonies, protection/respect

- Traditional

- Animals (salt licks)

- Mountains – significance

- Ecosystem

- Sacred – Mountains, Wood, Animals and Water

- Holistic pictures – planning and implementing

- Hunting

- Treaty Rights (involved)

- Protect environment

- Grave sites

- 1930 – Natural Resources Transfer Act, treaty signed with Canada, not the province of Alberta, gave up the lands to the depth of a plough which is 6-8 inches

- Communication, consultation

- Reclamation/restoration

- Access roads

- Impact of additional uses such as oil & gas, logging, etc. - would like to see a buffer

- Communication and involvement

- Coordination of County and other regulators

- Emergency Response/Evacuation (who is out there, coordinated planning)

- Return to natural state following disturbances

Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

General Comments:

- This question was not posed to this group as they ran out of time.

3.5   Fish and Wildlife Associations

Session participants included representation from the Alberta Chapter Foundation for Wild Sheep, Alberta Conservation Association – Fisheries, Alberta Conservation Association - Wildlife Conservation, Alberta Fish & Game Association, Alberta Outfitters Association, Alberta Professional Outfitters Society (APOS), Chungo Creek Outfitters, Lost Guide and Outfitters, and the Sundre Trapper's Association.

Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

Alberta Conservation Association – Fisheries:

- Small creek-fish impact

- Drainages (need for data RE timber harvest and fire impact)

- Cooperative fisheries program

- Spawning areas

- Fish inventories

- Bull trout

- Fish communities

- Upper North Saskatchewan river (inventory and telemetry)

- Access management (access to important fish areas)

- Road networks (sediment)

- Ecosystem management

- Fish habitat

Alberta Conservation Association - Wildlife Conservation:

- Range restoration program

- Creating high quality habitat

- Ungulate habitat

- Healthy ecosystem in general, range of age classes in the area from new to old growth

Alberta Fish and Game Association:

- South facing slopes – limited reforestation to increase pasture

- Healthy range of habitats – diversity

- Return to natural state (prior to suppression)

- Mimic natural fire conditions/patterns

- Access Management

- Fisheries (roads and bridges – service system)

- 1983 IRP be used as historical data – it was valid work

Alberta Outfitters Association and Chunga Creek Outfitters:

- Habitat improvement

- Defensible decisions (e.g. feral horses)

- Wild Fires – business impact

- Continuity of operations

- No new access or reduces access

- Proactive management (past-future data considerations)

- Feral horses

- Diversity of vegetation

- Predator/prey ratio

- Understand trade-offs re decisions

Alberta Professional Outfitters Society (APOS) and the Alberta Chapter of North American Association for Wild Sheep:

- Winter habitat

- Long-term planning

- Review legislation

- Corridor management

- Game populations

- Wild land status – world renowned

- Stakeholder input (Government promises)

- Liability issues on public property that need to be addressed

Lost Guide Outfitters:

- Communication Plan – let stakeholders and public know the timing of burns

- Timing of the burns (During operation times, Calving of ungulates)

- Between APOS and Fish & Game, similar values

Sundre Trapper's Association:

- Removal of Large trees (FLUZ)

- Affects on Pine Martin and fur-bearing animals

- Access – new access issues

Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

General Comments:

- See it as good or better for our children and grandchildren (Trying to save it, not see it destroyed)

- One of the true wilderness areas left, want to keep it that way

- There has to be a place for everyone, but there are some serious problems with ATV's and 4x4's

- In regards to the photos in Dan's presentation, would like to see more photography to capture the historical changes

- Large (50+) herds of 6 point elk (from old photos) would like the young biologists to look back into that era and what was so good in that era to create the sights we were able to see. What is changing?

- Let's go back to 1960 and try to determine where we have gone wrong. We have some history and data and have identified a need to make a change. Use the historical data to make it right. Keep in mind that this is the last postage size piece of wilderness left in Alberta. The ultimate goal is to preserve it

3.6   Municipal and Provincial Governments

Session participants included representation from Alberta Environmental Protection and the County of Clearwater. The Alberta Environmental Protection participant also brought forward the Red Deer River Watershed Alliance perspective.

Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

Alberta Environmental Protection:

- Supporting Red Deer River Watershed Alliance and the North Saskatchewan Watershed Alliance

- County Development Nodes (approval process)

County of Clearwater:

- Recreation and Tourism (areas set aside for tourism and areas for infrastructure in IRP; impact of tourism and recreation in the future; visual impact; social enjoyment)

- Development nodes (areas within and surrounding each node; impact on existing and future developers)

- Infrastructure

- Nordegg

- Beetles

Red Deer River Water Shed Alliance:

- Landscape management

- Watershed management

- Balance social and ecological interests

- Work together (input)

Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

General Comments:

- An area that has something to offer that people want e.g. hiking through natural areas
- More concerned about pine beetles than fire

3.7   Recreational Users

Session participants included representation from the Alberta Equestrian Federation, Alberta Office Road Vehicle Association, Alberta Snow Mobile Association and the Friends of the Eastern Slopes.

Question One: "From your group's perspective, what are the important factors that should be considered when planning and implementing the R11 Forest Management Plan?"

This group shared the same interests. They are as follows:

- Trails
- Camping
- Visual Impact
- Economic Impact
- Beetles
- Infrastructure
- Berries
- Hunting & fishing
- Impact on Tourism/Recreation and Community

Question Two: "Ideally, how would your stakeholder group envision the R11 area in 20 years?"

General Comments:

- Still there
- Still trees
- Still clean water
- Still water
- Recreation opportunities
- Vibrant communities around them – but not too close

4.0 Stakeholder Core Values Identification

Following the stakeholder meetings, the planning team reviewed the input received and analyzed the responses given by the stakeholders. The facilitation team led the planning team through a clustering exercise whereby all the responses given during the meetings were presented and then sorted into similar themes. These themes were then analyzed to determine the core value(s) presented.

The planning team will be encouraging meeting participants to review the work completed to ensure the stakeholder input was captured and clustered appropriately. The core values identified will likely serve as the foundation of the Charrette process. Objectives, indicators and targets will be set collaboratively for each core value.

4.1 Core Value Summary

Based on the analysis conducted by the planning team, the following core values were identified and will guide the planning efforts of the R11 Forest Management Unit. They include:

- Access
- Air Shed Quality
- Community Integrity
- Domestic Grazing
- Ecosystem Integrity
  - Holistic Picture
  - Natural disturbance emulation
- Existing Obligations
- Fish
- Forest Health
- Information and Education
- Infrastructure
- Multi-agency Cooperation
- Public Safety
- Recreational Opportunities
- Science-Based Decision Making
- Social Values
  - Aesthetics
  - Cultural Value

- Economic Value
- Inherent Value
- Watershed Integrity
- Wildfire Threat
- Wildlife

4.2 Core Value Clustering Exercise Results

The information provided below includes how the planning team clustered the input received from the stakeholder groups. The information provided in each bullet represents stakeholder input as presented in the sessions.

4.2.1 Core Value: Access

- Access
- Motorized hunting access
- Trail access maintained (new and existing)
- Trails open
- Access, foot access, ease of travel re safety
- Access existing trails or areas re-established
- Strategic management, e.g. cutting breaks
- No new access or reduced access
- Access management (access to important fish areas)
- Access roads
- Access, people access and fire risk, adding to problem
- Access eliminated/decreased, not created
- Use horse or helicopter re burning – no logging

4.2.2 Core Value: Air Shed Quality

- Air quality

4.2.3 Core Value: Community Integrity

- Development Nodes
- County Development Nodes (approval process)
- Nordegg
- Forest surrounding Centre (Outdoor Education Centre)

- Social Gateway community

4.2.4 Core Value: Domestic Grazing

- Avoid overgrazing
- Pasture
- Trails open to manage livestock
- Seasonal factors (no burning in summer where cows are)

4.2.5 Core Value: Ecosystem Integrity

4.2.5.1 Sub Value: Natural Disturbance Emulation

4.2.5.2 Sub Value: Holistic Picture

- Landscape Management
- Natural environment
- Natural process
- Minimal changes
- Strategic decision making – use this as an opportunity
- Healthy ecosystem – range of age class
- Healthy range of habitat
- Return to natural state – prior to suppression
- Mimic natural fire patterns
- Long term planning
- Corridor management, beyond the game
- Proactive management, past and future data considerations
- Diversity of vegetation
- Ecosystem management
- Long term range management variation, fire regimes/practices
- Ecosystem
- Holistic picture, planning and implementation
- Natural state following disturbances
- Protect environment
- Sustainable resources
- Reclamation

- Restoration

- Understand and respect natural functions

- Big picture planning

- Ecosystem approach, driver

- Sustainability

- Natural processes (over logging or thinning)

- Fire management based on natural ecosystem processes

- Role of this area Y to Y, vegetation, wildlife, etc. Connectivity

- Holistic

- Interactive

- Interconnected

- Old growth habitat and species in the area

- Ecosystem protection (driver)

- Wildfire, disease, insects – let happen unless a risk to facilities, human health, intervention can take place

- Natural process run the course

- Allow wildfires to burn

4.2.6 Core Value: Existing Obligations

- 1983 IRP historical data

- Importance of existing IRP

- Literature - summer and winter range , managing human use, e.g. oil and gas use

- Review legislation

- Treaty rights, involved

- 1973 Eastern Slopes Ppolicy

- Do not want Forest Management Plan, use of name R11

4.2.7 Core Value: Fish

- Bull trout

- Fish inventories

- Upper North Saskatchewan River

- Spawning areas

- Small creek fish impact

- Cooperative fish inventories – data available

- Fish communities

- Fish habitat

4.2.8 Core Value: Forest Health

- Beetles

- Infestations, e.g. beetles, mistletoe

- Beetles

- Beetles, timber supply

- Fire/pests - province wide approach over boundary approach

- Insect infestations, recognize role, need for discussion, climate change/fire

4.2.9 Core Value: Information and Education

- Communication – informative

- Knowledge/education (logging, fire)

- Communication (serving clients)

- Promote smart use of area

- Notification plan (prior to burn or intervention)

- Communication, stakeholder process update

- Education opportunity

- Defensible decisions

- Understand trade-offs re decisions

- Communication plan, notify stakeholders and public

- Communication/involvement

- Broad public input

4.2.10 Core Value: Infrastructure

- Infrastructure

- Staging areas, washrooms

- 4-H groups

- Bridges, campgrounds

- Infrastructure, volunteer groups

- Bridges, infrastructure
- Infrastructure, e.g. bridges
- Structure facility damage
- Volunteer contributions

4.2.11 Core Value: Multi-Agency Cooperation

- Work together – input
- Stakeholder input, government promises
- Shared responsibility work together
- Data sharing
- Adaptive management experience, monitoring and research
- Work together (regional and local)
- Coordination of County and other regulators
- Protection should be done outside the R11 area (e.g. responsibility of FMA holders to protect the FMA)
- Cumulative process rather than site specific (area rather than boundary)
- Continuity of operations
- Joint prescribed burns
- Wildfire mutual aid

4.2.12 Core Value: Public Safety

- Smoke density
- Safety
- Safety (safety, public)
- Liability issues
- Emergency response plan – know who is out there, coordinated planning

4.2.13 Core Value: Recreational Opportunities

- Recreation & Tourism
- Snowmobiles
- Trails
- Camping

- Recreation

- Trail riding

- Quads

- Hunting

- Fishing

- Berries

- Tourism

4.2.14 Core Value: Science Based Decision Making

- Defensible decisions

- Understand trade-offs re decisions

- Scientific thresholds

- Planning standards, adherence

- Due diligence

- Fire research

- Ongoing process, beyond plan, checkpoints

- Ecosystem integrity for all decision making

- Climate change considerations

4.2.15 Core Value: Social Values

4.2.15.1 Sub Value: Inherent Value

4.2.15.2 Sub Value: Economic Value

4.2.15.3 Sub Value: Aesthetics

4.2.15.4 Sub Value: Cultural Value

- Balance social & ecological interest

- Economic impact

- Client enjoyment, Bighorn Value

- Commercial site based on value

- Wilderness appeal

- Client impact

- Financial impact

- Tourism industry, attraction value

- Wildland Status – world renowned
- Wildfire business impact
- Visitor experience
- Mountains significance
- Economic contributions, e.g. parks
- Visual, view-scape
- Visual impact
- Visual impact, fire prevention option
- Buffer along trails
- Visual impact
- Buffers, visual enjoyment
- Involved in planning stage, beginning, throughout
- Expand buffers, culture perspective
- Traditional sites
- Sacred mountains, animals, woods and water
- Hunting
- Grave sites
- Kootenay Plains, spiritual, ecological, wildlife etc.

4.2.16 Core Value: Watershed Integrity

- Watershed management
- Supporting Red Deer River Watershed Alliance
- Watershed environment
- Watershed
- Buffer zones (water courses – fisheries)
- Drainages (need for data timber harvest and fire impacts
- Road networks, sediment
- Water protection/respect (ceremonies)
- Management of surrounding areas and the impact
- Upstream and downstream impact
- Water (top priority in plan)
- Flooding considerations

- Watershed protection

- Flow quality/quantity

- Flood prevention

- Watershed protection

4.2.17 Core Value: Wildfire Threat

- Fire risk

- Thompson Creek, old growth

- Accepted risk management

- Existing Initiatives re vegetation control

- Timing of burns

- Fire hazard (timber supply)

- Infrastructure protection done at a community level

- Communities, education re risk

4.2.18 Core Value: Wildlife

- Wildlife habitat

- Removal of large tree

- Zone 1 FLUZ – Pine Martin

- Squirrel (fur bearing)

- Range restoration program

- Ungulate habitat, high quality

- Winter habitat

- Game populations

- Habitat improvement

- Predator/Prey ratio

- Wildlife (species) conservation, e.g. grizzly, caribou, bull trout, long toed salamander

- Strategic framework for grizzly bear management

- Salvage logging policy, if applicable, benefit wildlife

- Feral horses

- Animals, salt lick

- Wildlife habitat protection

- Wildlife corridors identified and protected

4.3 Additional Input

An additional analysis was conducted regarding input provided by stakeholders that was deemed beyond the scope of the R11 Forest Management Planning process. Input was deemed as such if the input received requires provincial level policy. The planning team will provide further explanation to stakeholders if requested. The information categorized as additional input includes:

- Acknowledge significance of this area to Canada and beyond in planning
- Adopt Forest Conservation Strategy
- Allow wildfires to burn, assist with prescribed burns to burn for ecosystem protection
- Climate change strategy required, integrated plan continent wide
- FireSmart, no taxpayer money, companies and residents – regulated FireSmart policies
- Identify areas free to burn, province wide
- Legislation required to protect Bighorn Country
- Ozone, ground level
- Protect identified publicly owned property/areas
- Return of a Watershed Agency to plan for the Eastern Slopes
- Wildland Recreation Priority

5.0 Next Steps

Upon completion of Stage 3 of the process, the planning team will prepare background information packages based on the core values identified. The information will be presented to those participating in the Charrette process.

Those participating in the preliminary stakeholder meetings are invited to submit their names by July 18, 2005 to the planning team if they would like to be considered to participate in the Charrette planning event. Additional opportunities for input, including written submissions, will be considered at any time by those not participating in the Charrette or subsequent process steps.

For more information or to provide comment, please contact planning team member Yvette Choma at (403) 721-3965.

6.0 Appendix

The following is the invitation letter sent to stakeholder groups and individuals.

Dear ,

Alberta Sustainable Resource Development and Alberta Community Development are developing a forest management plan for the Bighorn Backcountry. With a history of fire suppression and lack of forest disturbance, this area is threatened with an increased risk of escape wildfires, insect outbreaks, and a decrease in the available habitat for many wildlife species. We are developing a management plan to reduce the number of high and/or extreme fire hazard stands, provide fuel breaks to protect the Community of Nordegg, the Big Horn Reserve, resorts, campgrounds, and lodges in the area, and to protect the surrounding forests. Additional goals will be to decrease hazard from pine beetles and improve winter range habitat for elk, mule deer, big horn sheep and other species.

The area being planned has the same boundaries as the Bighorn Access Management Plan; a map is provided with this letter. Prescribed burns will be the preferred method of hazard reduction, however some timber harvest may be considered in areas deemed appropriate under existing plans and legislation.

As someone who uses the Bighorn Backcountry for (insert stakeholder sphere here), we would welcome your input.   We realize that there are several values that need to be considered when planning this type of forest management. We would like to meet with you and other (insert stakeholder sphere here) users on XXXXXX, at XX:XX, at the Provincial Building in Rocky Mountain House. At this meeting we would be very interested in your organizations opinion of the values that should be incorporated into the plan. We will also explain the other avenues you have to get involved in the planning process.

We hope to see you at the meeting, which we anticipate will take no more than 2 to 3 hours. Please contact Yvette at 403-721-3930 to confirm your attendance or if you have any questions or need any additional information.

Sincerely

R11 Landscape Planning Team

Note to Reader:

This document was prepared by the facilitation team leading Stage 3 of the R11 Forest Management Planning process.

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Appendix II.

Rare Vascular Plant Species Potentially Found in the R11 Forest Management Unit

Rare Vascular Plant Species Potentially Found in the R11 Forest Management Unit

The Alberta Natural Heritage Information Centre (ANHIC) collects, evaluates, and makes available information on the elements of natural biodiversity in Alberta including animal and plant species and plant communities. Elements are evaluated and ranked on their status (global, national, and provincial) using a system developed by NatureServe that is in use throughout North America. Ranking is usually based primarily on the number of occurrences, since that is frequently the only information available. (The definition of an occurrence may vary from element to element but generally constitutes an area occupied by the element, separated from the location of another similar element by a specified minimum separation distance.) Other information, such as population size and trend, life history and reproductive strategies, range, and current threats, is used when available. Such detailed and spatially explicit information can be used in conservation planning and resource management decisions.

ANHIC has identified 304 rare vascular plant species from the five Natural Subregions occurring in the R11 Forest Management Unit. While a comprehensive survey would be required to confirm which plant species are indeed present, the following list delineates potential species that may be present and should be considered when the planning treatment activities indicated elsewhere in this FMP. Definitions of the various global, national, and subnational/provincial ranks are presented after the table.

Scientific Name	Common Name	Subnational Rank	National Rank	Global Rank
Adenocaulon bicolor	pathfinder	S2S3	N?	G5?
Adiantum aleuticum	western maidenhair fern	S2	N?	G5?
Agoseris lackschewitzii	pink false dandelion	S2	N?	G4
Agropyron x brevifolium		SNR	N?	GNA
Agrostis exarata	spike redtop	S2	N?	G5
Agrostis humilis	low bent grass	S1	N?	G4
Agrostis mertensii	northern bent grass	S2	N?	G5
Agrostis thurberiana	Thurber's bent grass	S2	N?	G5
Allium geyeri	Geyer's onion	S2	N2	G4G5
Alopecurus alpinus	alpine foxtail	S2	N?	G5
Anemone quinquefolia	wood anemone	S1	N?	G5
Antennaria aromatica	scented everlasting	S2	N?	G4
Antennaria corymbosa	corymbose everlasting	S1	N2	G5
Antennaria luzuloides	silvery everlasting	S1	N?	G5
Antennaria monocephala ssp angustata	one-headed everlasting	S2	N?	G4G5TNR
Aquilegia formosa	Sitka columbine	S2	N?	G5
Aquilegia jonesii	Jones' columbine	S2	N2	G4
Arabis lemmonii	Lemmon's rock cress	S2	N3?	G5
Arctagrostis arundinacea	polar grass	S1	N?	G5T5
Arenaria longipedunculata	sandwort	S1	N2N3	G3Q
Arnica amplexicaulis	stem-clasping arnica	S2	N?	G4
Arnica longifolia	long-leaved arnica	S2	N2	G5
Arnica parryi	nodding arnica	S2	N?	G5

Artemisia furcata var furcata	forked wormwood	S1	N?	G4TNR
Artemisia tridentata	big sagebrush	S2	N?	G5
Aster campestris	meadow aster	S2	N?	G5
Aster eatonii	Eaton's aster	S2	N?	G5
Aster x maccallae		S1S2	N?	GNA
Athyrium alpestre var americanum	alpine spleenwort	S1	N?	G4G5
Botrychium ascendens	ascending grape fern	S1	N2N3	G2G3
Botrychium campestre	field grape fern	S1	N1	G3G4
Botrychium crenulatum		S1	N1N3	G3
Botrychium hesperium	western grape fern	SU	N2?	G3G4
Botrychium lanceolatum	lance-leaved grape fern	S2	N?	G5
Botrychium lineare	straight-leaf moonwort	S1	N1	G1
Botrychium michiganense		SU	N?	G1
Botrychium minganense	Mingan grape fern	S2S3	N?	G4
Botrychium pallidum		S1	N1	G3
Botrychium paradoxum	paradoxical grape fern	S1	N1N2	G2
Botrychium pedunculosum		S1	N1N3	G2G3
Botrychium pinnatum		S1	N?	G4?
Botrychium simplex	dwarf grape fern	S2	N?	G5
Botrychium spathulatum		S2	N2N3	G3
Botrychium x watertonense		S1	N?	GNA
Boykinia heucheriformis	telesonix	S2	N2	G4
Braya humilis var maccallae	leafy braya	S1	N2N3	G5T2T3Q
Braya humilis var porsildii		S1	N?	G5TNRQ
Braya purpurascens	alpine braya	S1S2	N?	G4G5Q
Brickellia grandiflora	large-flowered brickellia	S2	N2	G5
Bromus latiglumis	Canada brome	S1	N?	G5
Calamagrostis lapponica	Lapland reed grass	S1	N?	G5
Camassia quamash var quamash	blue camas	S2	N?	G5T3T5
Campanula uniflora	alpine harebell	S2	N?	G4
Cardamine bellidifolia	alpine bitter cress	S2	N?	G5
Cardamine oligosperma var kamtschatica	mountain cress	S2	N?	G5T3T5
Cardamine pratensis	meadow bitter cress	S1S2	N5	G5
Carex adusta	browned sedge	S1	N?	G5
Carex aperta	open sedge	S1	N?	G4
Carex arcta	narrow sedge	S1	N?	G5
Carex backii	Back's sedge	S2	N?	G4
Carex bicolor		SU	N?	G5
Carex cordillerana		S1	N?	GNR
Carex crawei	Crawe's sedge	S2	N?	G5
Carex glacialis	glacier sedge	S2	N?	G5
Carex heleonastes	Hudson Bay sedge	S2	N?	G4
Carex heteroneura var epapillosa	blackened sedge	S1	N1N3	G5T5
Carex houghtoniana	sand sedge	S2	N?	G5
Carex illota	small-headed sedge	S1	N?	G4G5
Carex incurviformis var incurviformis	seaside sedge	S2	N?	G4G5T4T5
Carex infirminervia		S1	N?	G4G5
Carex lachenalii	two-parted sedge	S2	N?	G5
Carex lacustris	lakeshore sedge	S2	N?	G5
Carex lenticularis var dolia	lens-fruited sedge	S1	N2N3	G5T3Q

Carex leptopoda	taper-fruit short-scale sedge	S1	N?	G5
Carex mertensii	purple sedge	S1	N?	G5
Carex misandra	nodding sedge	S1S2	N?	G5
Carex paysonis	Payson's sedge	S1S2	N2	G4
Carex petasata	pasture sedge	S1S2	N?	G5
Carex platylepis	broad-scaled sedge	S1S2	N?	G4?
Carex podocarpa	alpine sedge	S2	N?	G4G5
Carex preslii	Presl sedge	S2	N?	G4
Carex saximontana		S1	N?	G5
Carex scoparia	broom sedge	S1	N?	G5
Carex tincta	tinged sedge	SU	N?	G4G5
Carex umbellata	umbellate sedge	S1	N?	G5
Carex vesicaria	blister sedge	S1	N?	G5
Castilleja pallida	pale greenish paintbrush	SU	N?	G5
Cheilanthes gracillima	lace fern	S1	N?	G4G5
Chenopodium incanum	goosefoot	S1	N1?	G5
Cirsium scariosum	thistle	SU	N2	G5
Conimitella williamsii	conimitella	S2	N2	G3?
Cornus unalaschkensis		SNR	N4?	G5?
Crepis atribarba	hawk's-beard	S2	N?	G5
Crepis intermedia	intermediate hawk's-beard	S2	N?	G5
Crepis occidentalis	small-flowered hawk's-beard	S2	N2	G5
Cryptogramma stelleri	Steller's rock brake	S2	N?	G5
Cypripedium montanum	mountain lady's-slipper	S2	N?	G4
Cystopteris montana	mountain bladder fern	S2	N?	G5
Danthonia spicata	poverty oat grass	S1S2	N?	G5
Deschampsia elongata	slender hair grass	S1	N?	G5
Diphasiastrum sitchense	ground-fir	S2	N?	G5
Douglasia montana	mountain dwarf-primula	S1	N1	G4?
Downingia laeta	downingia	S1S2	N1	G5
Draba densifolia	whitlow-grass	S1S2	N2	G5
Draba fladnizensis	whitlow-grass	S1	N?	G4
Draba glabella	whitlow-grass	S1	N4?	G4G5
Draba kananaskis	Kananaskis whitlow-grass	S1	N1	G1Q
Draba longipes	whitlow-grass	S1S2	N3N4	G4
Draba macounii	Macoun's whitlow-grass	S2	N3?	G3G4
Draba porsildii	Porsild's whitlow-grass	S2	N3N4	G3G4
Draba ventosa	whitlow-grass	S2	N2N3	G3
Drosera linearis	slender-leaved sundew	S2	N4	G4
Dryopteris filix-mas	male fern	S1	N4N5	G5
Eleocharis compressa var borealis	flattened spike-rush	SU	N?	G5T5
Eleocharis engelmannii	Engelmann's spike-rush	S1?	N2	G4G5Q
Eleocharis tenuis	slender spike-rush	SU	N?	G5
Ellisia nyctelea	waterpod	S2	N4	G5
Elymus scribneri	Scribner's wheat grass	S2	N?	G5
Elymus virginicus	Virginia wild rye	SNR	N?	G5
Epilobium clavatum	willowherb	S2	N?	G5
Epilobium glaberrimum ssp fastigiatum	willowherb	S1	N2N3	G5T4T5
Epilobium halleanum	willowherb	S1	N2?	G5

Epilobium lactiflorum	willowherb	S2	N?	G5
Epilobium leptocarpum	willowherb	S1	N?	G5
Epilobium luteum	willowherb	S1	N?	G5
Epilobium mirabile	willowherb	SNR	N1N3	G4Q
Epilobium saximontanum	Rocky Mountain willowherb	S1	N?	G5
Erigeron divergens	fleabane	S1	N?	G5
Erigeron flagellaris	creeping fleabane	S1	N?	G5
Erigeron lackschewitzii	front-range fleabane	S1	N1	G3
Erigeron ochroleucus var scribneri	buff fleabane	S2	N2?	G5T5
Erigeron pallens	pale alpine fleabane	S2	N?	G4
Erigeron radicatus	dwarf fleabane	S2	N2	G3
Erigeron trifidus	trifid-leaved fleabane	S1S2	N2N3	G2G3Q
Eriogonum pauciflorum		SU	N?	G5
Eriophorum callitrix	beautiful cotton grass	S2	N?	G5
Festuca altaica	northern rough fescue	S2	N5	G5
Festuca lenensis		SU	N1	G4G5
Festuca minutiflora	tiny-flowered fescue	S2	N2	G5
Festuca occidentalis	western fescue	S1	N?	G5
Festuca subulata	fescue	S1	N?	G5
Festuca viviparoidea ssp krajinae	viviparous fescue	S1	NR	G4G5TNR
Galium bifolium	two-leaved Bedstraw	S1	N3	G5
Gayophytum racemosum	low willowherb	S1	N1	G5
Gentiana fremontii	marsh gentian	S2S3	N?	G4
Geranium erianthum	geranium	SH	N?	G5
Glyceria elata	tufted tall manna grass	S2	N?	G4G5
Gnaphalium microcephalum	common cudweed	SH	N?	G5
Gnaphalium viscosum	clammy cudweed	SH	N?	G5
Gymnocarpium disjunctum		S1	N?	G4
Heuchera glabra	alpine alumroot	S1	N?	G5
Hippuris montana	mountain mare's-tail	S1	N?	G4
Huperzia haleakalae		S2	N?	G4G5
Huperzia selago	mountain club-moss	S1	N5	G5
Hydrophyllum capitatum	woollen-breeches	S2S3	N?	G4?
Hypericum scouleri ssp scouleri	western St. John's-wort	S1	N?	G5T3T5
Iliamna rivularis	mountain hollyhock	S2	N3	G5
Iris missouriensis	western blue flag	S1	N1	G5
Isoetes bolanderi var bolanderi	Bolander's quillwort	S1	N1	G4T4
Isoetes maritima		S1	N3N4	G4
Isoetes occidentalis		S1	N?	G4G5
Isoetes x truncata		S1	HYB	GNA
Juncus biglumis	two-glumed rush	S2	N?	G5
Juncus brevicaudatus	short-tail rush	S2	N5	G5
Juncus nevadensis	Nevada rush	S1	N?	G5
Juncus parryi	Parry's rush	S2	N?	G4G5
Juncus regelii	Regel's rush	S1	N3	G4?
Juncus stygius var americanus	marsh rush	S2	N?	G5T5
Koenigia islandica	koenigia	S1	N?	G4
Lactuca biennis	tall blue lettuce	S2	N?	G5
Larix occidentalis	western larch	S2	N5	G5

Lesquerella arctica var purshii	northern bladderpod	S2	N?	G4TNR
Lewisia pygmaea var pygmaea	dwarf bitter-root	S2	N?	G5T5
Lewisia rediviva	bitter-root	S1	N?	G5
Lilaea scilloides	flowering-quillwort	S1	N2	G5?
Linanthus septentrionalis	linanthus	S2	N?	G5
Listera caurina	western twayblade	S1	N?	G4?
Listera convallarioides	broad-lipped twayblade	S2	N?	G5
Lithophragma glabrum	rockstar	S2	N?	G4G5
Lithophragma parviflorum	small-flowered rockstar	S2	N?	G5
Loiseleuria procumbens	alpine azalea	S1S2	N?	G5
Lomatium cous	biscuit-root	S1S2	N1	G5
Lomatogonium rotatum	marsh felwort	S2S3	N5?	G5
Lupinus minimus	least lupine	S1	N2	G3G4
Lupinus polyphyllus	large-leaved lupine	S1	N4	G5
Lupinus wyethii	Wyeth's lupine	S1	N2	G5
Luzula acuminata	wood-rush	S1	N?	G5
Luzula rufescens	reddish wood-rush	S1	N?	G5
Melica smithii	melic grass	S1S2	N?	G4
Melica spectabilis	onion grass	S2	N2	G5
Mertensia lanceolata	lance-leaved lungwort	S2	N?	G5
Mertensia longiflora	large-flowered lungwort	S2	N?	G4G5
Microseris nutans	nodding scorzonella	S2S3	N?	G5
Mimulus breweri	Brewer's monkeyflower	S1	N2N3	G5
Mimulus floribundus	small yellow monkeyflower	S1	N?	G5
Mimulus guttatus	yellow monkeyflower	SU	N5	G5
Mimulus tilingii		S1	N?	G5
Minuartia elegans	purple alpine sandwort	S1	N?	G4G5
Monotropa hypopithys	pinesap	S2	N?	G5
Montia linearis	linear-leaved montia	S1	N?	G5
Montia parvifolia	small-leaved montia	S1	N?	G4G5
Nemophila breviflora	small baby-blue-eyes	S1S2	N3	G5
Nothocalais cuspidata	prairie false dandelion	S1	N2	G5
Oenothera flava	low yellow evening-primrose	S2	N?	G5
Oryzopsis exigua	little rice grass	S1	N?	G5
Oryzopsis micrantha	little-seed rice grass	S2	N?	G5
Osmorhiza longistylis	smooth sweet cicely	S2	N?	G5
Osmorhiza purpurea	purple sweet cicely	S2	N?	G4G5
Oxytropis campestris var davisii		S2?	N3	G5T3
Packera subnuda	ragwort	S2	N5	G5
Panicum acuminatum	hot-springs millet	SU	N5	G5
Papaver pygmaeum	alpine poppy	S2	N2	G3
Papaver radicatum ssp kluanense	alpine poppy	S2	N2N4	G5T3T4
Pedicularis flammea	flame-colored lousewort	S2	N?	G3G5
Pedicularis langsdorfii ssp arctica	Arctic lousewort	S2	N?	G4T4
Pedicularis oederi		S1	N?	G5
Pedicularis racemosa	leafy lousewort	S1	N?	G5
Pellaea gastonyi	Gaston's cliff brake	S1	N2N3	G2G4
Pellaea glabella	smooth cliff brake	S2	N4N5	G5
Pellaea glabella ssp occidentalis		S1	N2	G5T4

Pellaea glabella ssp simplex		S2	N?	G5T4?
Penstemon fruticosus var scouleri	shrubby beardtongue	S2	N?	G4T4
Phacelia linearis	linear-leaved scorpionweed	S2	N3N4	G5
Phacelia lyallii	Lyall's scorpionweed	S2	N2N3	G3
Phegopteris connectilis	northern beech fern	S2	N?	G5
Philadelphus lewisii	mock orange	S1	N?	G5
Phlox gracilis ssp gracilis	slender phlox	S1	N4N5	G5T5
Physocarpus malvaceus	mallow-leaved ninebark	S1	N4	G4G5
Pinus flexilis	limber pine	S3?	N3N4	G5
Pinus monticola	western white pine	SU	N4N5	G5
Platanthera stricta	slender bog orchid	S2	N?	G5
Poa gracillima	Pacific bluegrass	S2	N?	G4
Poa laxa ssp banffiana		S1	N1	G5?T1
Poa lettermanii	Letterman's bluegrass	S1	N?	G4
Poa stenantha	bluegrass	SU	N?	G5
Polygonum minimum	least knotweed	S2	N?	G5
Polypodium hesperium	western polypody	S1S2	N?	G5
Potentilla drummondii	Drummond's cinquefoil	S2	N?	G5
Potentilla hookeriana	Hooker's cinquefoil	S2	N?	G4
Potentilla macounii	Macoun's cinquefoil	S1	N1	G1?
Potentilla multisecta	smooth-leaved cinquefoil	S2	N2	GNR
Potentilla subjuga		S1	N1	G4
Potentilla villosa	hairy cinquefoil	S2	N?	G4
Prenanthes alata	white lettuce	S1	N?	G5
Prenanthes sagittata	purple rattlesnakeroot	S2	N2	G3G4
Primula egaliksensis	primrose	S2	N?	G4
Primula stricta	erect primrose	S1	N?	G4
Pyrola picta	white-veined wintergreen	S1	N?	G4G5
Ranunculus glaberrimus	early buttercup	S2	N?	G5
Ranunculus nivalis	snow buttercup	S1	N?	G5
Rhododendron lapponicum	Lapland rose-bay	S2	N?	G5
Ribes laxiflorum	mountain currant	S2	N5	G5
Romanzoffia sitchensis	Sitka romanzoffia	S2	N?	G4
Rorippa curvipes	yellow cress	SU	N?	G5
Rorippa curvipes var truncata	blunt-leaved yellow cress	S1	N3N4	G5
Rorippa tenerrima	slender cress	S1S2	N3N4	G5
Rumex paucifolius	alpine sheep sorrel	S1	N2	G5
Sagina nivalis	pearlwort	SU	N?	G5
Sagittaria latifolia	broad-leaved arrowhead	S1	N?	G5
Salix alaxensis var alaxensis	Alaska willow	S2	N?	G5T4T5
Salix commutata	changeable willow	S2	N?	G5
Salix lanata ssp calcicola	woolly willow	S1	N4	G4T4
Salix raupii	Raup's willow	S1	N2	G2
Salix stolonifera	willow	S1	N?	G4G5
Saussurea americana	American saw-wort	S1	N?	G5
Saxifraga flagellaris ssp setigera	spiderplant	S2	N?	G5T3T5
Saxifraga nivalis	alpine saxifrage	S2	N?	G4G5
Saxifraga odontoloma	saxifrage	S1	N?	G5
Saxifraga oregana var montanensis	Oregon saxifrage	SU	N1	G4G5TNRQ
Sedum divergens	spreading stonecrop	S2	N?	G5?

Selaginella wallacei	Wallace's little club-moss	S1	N?	G5
Silene involucrata	alpine bladder catchfly	S1S2	N?	G5
Sisyrinchium septentrionale	pale blue-eyed grass	S2S3	N3N4	G3G4
Sparganium hyperboreum	northern bur-reed	S1	N?	G5
Spergularia salina	salt-marsh sand spurry	S2	N5?	G5
Sphenopholis obtusata	prairie wedge grass	S2	N?	G5
Spiraea splendens	pink meadowsweet	S1	N?	G5
Stellaria americana	American chickweed	S1	N1	G3G4
Stellaria crispa	wavy-leaved chickweed	S2	N?	G5
Stellaria obtusa	chickweed	S1	N2	G5
Stellaria umbellata	chickweed	S1	N2	G5
Streptopus roseus	rose mandarin	S1	N?	G5
Streptopus streptopoides	twisted-stalk	S1	N?	G5
Suksdorfia ranunculifolia	suksdorfia	S2	N?	G5
Suksdorfia violacea	blue suksdorfia	S1	N?	G4
Taxus brevifolia	western yew	S1	N4N5	G4G5
Tellima grandiflora	fringe-cups	S1	N?	G5
Thuja plicata	western red cedar	S1S2	N5	G5
Torreyochloa pallida var pauciflora	few-flowered salt-meadow grass	S1	N?	G5?T5?
Townsendia condensata	alpine townsendia	S2	N2	G4
Triantha occidentalis ssp brevistyla	western false-asphodel	S1	N?	G5T4
Triantha occidentalis ssp montana	western false-asphodel	S1	N?	G5T4T5
Trichophorum clintonii	Clinton's bulrush	S1	N?	G4
Trillium ovatum	western wakerobin	S1	N?	G5
Trisetum cernuum	nodding trisetum	S2	N?	G5
Trisetum cernuum var canescens	tall trisetum	S1	N?	G5TNR
Trisetum montanum	mountain trisetum	S1	N2	G4G5
Trisetum wolfii	awnless trisetum	S1	N1N3	G4
Tsuga heterophylla	western hemlock	S1	N5	G5
Vaccinium ovalifolium	oval-leaved blueberry	S2	N?	G5
Veronica catenata	water speedwell	S2S3	N?	G5
Viola pallens	Macloskey's violet	S1S2	N?	G5T5
Viola praemorsa ssp linguifolia		S2	N2	G5T5
Woodsia glabella	smooth woodsia	S1	N?	G5

The following explanation of global (G), national (N), and sub-national/provincial (S) ranks is modified from http://www.natureserve.org/explorer/ranking.htm#natsub. Global and national status assessments are carried out by experts from particular taxonomic groups and scientists receiving input from relevant natural heritage programs. Subnational ranks are assigned and maintained by state or provincial natural heritage programs and conservation data centers.

Global Conservation Status Ranks

Basic Ranks

Rank	Definition
GX	**Presumed Extinct** (species)—Not located despite intensive searches and virtually no likelihood of rediscovery.

	Eliminated (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	**Possibly Extinct** (species)—Missing; known from only historical occurrences but still some hope of rediscovery. **Presumed Eliminated**— (historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration.
G1	**Critically Imperilled**—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	**Imperilled**—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	**Vulnerable**—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**—Common; widespread and abundant.
G#G#	**Range Rank**—A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. A G2G3 rank would indicate that there is a roughly equal chance of G2 or G3 and other ranks are much less likely.
GU	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and a question mark qualifier may be added (e.g., G2?) to express minor uncertainty, or a range rank (e.g., G2G3) may be used to delineate the limits of uncertainty.
GNR	**Unranked**—Global rank not yet assessed.
GNA	**Not Applicable**—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Rank Qualifiers

Rank	Definition
?	**Inexact Numeric Rank**—Denotes some uncertainty about the numeric rank (e.g., G3? – believed most likely a G3, but some chance of either G2 or G4).
Q	**Questionable Taxonomy**—Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.
C	**Captive or Cultivated Only**—At present extant only in captivity or cultivation, or as a reintroduced population not yet established.

Infraspecific Taxon Conservation Status Ranks

Rank	Definition
T#	**Infraspecific Taxon** (trinomial)—The status of infraspecific taxa (subspecies

| | or varieties below the level of species) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperilled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole-for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under the U.S. Endangered Species Act, may be considered an infraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status. At this time, the T rank is not used for ecological communities. |

National (N) and Subnational (S) Conservation Status Ranks

Rank	Definition
NX SX	**Presumed Extirpated**—Species or community thought to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
NH SH	**Possibly Extirpated**—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
N1 S1	**Critically Imperilled**—Critically imperilled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
N2 S2	**Imperilled**—Imperilled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
N3 S3	**Vulnerable**—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
N4 S4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
N5 S5	**Secure**—Common, widespread, and abundant in the nation or state/province.
NNR SNR	**Unranked**—Nation or state/province conservation status not yet assessed.

NU SU	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
NNA SNA	**Not Applicable**—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
N#N# S#S#	**Range Rank**—A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
Not Provided	Species is known to occur in this nation or state/province. Contact the relevant natural heritage program for assigned conservation status.

Appendix III.

Environmentally Significant Areas and Special Features Found in the R11 Forest Management Unit

Environmentally Significant Areas and Special Features Found in the R11 Forest Management Unit

This document provides a summary of Environmentally Significant Areas and Special Features within the R11 FMU. For complete details on the definitions of ESAs and Special Features, significance levels, methodology, criteria used to identify sites, and site descriptions, the following references should be consulted:

- Sweetgrass Consultants 1997– This report is a provincial overview of ESAs as of March 1997, and is a review and synthesis of ESA work completed between 1983 and 1996. Included are sites that have been identified as being of a Provincial, National, or International significance level. The report and associated GIS data set covers almost the entire province, although portions of the Rocky Mountain Natural Region are not included. Available online at http://www.tprc.alberta.ca/parks/heritageinfocentre/environsigareas/default.aspx

- Timoney 1998 – This report is an overview of ESAs in the Rocky Mountain Natural Region, excluding Jasper National Park, and was completed in January 1998. Sites that have been identified as being of Local and Regional significance are included as well as those of Provincial, National, or International significance. Available online at http://www.tprc.alberta.ca/parks/heritageinfocentre/environsigareas/docs/esa_rocky_mountain.pdf

- Alberta Environmental Protection 1998 – This report identifies particular landforms, vegetation communities, or plant or animal species or subspecies that are limited in distribution, are small in number, or are unique examples of Alberta's natural biodiversity. Available online at http://www.tprc.alberta.ca/parks/heritageinfocentre/docs/special_features_in_alberta_report.pdf

Environmentally Significant Areas (Sweetgrass Consultants 1997)

ESA: DAVID THOMPSON CORRIDOR; FOOTHILLS
Name: Upper North Saskatchewan River
Area: 13828 ha
Location:
- Twp. 39 - Rge. 15 - W5M
- North Saskatchewan River valley downstream of Bighorn Reservoir
NTS Map Sheet: 83C
Municipality: MD of Clearwater
Natural Subregions: Upper Foothills; Lower Foothills
Significance: National
- intact interprovincial waterway
Description:
- isolated patches of montane grassland and limber pine
- calcareous wetlands including large, permanent, cold spring in LSD 4, Section 15 - Twp. 35 - Rge. 19 - W5M and "blue holes" along river
- braided stream
- Elk habitat
- potential for rare and uncommon plants

- good views of Main Ranges Thrust and the Main Range/Front Range boundary
- key winter ungulate range and movement corridor
- high wildlife species diversity
- high fish species diversity (including Bull Trout) and sport fishery
- diverse valley plant communities

Management Considerations:
- grazing by domestic animals has negative impacts on montane and calcareous spring habitats
- additional roads or uncontrolled motor vehicle access created through clearing or logging may have
- adverse impacts on wildlife populations

References:
- 1988 field notes
- Wildlife key area maps
- Rayner and Dutchak (1984)
- Fisheries inventory maps
- Jones and Workum (1978) for geology

ESA: FOOTHILLS
Name: Wapiabi Creek
Area: 8,184 ha
Location:
- Twp. 41 - Rge. 17 - W5
- valley of Wapiabi Creek
NTS Map Sheet: 83C
Municipality: MD of Clearwater
Natural Subregions: Upper Foothills; Subalpine
Significance: Provincial
- one of the most diverse and undisturbed areas in the Foothills of Alberta
Description:
- critical Elk habitat and movement corridor
- key Moose and Mule Deer range
- spawning, rearing and overwintering habitat for Bull Trout, Brook Trout and Mountain Whitefish; sport
- fishery
- key Wolf and Grizzly Bear habitat
- extensive valley bottom riparian shrubland in upper reaches
Management Considerations:
- maintenance of natural habitats will support a variety of wildlife
- Grizzly Bear are particularly sensitive to habitat fragmentation
References:
- Fisheries inventory maps
- Rayner and Dutchak (1984)

ESA: FOOTHILLS
Name: Blackstone River
Area: 5,857 ha
Location:
- Twp. 42 - Rge. 17 - W5
- Blackstone River valley
NTS Map Sheet: 83C
Municipality: MD of Clearwater
Natural Subregions: Upper Foothills
Significance: Provincial

- one of few key Grizzly Bear habitats in the Foothills of Alberta
Description:
- key ungulate habitat (Moose and Mule Deer)
- critical Elk habitat and movement corridor
- key wolf habitat
- spawning, rearing and overwintering habitat for Bull Trout, Brook Trout and Mountain Whitefish
Management Considerations:
- maintenance of natural habitats will attract a variety of foothills wildlife
- Grizzly Bear are particularly sensitive to habitat fragmentation
References:
- Bentz et al. (1995)

ESA: DAVID THOMPSON CORRIDOR; FOOTHILLS
Name: Shunda Creek
Area: 10,978 ha
Location:
- Twp. 40 to 41 - Rge. 13, 14, 15 and 16 - W5M
- generally along Shunda Creek between Goldeye Lake and junction with the North Saskatchewan
- River; includes main tributary streams, a portion of Coliseum Mountain and a portion of the Brazeau
- Rge
NTS Map Sheet: 83C
Municipality: MD of Clearwater
Natural Subregions: Upper Foothills; Subalpine
Significance: Provincial
- a provincially significant concentration of calcareous spring wetlands and associated important fish
- habitats
Description:
- coniferous and mixed wood forest and numerous spring-fed boreal fens, swamps and lakes
- Beaver dam complexes and mature white spruce forest along Shunda Creek
- riverine swamps with diverse breeding bird populations, especially west of Harlech
- Common Loons nesting on lakes and ponds
- glacially stream-lined terrain through most of western portion
- small area of aeolian sand just north of Nordegg
- Eastern Brook Trout and Brown Trout spawning and overwintering along Shunda Creek and tributary
- of Shunda Creek
- critical wildlife habitats for Elk (summer and winter) and Bighorn Sheep
- regionally uncommon birds -- Swamp Sparrow and Red-necked Grebe
- traditional Osprey nesting area at Goldeye Lake
- rare or uncommon plants including Parry's sedge (*Carex parryana*) and provincially rare plants such as
- Greenland primrose (*Primula egaliksensis*)
- key terrestrial bird habitat
- high wildlife diversity
Management Considerations:
- power boats can affect the nesting success of Common Loons
- clearing and drainage, including that on adjacent lands, reduces the habitat diversity for breeding birds
- developments (e.g. roads, seismic) in the watershed, even those outside the study area, can disrupt
- natural drainage patterns and adversely impact important fish, plant and animal habitats
- additional roads or uncontrolled motor vehicle access created through petroleum development,

- clearing or logging may have adverse impacts on wildlife populations

References:
- 1988 field notes
- Fish and Wildlife key area maps
- Nordegg-Red Deer River Sub-regional Integrated Plan
- Bayrock and Reimchen (1980) for surficial geology
- Don Anderson (personal communication) for fish, Osprey and springs

ESA: FOOTHILLS
Name: North Ram River
Area: 10,608 ha
Location:
- Twp. 38 - Rge. 13 - W5
- valley of North Ram River

NTS Map Sheet: 83B
Municipality: MD of Clearwater
Natural Subregions: Upper Foothills; Subalpine
Significance: Provincial
- one of the most diverse Foothills streams

Description:
- key ungulate habitat (Bighorn Sheep, Elk and Mule Deer)
- important movement corridor
- includes the ecologically significant area along the North Ram River that contains diverse plant
- communities including shrublands, meadows, forest and peatlands
- high fish species diversity (including Bull Trout); sport fishery

Management Considerations:
- maintenance of natural habitats will support a variety of wildlife

References:
- Fisheries inventory maps
- Key Wildlife Area Maps
- Rayner (1984)

ESA: FOOTHILLS
Name: Ram River
Area: 9,334 ha
Location:
- Twp. 37 - Rge. 13 - W5
- valley of Ram River

NTS Map Sheet: 83B
Municipality: MD of Clearwater
Natural Subregions: Upper and Lower Foothills
Significance: Provincial
- one of the most diverse Foothills streams in Alberta

Description:
- key ungulate habitat (Bighorn Sheep, Elk and Mule Deer)
- important movement corridor
- includes Ram Falls, a unique landform feature
- high fish species diversity (including Bull Trout); sport fishery

Management Considerations:
- maintenance of natural habitats will support a variety of wildlife

References:
- Rayner (1984)
- Wildlife key area maps

- Fisheries inventory maps

ESA: MONTANE
Name: Ya-Ha-Tinda
Area: 2,477 ha
Location:
- Twp. 32 - Rge. 12 - W5
- Ya-Ha-Tinda Ranch on the Upper Red Deer River
NTS Map Sheet: 82O
Municipality: MD of Clearwater
Natural Subregions: Montane
Significance: Provincial
- one of the two largest Elk wintering areas in Alberta
Description:
- extensive montane grassland
- Bighorn Sheep, Wolf, Grizzly Bear and Cougar habitat
- popular recreation area
Management Considerations:
- maintenance of natural habitats will support the greatest diversity of native species
- overgrazing by horses has been a problem in the past
References:
- Alberta Environmental Protection (1995)

ESA: FOOTHILLS
Name: Upper Red Deer River
Area: 4,700 ha
Location:
- Twp. 31 - Rge. 10 - W5
- valley of the Red Deer River
NTS Map Sheet: 82O
Municipality: MD of Clearwater
Natural Subregions: Upper and Lower Foothills
Significance: Provincial
- one of the most diverse river valleys in the Foothills of Alberta
Description:
- key winter ungulate habitat and travel corridor
- high wildlife species diversity
- sport fishery (including Bull Trout, Brook Trout and Mountain Whitefish)
- important migration corridor for Mountain Whitefish
- diverse shrubland and riparian plant communities
- important recreational watercourse
- Critical Wildlife Zone
Management Considerations:
- maintenance of natural habitats will support a variety of wildlife
References:
- Bentz and Karpuk (1990)
- Fisheries inventory maps

ESA: DAVID THOMPSON CORRIDOR; MONTANE
Name: White Goat Lakes
Area: 203 ha

Location:
- Twp. 37 - Rge. 18 - W5M
- west and north of Cline River resort

NTS Map Sheet: 83C

Municipality: MD of Clearwater

Natural Subregions: Montane

Significance: Provincial
- one of the most diverse and productive calcareous wetlands in Alberta

Description:
- extensive calcareous wetlands, springs, meadows and open water
- calcareous tufa deposits in White Goat Lakes
- uncommon plants including dwarf Canadian primrose (*Primula mistassinica*) and (*Salix calcicola*)

Management Considerations:
- disruption of groundwater flow or use by grazing animals can have negative impacts on the spring
- ecosystems

References:
- 1988 field notes

ESA: MONTANE; DAVID THOMPSON CORRIDOR

Name: Kootenay Plains

Area: 13,587 ha

Location:
- Twp. 35 to 37 - Rge. 17 to 18 - W5M
- valley bottom along the North Saskatchewan River

NTS Map Sheet: 83C

Municipality: MD of Clearwater

Natural Subregions: Montane; Subalpine

Significance: Provincial
- the largest, most diverse area of disjunct Montane vegetation in Alberta
- largest populations of *Haplopappus uniflorus* in Alberta

Description:
- large, diverse area of disjunct Montane habitat
- extensive grassland, limber pine and Douglas fir
- rare calcareous spring wetlands and cliff habitats
- spring Grizzly Bear habitat on south-facing slopes
- Elk wintering area
- Spotted Frog habitat (rare species in the region)
- classic braided streams
- silt dunes
- numerous rare and uncommon plants including: moonwort (*Botrychium sp.*), slender lip fern
- (*Cheilanthes feei*), cliff brake (*Pellaea glabella*), Franklin's sedge (*Carex franklinii*) cottongrass
- (*Eriophorum scheuchzeri*), Alaska willow (*Salix alaxensis*), glandular Labrador tea (*Ledum*
- *glandulosum*), dwarf Canadian primrose (*Primula mistassinica*), one-flowered ironplant (*Haplopappus*
- *uniflorus*)
- numerous disjunct grassland or montane plant species
- geological section at Whirlpool Point with representation of the Bourgeau/Siffleur Thrust

Management Considerations:
- grazing by horses can result in a reduction in diversity of plant species in the grassland
- off-highway vehicle use has adverse effects on grassland vegetation and wildlife
- Grizzly Bear are particularly sensitive to habitat fragmentation

References:
- 1988 field notes

- Fish and Wildlife (personal communication)
- Wallis and Wershler (1981) for Kootenay Plains
- Nordegg-Red Deer River Sub-regional Integrated Plan
- Jones and Workum (1978) for geology

ESA: FOOTHILLS; CLEARWATER
Name: Clearwater River
Area: 38,036 ha
Location:
- Twp. 35 to 39 - Rge. 6 to 12 - W5M
- Clearwater River valley from Dovercourt area to west of Ricinus
NTS Map Sheet: 83B
Municipality: MD of Clearwater
Natural Subregions: Upper and Lower Foothills; Dry Mixedwood
Significance: Provincial
- one of the most diverse and productive Foothills streams in Alberta
Description:
- key Elk, Mule Deer and White-tailed Deer habitat
- Osprey nesting sites
- key movement corridor
- high fish diversity (including Bull Trout) and sport fishery
- Eastern Brook Trout, Brown Trout, and Mountain Whitefish
- includes Edmond's and Rauch Springs, two of Alberta's larger springs
- includes Clearwater-Ricinus and Chedderville Natural Areas
- braided stream floodplain and valley habitats
- diverse riparian woodland, shrubbery and back channel wetlands along the Clearwater River
- variety of breeding birds
- includes Clearwater-Ricinus and Chedderville Natural Areas
Management Considerations:
- heavy grazing, clearing and cultivation will reduce the attractiveness of the area for wildlife and fish
References:
- 1991 field notes
- Fish and Wildlife key area maps
- Natural and Protected Areas Program files
- Nordegg-Red Deer River Sub-regional Integrated Resource Plan
- Borneuf (1983) for springs

Environmentally Significant Areas (Timoney 1998)

Name	Level of Significance	Reason for Significance
North Saskatchewan Gap	National	River existed before upheaval of mountains and withstood uplift to create canyon
WMU 418	National	Elk winter range; supports large numbers of wolves; occurrence of extra-limital rough fescue and Stipa comata grasslands at Ya Ha Tinda; Bighorn Falls; Scalp Creek and Eagle Creek Natural Areas
Brazeau River/Job Creek	Provincial	Major river valleys provide connectivity to Banff and Jasper National Parks; diversity of wildlife; cutthroat spawing at outlet of Job Lake
Wapiabi Cave	Provincial	Hibernaculum for little brown and long-legged bats
White Goat Wilderness	Provincial	Prime subalpine and alpine riparian habitat; rare plants;

Area/Cline River & tributaries		small glaciers; Pinto Lake/other small lakes; popular with recreationists
Kootenay Plains and vicinity	Provincial	Disjunct montane ecoregion; riparian mudflats; landscape around Whirlpool Point; dune fields; marl wetlands; limestone/dolomite cliffs; history of native use; key ungulate habitat; rare plants/vegetation types
North Saskatchewan River Valley	Provincial	Key riparian habitat; major east/west corridor for weather systems and biota migration and movement; rare plants
Ram Mountain	Provincial	Cordilleran outlier, prime bighorn sheep range and scientific study area; relatively undisturbed habitat supporting deer, moose, elk, cougar, and wolf
Ram-Whiterabbit	Provincial	High quality riparian and valley habitat for movement and migration; prehistoric cultural sites along Clearwater River; fossils near Hummingbird and Onion Creeks
Siffleur Wilderness Area and North Saskatchewan Connection	Provincial	Spectacular subalpine and alpine wilderness; diversity of large mammal species
Clearwater River	Provincial	(Most of area is outside FMU in Banff National Park) hoodoos; tracts of permafrost; rare plants; ungulate mineral licks; elk fall range; bighorn sheep summer and winter range; wolf habitat; prehistoric cultural sites
Panther Corners	Provincial	High quality ungulate habitat; historic native campsites
Shunda Mountain	Regional	Cordilleran outlier; critical wildlife zone; popular with recreationists; rare plants; view of geomorphic features makes it popular for educational field trips
Colliseum Mountain	Regional	Cordilleran outlier with a classic amphitheatre; critical wildlife zone; popular with recreationists; rare plants
WMU 430	Regional	Critical habitat for woodland caribou, bighorn sheep, mountain goat, and wolf
White Goat Lakes	Regional	Calcareous rich fen fed by shallow stream; rare plants; within Development Node so facing pressure
Tarpeian Rock/Opabin Creek	Regional	Subalpine and alpine area with riparian old-growth forest; rugged and scenic Tarpeian Rock

Special Features (Alberta Environmental Protection 1998)
(SPCAN – Special Places candidate site; SPNOM – Special Places Nominated site; PNT – under Protective Notation)

SF27. **Clearwater River West**: 3 rare plants – (PNT, SPCAN, SPNOM), integrity needed verification
SF 29. Ya-Ha-Tinda; (PNT, SPCAN, SPNOM) many rare plants, patterned ground, waterfalls, rock labyrinths, Biscuit Board Topography.
SF 30. **Kootenay Plains Ecological Reserve Extension** (SPCAN, SPNOM) –montane, includes a number of rare plants.
SF 31. White Goat Lakes: outstanding, at risk (SPCAN, SPNOM); rare sp. (vascular, non-vasc. plants, limber pine community).
SF 35. **Coliseum-Shunda Mtn**. (rare, outstanding, at risk) (PNT, SPNOM): many rare plants (includes *Anemone quinquefolia* and *Rhododendron lapponicum*), spring fen, rock labyrinths
SF 53. Ram River Falls /Canyon: waterfalls, gorges/canyons, Plunge Pool lakes (outstanding, rare, SPCAN, SPNOM)
SF 54. Bighorn Mountain / South Ram: four rare plant species, including *Rhododendron lapponicum* (SPCAN, SPNOM), integrity needed verification
SF 55. Landslide Lake Landslide Lakes (outstanding, PNT, SPCAN, SPNOM)
SF 252. Wapiabi Cave: (SPCAN, SPNOM) Karst Caves, long-legged bat; (outstanding), integrity needed verification