4.4.02

# FOOTHILLS MODEL FOREST

## IOSTE TOUR

International Organization of Science and Technology Education

**FOOTHILLS MODEL FOREST**
**WELDWOOD OF CANADA**
**AUGUST 20, 1996**

Weldwood

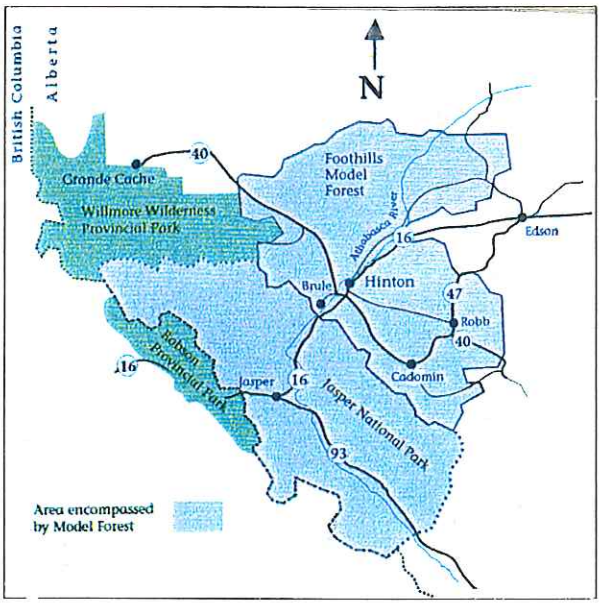
Weldwood of Canada Ltd.
Hinton Division

# FOOTHILLS MODEL FOREST PROGRAM OVERVIEW

The Foothills Model forest is one of 10 Model forests that make up Canada's Model Forest Network. The network is funded as part of the "Partners in Sustainable Development of Forests" program, administered by the Canadian Forest Service of Natural Resources Canada.

The Partners in Sustainable Development of Forests program was developed to demonstrate Canada's commitment to sustainable development and to maintain the health of our forests for the benefit of people everywhere.

The sponsoring partners are committed to achieving this mission by incorporating values such as conservation, cooperation and integrated resource management into the Foothills Model Forest program.




The Foothills Model Forest is a non-profit corporation, founded on November 12, 1992 under Part 9 of the Companies Act of Alberta. The Board of Directors has overall responsibility for the Foothills Model Forest program and is comprised of 10 members from the sponsoring partners, Jasper National Park and 2 elected members from the Partners Advisory Committee.

An Executive Committee, comprised of local representatives from the Board of Directors who represent the sponsoring partners, meet regularly to expedite the delivery of the Annual Work Plan.

The Partners Advisory Committee is a 12 member group made up entirely of elected representatives from the larger partner coalition. this group, working in conjunction with the Project Steering Committee, are responsible for helping to identify any potential information gaps that may exist in the development of work plans and making recommendations to the Board of Directors on proposed plans and activities.

The Project Coordinator, a full-time forester seconded from the Department of Environmental Protection, and Administrator, in conjunction with the Project Steering Committee, are responsible for the overall coordination and continuity of the Foothills Model Forest program. The Project Steering Committee, with representation from Weldwood of Canada Limited, the Environmental Training Centre, Alberta's Land and Forest Service and Fish and Wildlife, and Jasper National Park prepare the annual work plans, five year work plans and submissions for the annual report.

The projects and activities of the Foothills Forest Model Forest are delivered by full-time staff including a GIS (Geographic Information Systems) analyst, wildlife biologist and technician, forest operations coordinator, watershed coordinator, communications officer and a half-time partner liaison/communications officer. Research opportunities have also been created for 16 graduate students as well as a number of research assistants from the University of Alberta, University of Calgary, and the University of Guelph.

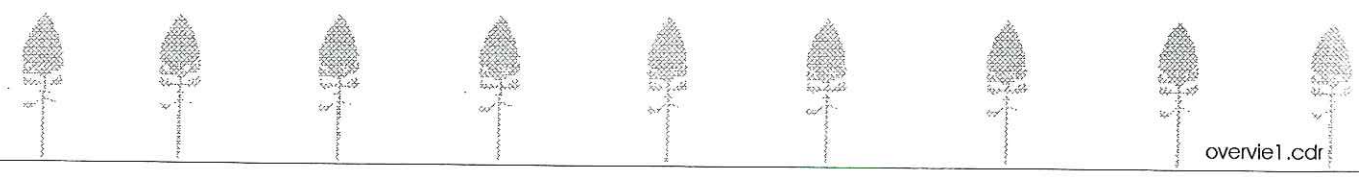
# PROGRAM OVERVIEW

Jasper National Park has also devoted one full-time position to the Model Forest program to coordinate joint projects.

The Foothills Model Forest program is directed towards the following strategic initiatives:

- integrated resource management and sustainability
- information, research and knowledge
- partnerships
- communications

From these initiatives a series of projects and activities were developed including resource inventories, ecological land classification, decision support system development, water-shed research/modeling, integration of commercial and non-commercial forest uses, evaluation of alternative harvest and silviculture techniques, computerized planning/mapping and training tools, socio-economic research, public information and partnership development and involvement.



# FOOTHILLS MODEL FOREST OFFICERS AND BOARD OF DIRECTORS

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Land and Forest Service

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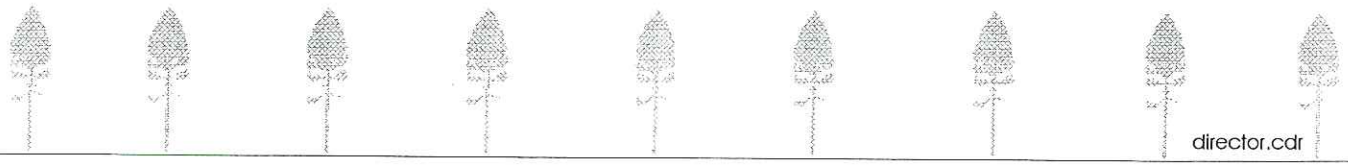
Land and Forest Service

Don Laishley
Director, Forest Strategy
Weldwood of Canada Limited

Ex-officio Member
Bob Newstead
Model Forest Coordinator

### FOOTHILLS MODEL FOREST FUNDING PROFILE

The Foothills Model Forest receives its primary funding from Natural Resources Canada, Canadian Forest Service, through Canada's Model Forest Program. Considerable support is also provided by the three sponsors of the Foothills Model Forest: Weldwood of Canada Limited (Hinton Division), the Province of Alberta (Department of Environmental Protection, Environmental Training Centre (in Hinton), and Parks Canada (Jasper National Park).



director.cdr

# LIST OF AGENCIES PROVIDING DIRECT AND IN-KIND SUPPORT FOR THE FOOTHILLS MODEL FOREST

## Ecological Classification and Landscape Forecasting

Alberta Research Council
ESRI Canada
Natural Resources Canada - Canadian Forest Service
    Canada's Model Forest Program
The Forestry Corp
University of New Brunswick
Weldwood of Canada Ltd. (Hinton Division)

## Forestry Program

Alberta Environmental Protection
    Alberta Environmental Centre
    Environmental Training Centre
    Land and Forest Service
Natural Resources Canada - Canadian Forest Service
    Canada's Model Forest Program
    Northern Forestry Centre, Edmonton
University of Alberta - Department of Renewable Resources
Weldwood of Canada Ltd. (Hinton Division)

## Socio-economic Research Program

Natural Resources Canada - Canadian Forest Service
    Canada's Model Forest Program
    Northern Forestry Centre, Edmonton

## Watershed Program

Alberta Environmental Protection
    Fisheries Management Enhancement Fund
    Forest Resources Improvement Program (FRIP)
    Natural Resources Service - Fish and Wildlife Division
    Land and Forest Service - Watershed
    Surface Water Assessment Branch
Forest Resources Improvement Fund (FRIP)

## Wildlife Habitat and Fire Ecology Program

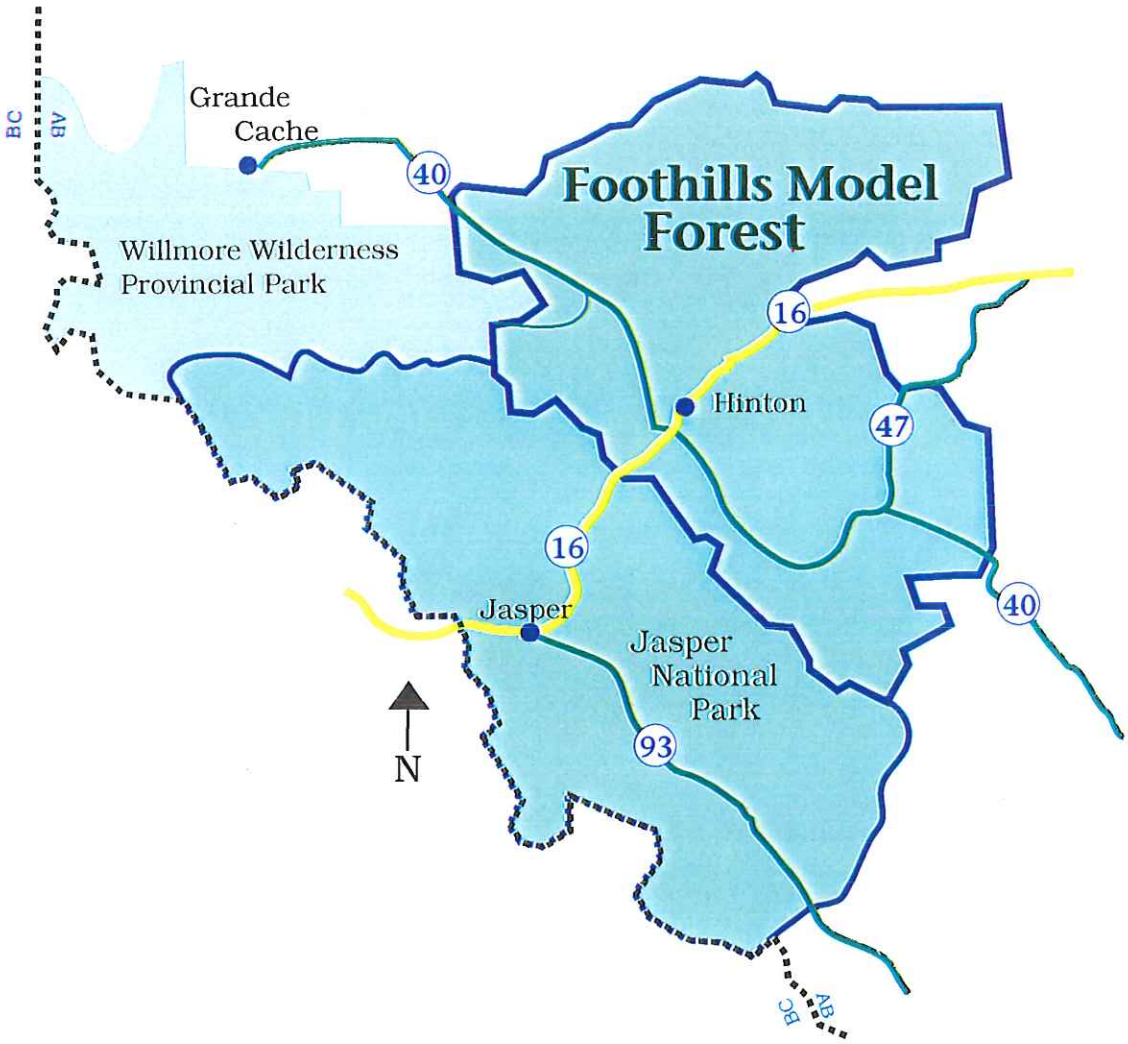
Alberta Advanced Education and Career Development (STEP)
Alberta Environmental Protection
- Land and Forest Service
- Natural Resources Service - Fish and Wildlife
- Wildlife Management Enhancement Fund

Alberta Recreation, Parks and Wildlife Foundation
Canada - Alberta Partnership Agreement in Forestry (PAIF)
Canadian Wildlife Service
- Prairie and Northern Region
- Prairie and Northern Wildlife Research Centre

Forest Resources Improvement Fund (FRIP)
Hinton Fish and Game
Parks Canada - Jasper National Park
Natural Resources Canada - Canadian Forest Service
- Canada's Model Forest Program
- Decision Support System Initiative

Natural Sciences and Engineering Research Council of Canada (NSERC)
Nova Gas Transmission Ltd.
Rocky Mountain Elk Foundation
University of Alberta
- Canadian Circumpolar Insititute
- Department of Biological Sciences
- Department of Renewable Resources

University of Guelph - Department of Zoology
Weldwood of Canada Ltd. (Hinton Division)
Weyerhauser Canada Ltd.


BC
AB
Grande
Cache
40
Foothills Model
Forest
Willmore Wilderness
Provincial Park
16
Hinton
47
16
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Jasper
Jasper
National
Park
93
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BC

# IOSTE
# (INTERNATIONAL ORGANIZATION OF SCIENCE AND TECHNOLOGY EDUCATION)
# TOUR
## AUGUST 20, 1996
## TOUR HIGHLIGHTS

### STOP 1 GREGG CABIN - LANDSCAPE DISTURBANCE RESEARCH AND LUNCH

An historic Dominion Forest Service Cabin is in the centre of a number of interpretive features on the ecology and reforestation of lodgepole pine. Fire origin lodgepole pine, both mature and 40 years old, successes and challenges in reforestation, and the 50 millionth tree plantation are featured.

### STOP 2 GREGG RIVER DEMONSTRATION PROJECT

The floodplains along streams and rivers, called riparian areas, have many values, including fish and wildlife habitat, recreation, water quality, and historic/cultural significance. The Gregg River Demonstration Project is an example of managing watercourse corridors for multiple values.

### STOP 3 MINE SITE

Cardinal River Coals Ltd. is another partner that shares the Foothills Model Forest landbase. Like other organizations that use out natural resources, Cardinal River Coals is responsible for restoring the land and allowing Alberta's native plant and wildlife species to return to the area.


Athabasca W.C.
McLeod W.C.
STOP 1
STOP 2
STOP 3
HINTON
JASPER
BRULE
ROBB
MARLBORO
MERCOAL
LOVETT
Obed Mountain Coal
Gregg River Coal
C.R.C. Luscar
W.A. Switzer Provincial Park
Jasper-Hinton Airport
Wildhorse Lakes
Mary Gregg Lake
Peppers Lake
Cregg Lake
Jarvis Lake
Obed Lake
Sucker Lake
Millers Lake
Fickle Lake
Mystery Lake
Moberly
Obed
Athabasca
Yellowhead
Luscar-Sterco
WILDHAY
RIVER
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# GREGG RIVER CABIN

## THE GREGG CABIN

In 1911, the Dominion Forestry Service established the Rocky Mountain Forest Reserve all along the foothills. Hinton was the headquarters for the Athabasca Reserve, and the Gregg Cabin was built around 1927. It was one of a series of cabins about one day's ride apart on a trail system which stretched form the U.S. border through the foothills and front ranges to Hinton. The cabins were built to provide shelter for Dominion rangers on horseback patrol. In the early 1970's the Hinton Junior Forest Wardens reclaimed that portion of the one of these trails, the Bighorn Trail, which stretches from here to Hinton, following the top of the Bighorn Ridge which can be seen on the north side of the valley. Weldwood now maintains the trail.

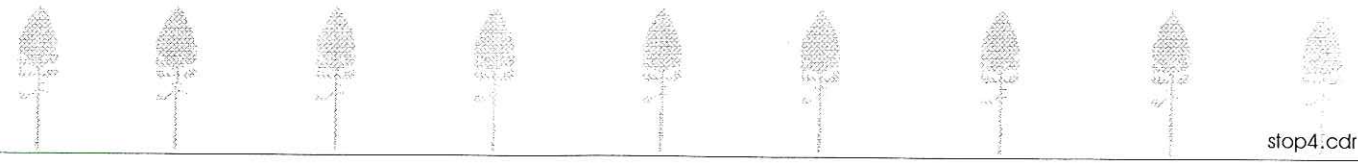
In 1930, control of the Rocky Mountain Forest Reserve was passed over to the Government of Alberta, and the Alberta Forest Service was born (now Land and Forest Services as of 1993). So this site is symbolic of the co-operation which existed during that transition period, as well as the continuing good relations between Forestry Canada, the Alberta Land and Forest Services and Weldwood Hinton Division. The site is maintained cooperatively by Weldwood and the Alberta Land and Forest Services.

Company operations began in this valley in the early 1960's, and the results of our reforestation efforts are displayed in the hills along both sides of the valley. It is also in this valley where we began spacing young pine regeneration to improve growth.

## FIRE ECOLOGY

Fire at a catastrophic scale has shaped the forests of the Rocky Mountain Foothills. On a historic average before modern fire suppression efforts, the fires would occur frequently enough to burn the entire area every 40 - 50 years. See attached article by Professor Murphy. Of course, some areas burned more frequently than this and others escaped fire for much longer periods. This massive and regular release of sequestered carbon into the earth's atmosphere is typical of natural processes in the unmanaged forest. Modern forest management has largely eliminated such occurrences.

In the summer of 1956 there were three major forest fires on the FMA. The young, 39 year old forest on the south side of the valley originated from one of these fires, one which consumed 8,700 ha. of mature timber. Since that wakeup call, fire prevention and suppression efforts were increased, and have been very successful. As a result, the forests of the FMA are probably older today on average than they have been for many centuries. The Gregg River Fire in 1956 was one of the last major fires.



The plant and wildlife species native to this area are adapted to fire ecology and frequent major disturbances. The cones of lodgepole pine require a temperature of about 50 degrees Celsuis to open and release their seeds. Mature cones wait many years of the adult trees for a heat source. When a fire comes, the intense heat opens the cones, which spill their seed into the ashes. The lodgepole pine is truly a phoenix tree, with new seedlings rising from the ashes and seeds of their parents.

In fact, lodgepole pine cones spill so much seed after a fire that the number of seedlings is enormous, amounting to several hundred thousand per hectare. For many years the seedlings struggle against their neighbors for light and nutrients. As a result, young fire origin pine stands are very dense, and growth of individual trees is often stunted.

Thirty-nine years after the fire, the Gregg Burn is covered with a dense coat of mainly lodgepole pine and black spruce. The pine needs full sun to grow, while black spruce can grow in partial shade under the faster-growing pine. If another fire or logging does not occur, the pine would eventually die of old age and the area would be occupied by black and white spruce and subalpine fir, which all can tolerate partial shade conditions.

## FIRE VERSUS LOGGING

Patch logging in mature pine stands can be used to imitate the natural fire disturbance patterns. Lodgepole pine cones close to the ground after logging will open in the hot sun and their seed will grow if mineral soil is exposed by scarification. Wildlife that prefer early successional habitat will also colonize the logged areas in the early years.

However, fire and logging are not the same. Fire often leaves snags and logs that were not totally burned - these usually are removed and used when the area is logged. Fire can also burn much of the carbon-storing organic material on the soil surface, material that remains long after logging. There are a number of differences also. The challenge to managers is to understand the differences and their impact on the forest ecosystems of the area.

## FOREST RECREATION

Weldwood constructed the Pine Management Trail in the late 1970's as an interpretive hiking and ski trail which traverses a number of experiments in the Gregg Burn, as well as reforestation established following harvesting. Public use of this trail system in the winter has declined since the Athabasca Nordic Centre was developed near Hinton, and the trail is no longer maintained for skiing. A new project is underway to renew the trail for summertime hiking and interpretive purposes.

The original forests in the Gregg River valley have been mainly logged over and reforested, and it is now one of the most popular camping areas for visitors and tourists.

# STOP 1

## 50 MILLIONTH TREE COMMEMORATIVE PLANTING

Just East of the Cabin, Weldwood's 50 millionth tree was planted on June 8, 1991. The Company plans to continue to use this site to mark significant benchmarks in it's forest management history. On each such occasion, a small clearing will be made in the forest, and a children's grove planted, along with a commemorative tree. In future years, those children who participate will be able to return here and track the progress of their plantations.

## WILDLIFE

A forest fire is a catastrophe for wildlife as well as for the trees. Some species that occur only in mature forests will be absent for many years following a major fire, while other will adjust and continue to occupy the area. An even greater number of species will thrive for a time in the early years after a fire. Because disturbances occur so frequently, many of the species native to the area do best in the early years. As the forest grows older, they will be replaced by species that prefer habitat conditions associated with older forests.

At this stage, many of the species that found good habitat after the fire are starting to decline. Much of the shrub and herbaceous plant cover needed by browsers such as moose or grazers like elk and deer has been shaded out by the dense pine canopy or grown too tall to reach. Snowshoe hares are still abundant during peak years of their population cycle, and their major predators like lynx and great horned owls will respond to hare numbers.

Because the forest is very dense and quite homogenous, relatively few bird species find conditions now to their liking. This also applies to most of the mammal species. As the forest grows older and becomes more diverse, other species will come back to the area.

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# STOP 1

## ECOSYSTEM RESPONSE TO FOREST DISTURBANCE BY FIRE AND LOGGING

### OVERVIEW

The Foothills Model Forest has begun a research program to assess the response of forest ecosystems to disturbance by logging and by fire. Past forest fires have been important events in the history of the Foothills Model Forest, resulting in a patchwork mosaic of forest stands of different ages. The effects of fire on ecosystem processes and biodiversity are not well understood, making it difficult to know the effects of activities such as fibre harvesting, which has replaced fire as the dominant disturbance agent in the Rocky Mountain foothills. The objective of this research program is to estimate the variability in forest structure within two recent burns in the Foothills Model Forest, and to compare structure in burned stands with logged stands. Forest structure in this project is estimated in terms of the density and size of standing and fallen dead trees. By understanding the effects of major ecosystem processes (burning and logging) on important forest structures (dead trees), land management agencies would be able to apply "coarse filter" management techniques that attempt to sustain ecosystem productivity and biodiversity by approximating the effects of naturally occurring processes such as forest fire.

### BACKGROUND

Disturbance to forest ecosystems can range from the falling of individual trees, to catastrophic forest fires affecting many thousands of hectares. Much of the biodiversity in Canada's forest ecosystems is the result of historical patterns of disturbance size, frequency, and intensity. Cultural activities in the Rocky Mountains region have altered natural disturbance processes, through fire ignition and fire control in protected areas such as Jasper National Park, plus logging and fire control in the adjacent foothills. The two major disturbance types, fire and logging, are not identical and the responses of wildlife and other resources are likely different, with uncertain impacts on future biodiversity. This proposal addresses this information gap by estimating the forest structure and composition in forests burned by fire, and comparing them with areas disturbed by logging. Because obtaining a complete inventory of structural and compositional attributes in a forest ecosystem is impractical, we are using three indicators, namely standing dead trees, fallen trees, and small mammals. Standing and fallen dead trees provide important habitat structures in forest stands, and decomposition plays a significant role in nutrient cycling. Forest wildlife such as mice and voles may depend on a sufficient supply of snags and coarse woody material, and understanding these dependencies will also advance prospects for successional integration of forestry with wildlife habitat. This work is part of a growing program that may include operational trials to assess the relative costs and resource benefits associated with management approaches and methods that encourage or more closely resemble the disturbances caused by forest fire.

### PROJECT DESCRIPTION

Phase 1: Estimate the density and size-class distribution of standing and fallen dead trees in 10 pairs of research plots along the northwest boundary of the 1956 Gregg River Burn south of Hinton. One plot in each pair is located within the burn, the other is located within an adjacent stand that was harvested by clearcutting between 1963 and 1974. A small mammal live-trapping program was also completed in order to estimate relative abundance and species composition. Using statistical analyses for paired samples, differences in dead trees and small mammals will be estimated and compared between the two types of stands (burned and logged).

Phase 2: Estimate the density and size of standing and fallen dead trees in 30 randomly selected locations in the 8,700 hectare Gregg River Burn (1956). Combined with analyses of aerial photos taken in 1955, this phase will permit estimation of the range of variability in forest condition after a single disturbance event (Gregg River Fire) in the context of pre-burn forest conditions.

### PROJECT DESCRIPTION

Financial support for this project is provided by Natural Resources Canada (Canada's Model Forest Program), Canadian Heritage (Jasper National Park), and partner agencies of the Foothills Model Forest.

# GREGG RIVER DEMONSTRATION PROJECT

## (Integrated Resource Management: Wildlife; Riparian Zone Management)

### HARVESTING AND TIMBER MANAGEMENT

River valleys, or riparian zones, are sensitive areas representing about 5% of the landbase of Weldwood's Forest Management Agreement. This figure does not incorporate the riparian areas found in Jasper National Park or the Prime Protection Zone. They provide multiple values that include water supply and quality, wildlife and fisheries habitat, recreation and timber. In theory, all the landbase outside a 60 m buffer on each side of the high water mark is part of the allowable cut landbase managed primarily for the production of timber. But in fact, Weldwood is required to conduct its activities in timber management with sensitivity for other priority values. This usually means some modification of harvest practice. Forests in riparian zones are very complex ecosystems, and past attempts to manage them with conventional clear cuts have often resulted in difficult reforestation challenges.

Key priorities in management include:

- → retrieve fibre/maintain contribution to the Allowable Annual Cut
- → retain visual quality from the river
- → maintain wildlife habitat presently supplied
- → improve reforestation effectiveness
- → maintain watershed values

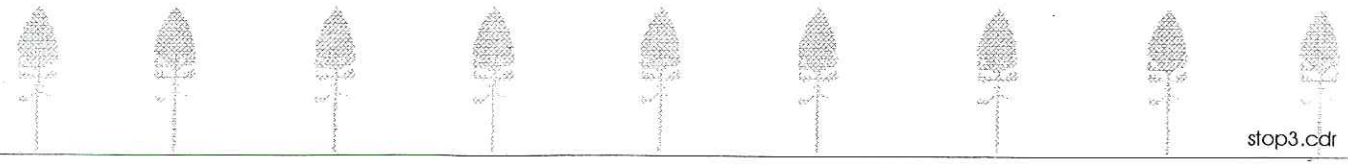
This area was logged, using both horse logging and single grip, low ground pressure harvest systems, as an experiment to examine ways to manage for multiple uses in sensitive areas. There are seven areas with a variety of forest conditions. In each area, logging was carefully fitted to the site to ensure tree removal protected other resource values. This included small patch cuts, selection logging in spruce, retention of snags and deciduous trees for wildlife habitat, and operating during winter to reduce soil disturbance. Concerns over the lack of adequate seed and seed bed preparation, as well as less than optimal crown removal led to preparation of the site with an excavator in 1994, and planting with spruce in 1955.

An old telephone line insulator was found nailed in one of the younger trees in this area - dating from about 1925. This suggests some of the younger trees in these stands may have originated from logging which is known to have been done in these river valleys in early times.

### WILDLIFE HABITAT

This stand is occupied by many wildlife species associated with old-growth spruce forest, including pileated woodpecker, brown creeper, varied thrush, marten and mink. It also provides winter cover for white-tailed deer.

Partial cutting in the stand has helped to retain many of the structural habitat features required by species that used the stand prior to harvest. In addition, the quality of deer winter range should be improved as food plants respond to the increased light on the forest floor. Wildlife species that specialize in open forest stands should also find the new conditions attractive - these include American kestrel and olive-sided flycatcher.



# STOP 2 SITE A

## ECOLOGICAL ASSESSMENT OF A RIPARIAN AREA (SITE A)

| | | |
|---|---|---|
| **Natural Subregion:** | Upper Foothills | |
| **Ecological Classification:** | Complex: e4 bracted honeysuckle Sw / fl horsetail Sw | |
| **Plant Species Present:** | e4: white spruce, blasam poplar, rose, buffaloberry, river alder, salix, twinflower, palmate-leaved coltsfoot, horsetail, various grass species<br>fl: white spruce, balsam poplar, salix, river alder, bracted honeysuckle, horsetail, various grass species, feathermosses | |
| **Site Characteristics** | e4 | fl |
| **Moisture Regime:** | mesic | subhygric-hygric |
| **Nutrient Regime:** | medium-rich | medium-rich |
| **Topographic Position:** | level | level-depressional |
| **Soil Characteristics:** | rhizomull | - |
| **Humus Form:** | sand | - |
| **Surface Texture:** | sand | - |
| **Effective Texture:** | well | - |
| **Drainage:** | fluvial | fluvial |
| **Parent Material:** | Cumulic Regosol | - |
| **Soil Subgroup:** | SM1 | - |
| **Soil Type:** | | |

### ECOLOGICAL OVERVIEW

This riparian area is described as an e4/fl complex "Complexing" or forming a "compound unit" as it is sometimes referred, is a useful tool for mapping purposes. Complexes are most effectively used when they refer to a heterogenous area consisting of two ecosites and when ecological units are too small to map as separate units. Precise geographical references are lost for each ecosite phase when complexing is employed but important ecological information is maintained.

On this site, a complex unit exists because several factors are working together to influence its ecological variability. The major factors include:

1. water table fluctuations due to seasonal influences
2. the coarse textured soil
3. elevational variability
4. solar radiation variability

This riparian area adjacent to Gregg River is strongly influenced by changes in the water table level. It is expected that in the spring and during heavy rainfall periods, water table levels rise close to the surface supplying plant roots with an excess amount of moisture. In the fall or during drought periods of the summer, water table levels recede and may temporarily limit plant water availability on higher elevational areas. Elevational differences within the riparian area is caused by the erosional and depositional effects of recent and old flood events.

## ECOLOGICAL OVERVIEW CONT'D

The coarse textured soil increases the degree of moisture variability along elevational gradients due to its poor ability to absorb, and to draw water up from greater depths. Consequently, low or depressional areas tend to be wet and are associated with the horsetail ecosite (f) while higher areas are moist and are associated with the bracted honeysuckle ecosite (e).

Plant species composition on the bracted honeysuckle ecosite (e) component of this site is not typical because of the unique site and soil factors mentioned above.

Plate 6
**River alder: a shrub species characteristic of the bracted honeysuckle ecosite of the Upper Foothills.**

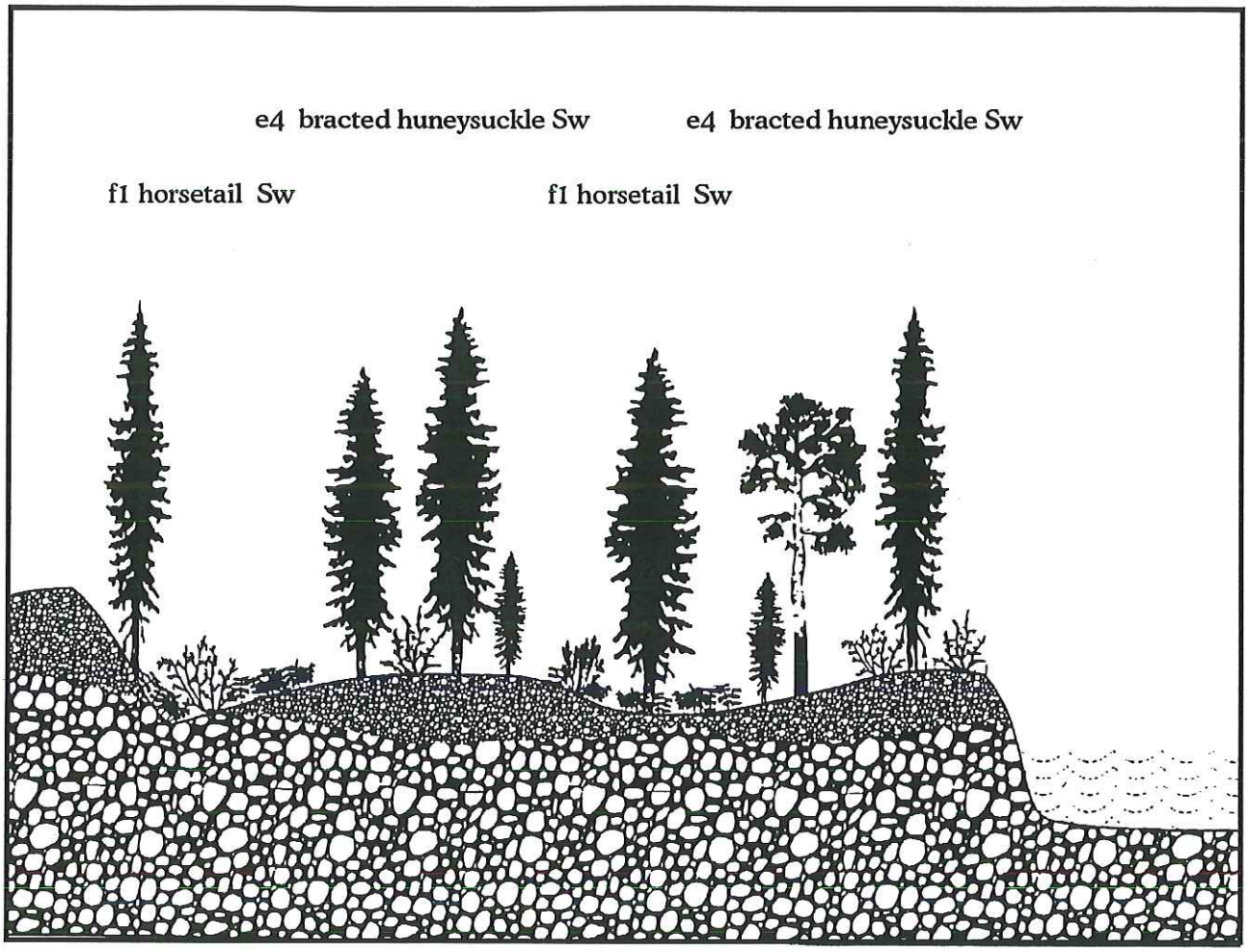



Figure 6.1

Landscape profile diegram at Stop 3, Site A showing the topographic relationship between the bracted honeysuckle ecosite (e) and the horsetail ecosite (f) of the Upper Foothills.

## MANAGEMENT INTERPRETATIONS

Shrub and grass competition is common on bracted honeysuckle and horsetail ecosites. Since these ecosites are typically moist to wet, and rich, once partial or complete canopies have been removed, density of understorey plant growth increases.

Site preparation within this riparian zone has created an ideal micro-climate for white spruce seedling growth. Exposed mineral surfaces offer the seedlings a chance to grow in an ideal location which is warm and free of intense competition for at least a portion of their most critical growth period.

## OVERVIEW OF ECOLOGICAL SITE CLASSIFICATION OF WEST-CENTRAL ALBERTA

A forest-ecosystem classification system is being developed for west-central Alberta using vegetation, soil and forest productivity information. This system is intended to provide a framework for organizing and understanding ecological information as a basis for ecologically based sustainable integrated resource management. The ecological classification system employed is hierarchical consisting of five levels (natural region, natural subregion, ecosite, ecosite phase and plant community type) (Figure 3.0) and are described as follows:

**Natural Region**: Broad geographic area separated on the basis of the broad landscape patterns of vegetation, soil and landform. In west-central Alberta two natural regions are delineated: Foothills and Rocky Mountain.

**Natural Subregion**: A distinct geographic area within a natural region separated primarily on the basis on climate, as well as, vegetation and soils. Repeated vegetation/site condition sequences and distinctive ecological relationships can be found within and individual natural subregion.

**Ecosite**: Ecological units that develop under similar environment influences (climate, moisture and nutrient regime). Ecosites are groups of one or more ecosite phases that occur within the same portion of the edatopic gradient and are named after typical plant species of the ecosite (e.g. b bearberry/lichen, c hairy wild rye, etc.).

**Ecosite Phase**: An ecosite phase is a subdivision of the ecosite based on dominant tree species in the canopy or variations in specific environmental influences (e.g. c2 hairy wild rye Aw, c4 hairy wild rye Sw). Differences in phases of the same ecosite may be expressed as differences in plant species abundance or pedogenic processes. On lowland sites where tree canopies may be sparse, the tallest structural vegetation layer with greater than 5% cover determines the ecosite phase. Generally, ecosite phases are mappable units.

**Plant Community Type**: Plant community types are a subdivision of the ecosite phase and are the lowest taxonomic unit in the classification system. The environmental characteristics of the community are defined at the ecosite and ecosite phase levels in the clarification system. While plant communities of the same ecosite share vegetative similarities, they differ in their understory shrub species abundance (e.g. e2.2 Aw/saskatoon, e2.3 Aw/green alder). These differences are not mappable from aerial photography but may be important to wildlife, recreation and other resource sectors.

The ecosite phase and plant community type levels of the system are only used when more resolution is required. Some ecosites (ecological units with similar moisture and nutrient regimes) and ecosite phases do not have definitive variation in the tree canopy, understory vegetation or pedogenic properties, so stratification beyond the ecosite or ecosite phase level does not enhance ecological understanding or ecologically based management decisions. Therefore, the user can choose the level that is required for their purposes.

**Soil Type**: Soil types are taxonomic units used to group soils based on soil moisture regime, effective soil texture, organic matter thickness and solum depth. They can be used independently, in association with the hierarchical classification system or to classify disturbed sites. The soil type is represented by a two- or three-character code whereby the first letter is an S (soil type identifier) followed by representative letters for different moisture classes.

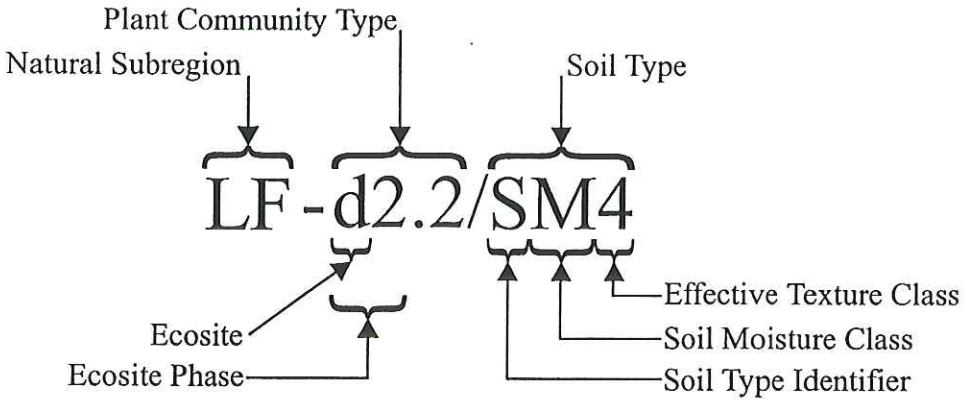



**Figure 3.0. Summary of the hierarchical ecological classification system of west-central Alberta.**

The forest vegetation of west-central Alberta lies within two Natural Regions (Foothills and Rocky Mountain) and four Natural Subregions (Lower Foothills, Upper Foothills, Montane and Subalpine).

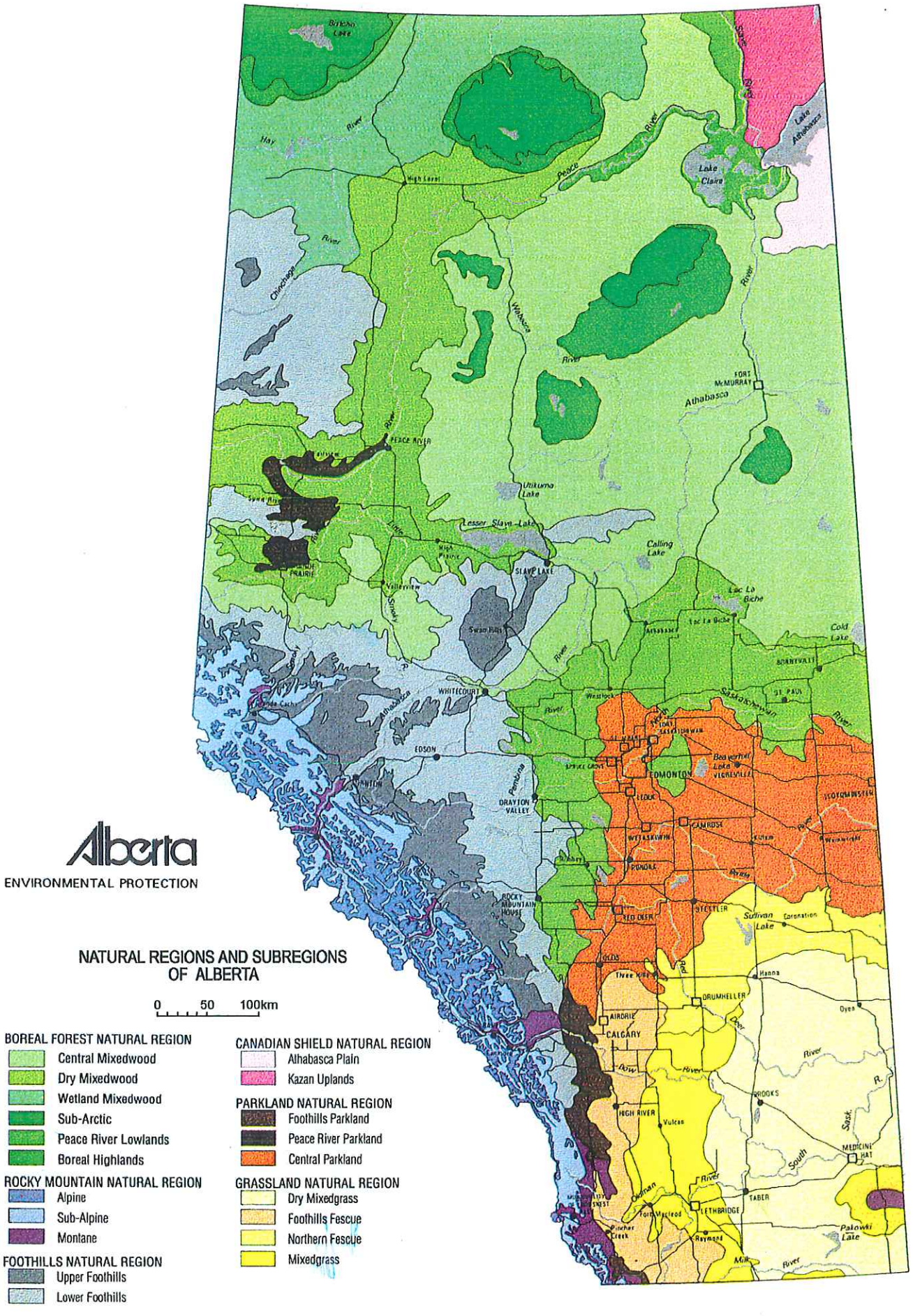



**Figure 3.1 Natural Regions and Subregions**

## 3.1 FOOTHILLS NATURAL SUBREGION

The Foothills Natural Subregion extends north from about Turner Valley, along the eastern edge of the Rocky Mountains in a gradually widening belt. It also includes several outlying hill masses such as Swan Hills, Pelican Mountains and Clear Hills. The rolling landscape is strongly influenced by both boreal and mountain landscapes and weather patterns. Coniferous and mixedwood forests underlain by Luvisolic and Brunisolic soils are characteristic of this region.

### 3.1.1 Lower Foothills Subregion

The Lower Foothills Subregion (LF) includes rolling topography created by the deformed sandstone and shale along the edge of the Rocky Mountains as well as erosional remnants with flat-lying bedrock, such as Swan Hills, Pelican Mountain and Clear Hills. Surficial material are mostly morainal with extensive organic deposits in valleys and wet depressions. Shales and sandstones occur as out crops along the mountains. Although this is somewhat cooler in summer than the adjacent lower elevation Boreal Forest subregions, it is warmer in winter because it is less often influenced by cold Arctic air masses and more frequently moderated by chinook winds particularly in southern Alberta. Soils are predominantly Luvisols and Brunisols with Gleyed Luvisols and Gleysols on poorly drained mineral soils and Organic soils in muskegs.

The forests reflect the transition nature of this subregion in which mixed forest of white spruce, black spruce, balsam fir, trembling aspen, white birch and balsam poplar occur. Lodgepole pine forest occupy extensive portions of the upland, especially following fire. Black spruce forest occur on moist upland sites in the north, on poorly drained muskegs or in association with Tamarack on rich wet sites.

### 3.1.2 Upper Foothills Subregion

The Upper Foothills Subregion occurs on strongly rolling topography along the eastern edge of the Rocky Mountains. Bedrock outcrops of marine shales and non-marine sandstones are frequent. This subregion has the greatest amount of summer precipitation of about 540 mm. The summers are cooler and the winters are milder than the Lower Foothills Subregion. Soils are typically Luvisols and Brunisols with Gleysols on poorly drained mineral soils and Organic soils on muskegs.

Upland forest of this subregion are nearly all coniferous and are dominated by lodgepole pine, white spruce, black spruce and subalpine fir. Lesser amounts of balsam poplar or trembling aspen may be found at lower elevations. Black Spruce may also be found on poorly drained muskegs or on rich wet sites in association with tamarack.

## 3.2 ROCKY MOUNTAIN NATURAL REGION

The Rocky Mountain Natural Region occurs along the western edge of this area. It contains the most rugged terrain in Alberta. Elevations rise from east to west with mountain peaks up to 3700 meters along the Continental Divide. This subregion consists of folded and faulted limestone, dolomite and quartzite. The different subregions reflect the changes in environmental conditions due to difference in elevation.

### 3.2.1 Montane Subregion

The Montane Subregion occurs as a minor inclusion in the western part of this area along the Athabasca and Smokey River valleys. Chinooks are characteristic and the subregion is sometimes snow free in the winter.

The Montane landscape is characterized by a pattern of open forest and grasslands. White spruce, lodgepole pine and trembling aspen characterized the upland sites in the upland sites. Lodgepole pine occurs infrequently in the Athabasca Valley due to the calcareous nature of the soil. Balsam poplar is often found along the streams. Black spruce and tamarack are found on organic soils in depressional areas.

### 3.2.2 Subalpine Subregion

The Subalpine Subregion occupies a band between the Upper Foothills and the Alpine Subregion. Freezing temperatures occur in all months and the frost-free period is likely less than 30 days. Winter precipitation is higher in the subregion than any other in Alberta.

The Subalpine has forests of lodgepole pine, Engelmann spruce and subalpine fir. High elevation grasslands and infrequently scrubby trembling aspen occur on steep south and west facing slopes.

## 3.3 MOISTURE AND NUTRIENT REGIME ASSESSMENT

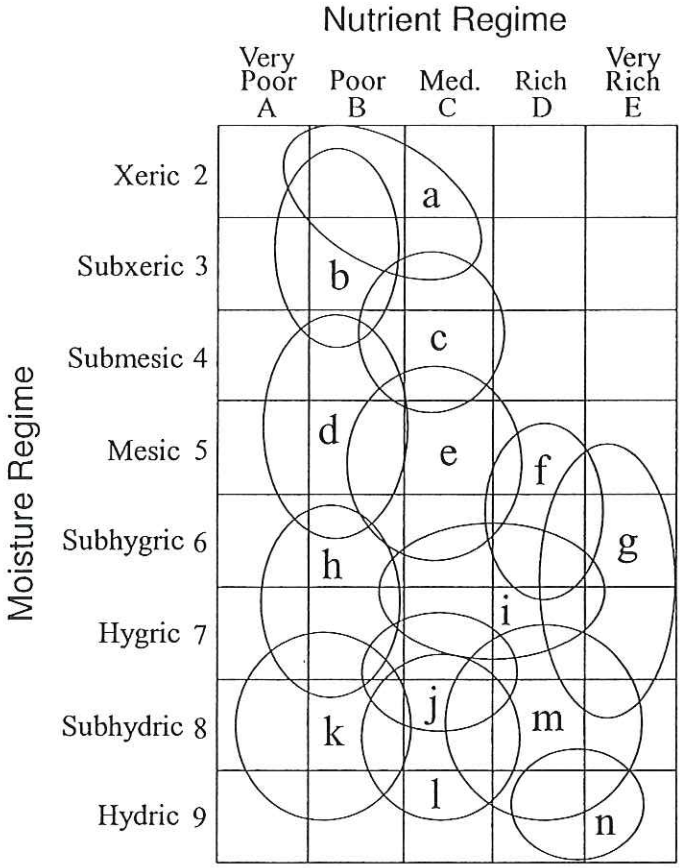
In order to classify a site to an ecosite, one must be able to recognize common plant species and be able to determine moisture and nutrient regime. Soil and site characteristics that are used to determine **moisture regime** include:

- humus depth
- surface and effective soils texture
- percentage of coarse fragments in the soil profile
- presence and depth to mottles, gleying, seepage, or water table
- percent slope
- aspect
- topographic position
- soil drainage
- plant indicator species.

The assessment of **nutrient regime** is based on:

- humus form
- presence of eluviated (Ae) or humified (Ah) surface soil horizons or layers
- surface and effective soil texture
- percentage of coarse fragments in the soil profile
- soil pH
- presence of carbonates
- presence of seepage
- ground water condition (moving versus stagnant)
- site index (productivity rating based on tree height and age)
- plant indicator species

## ECOSITES OF THE LOWER FOOTHILLS NATURAL SUBREGION




Ecosites

a = **grassland**
xeric/poor

b = **bearberry/lichen**
subxeric/poor

c = **hairy wild rye**
submesic/medium

d = **Labrador tea–mesic**
mesic/poor

e = **low-bush cranberry**
mesic/medium

f = **bracted honeysuckle**
subhygric/rich

g = **meadow**
subhygric/very rich

h = **Labrador tea–hygric**
hygric/poor

i = **horsetail**
hygric/rich

j = **Labrador tea/horsetail**
hygric/medium

k = **bog**
subhydric/poor

l = **poor fen**
subhydric/medium

m = **rich fen**
subhydric/rich

n = **marsh**
hydric/rich

**Figure 3.2** **Edatope (moisture/nutrient grid) showing the location of ecosites for the Lower Foothills.**

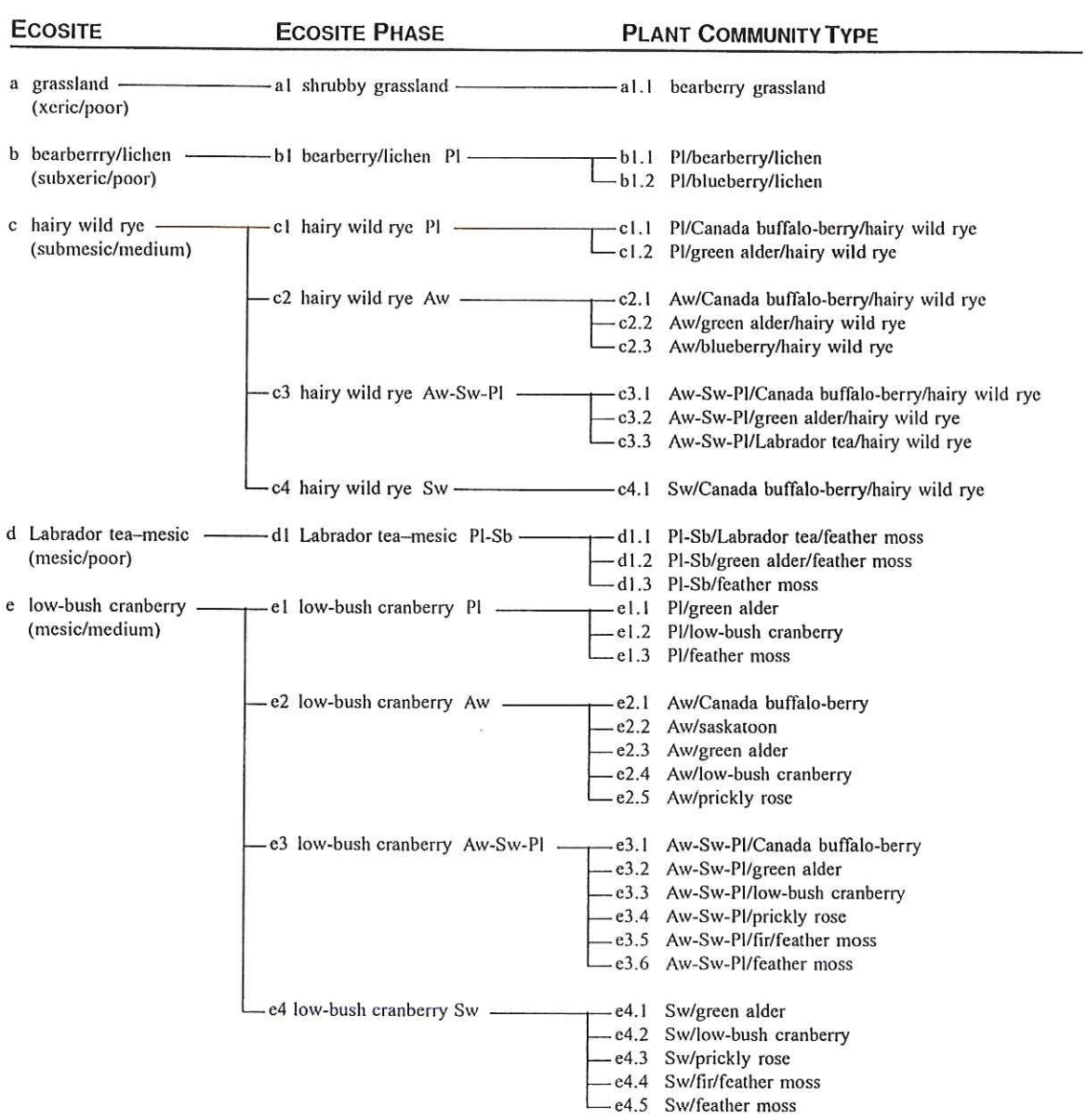



**Figure 3.3 Ecological units for the Lower Foothills.**

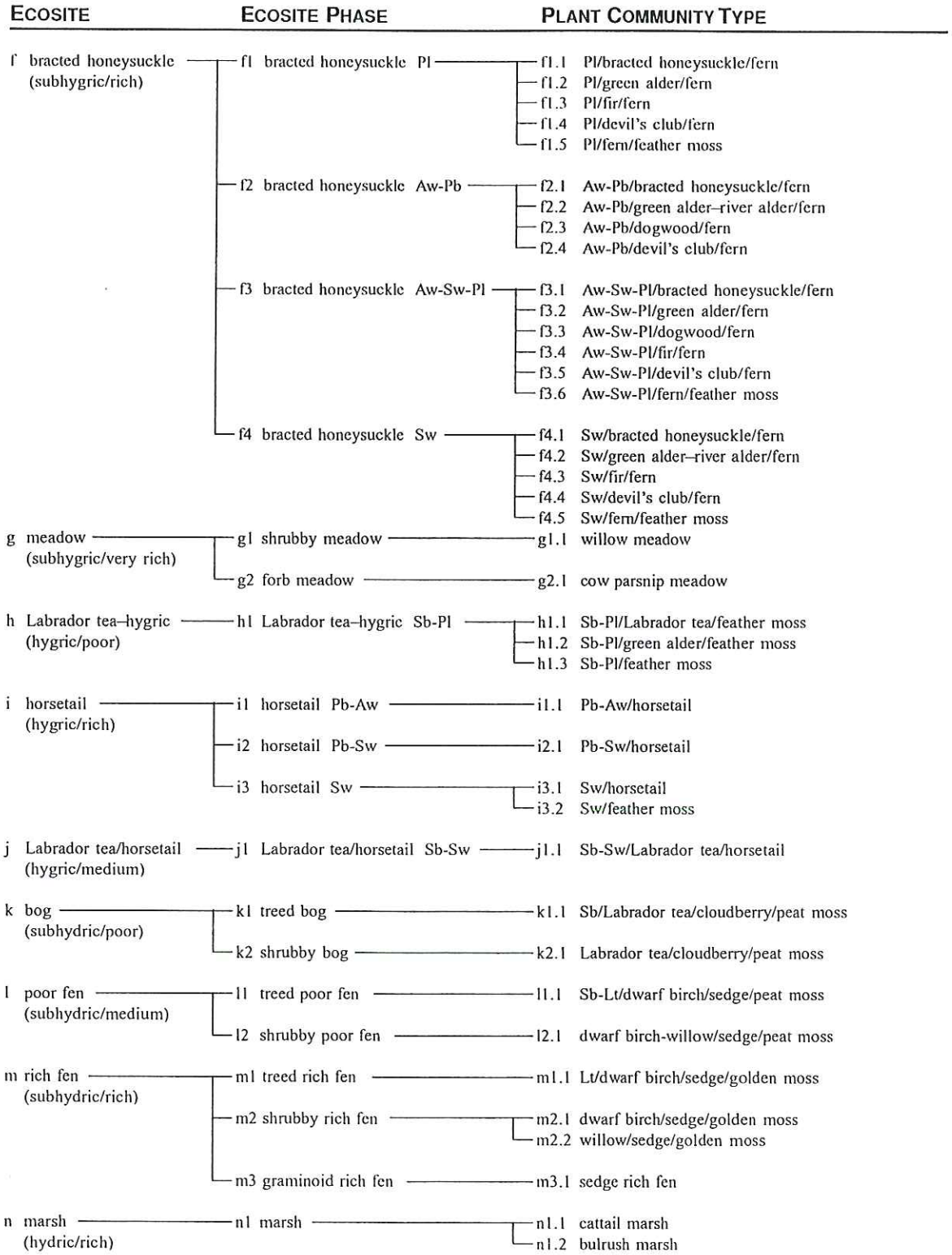
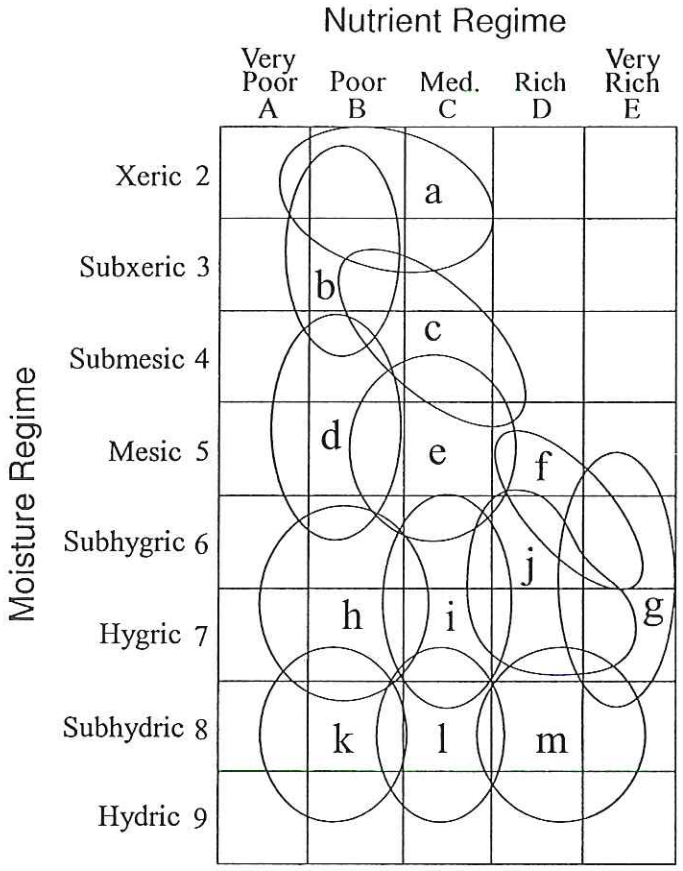



**Figure 3.3 Ecological units for the Lower Foothills (concluded).**

## ECOSITES OF THE UPPER FOOTHILLS NATURAL SUBREGION




Ecosites

a = **grassland**
xeric/poor

b = **bearberry/lichen**
subxeric/poor

c = **hairy wild rye**
submesic/medium

d = **Labrador tea–mesic**
mesic/poor

e = **tall bilberry–arnica**
mesic/mediium

f = **bracted honeysuckle**
subhygric/rich

g = **meadow**
subhygric/very rich

h = **Labrador tea–hygric**
hygric/poor

i = **Labrador tea/horsetail**
hygric/medium

j = **horsetail**
hygric/rich

k = **bog**
subhydric/poor

l = **poor fen**
subhydric/medium

m = **rich fen**
subhydric/rich

**Figure 3.4** **Edatope (moisture/nutrient grid) showing the location of ecosites for the Upper Foothills.**

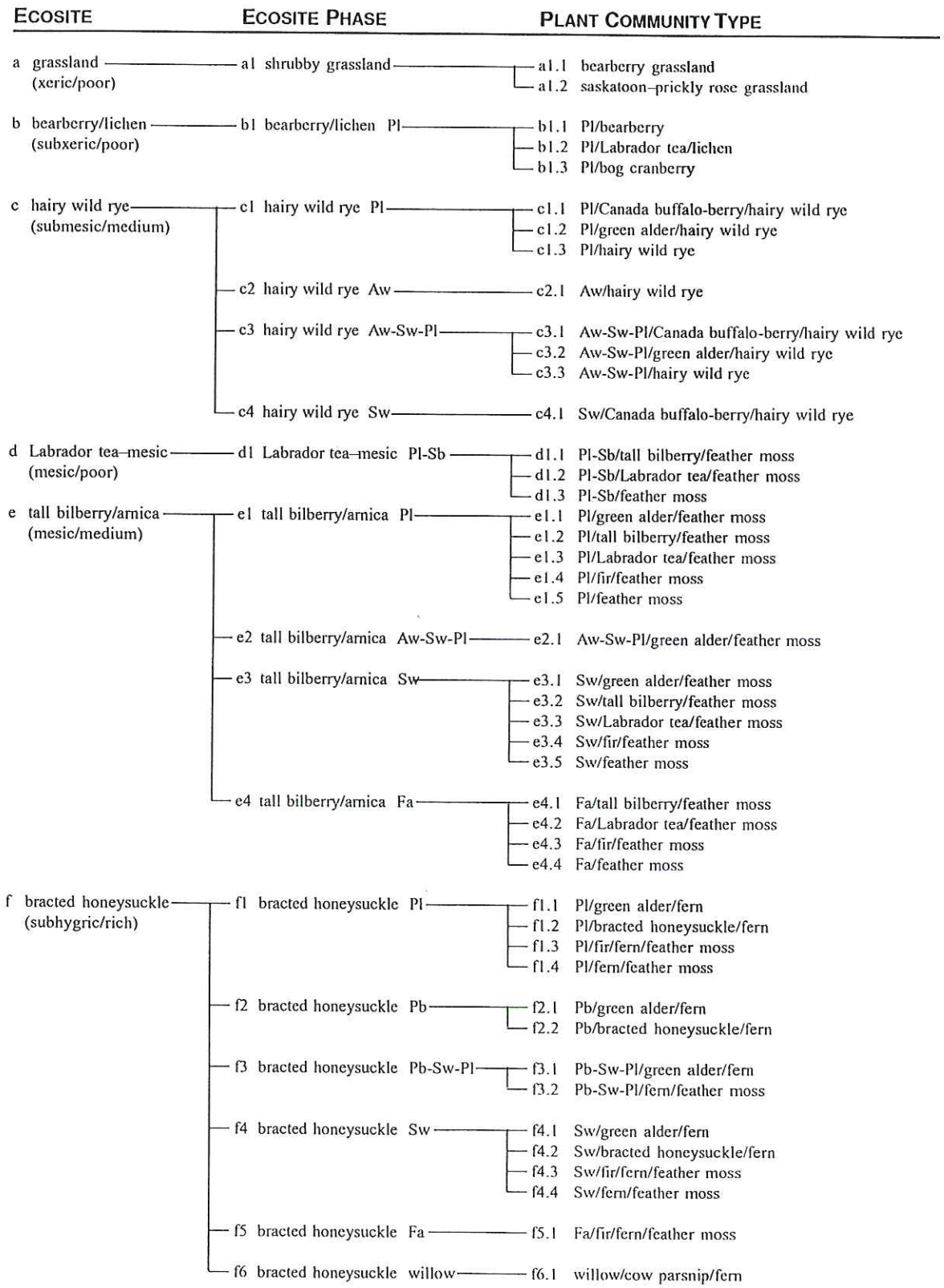



**Figure 3.5 Ecological units for the Upper Foothills.**

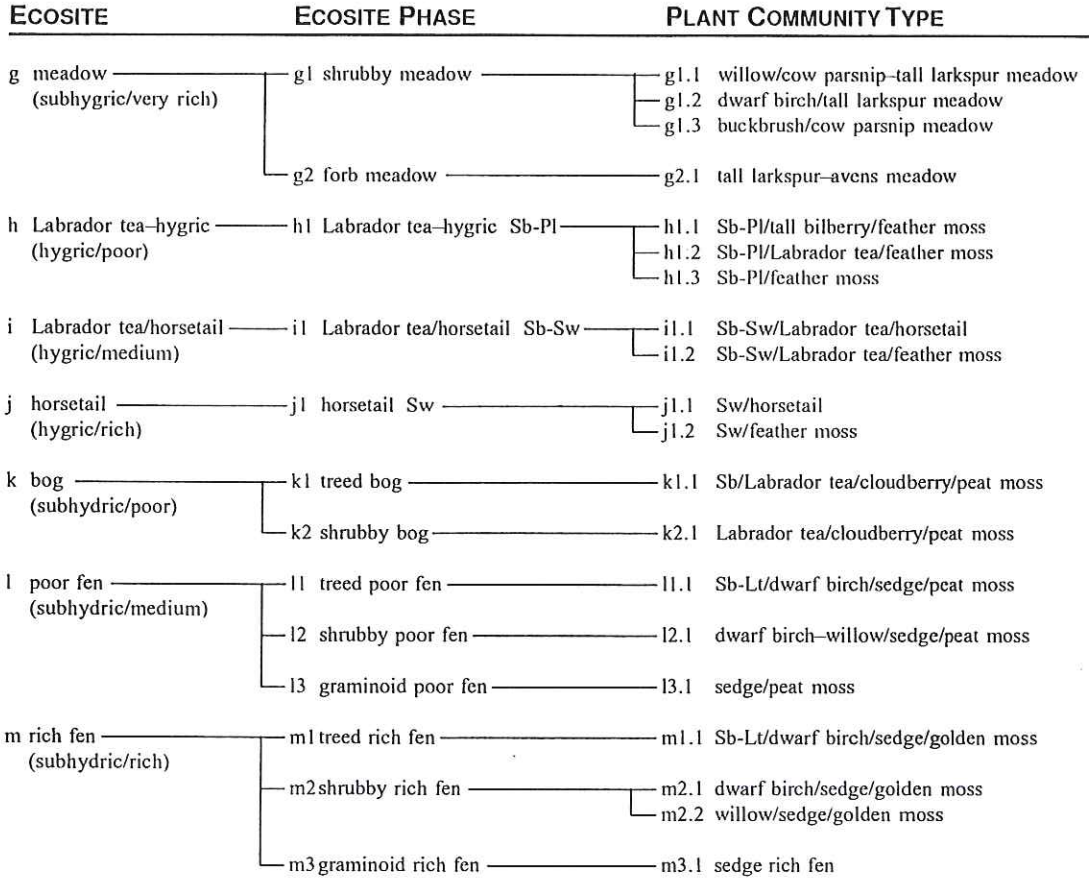
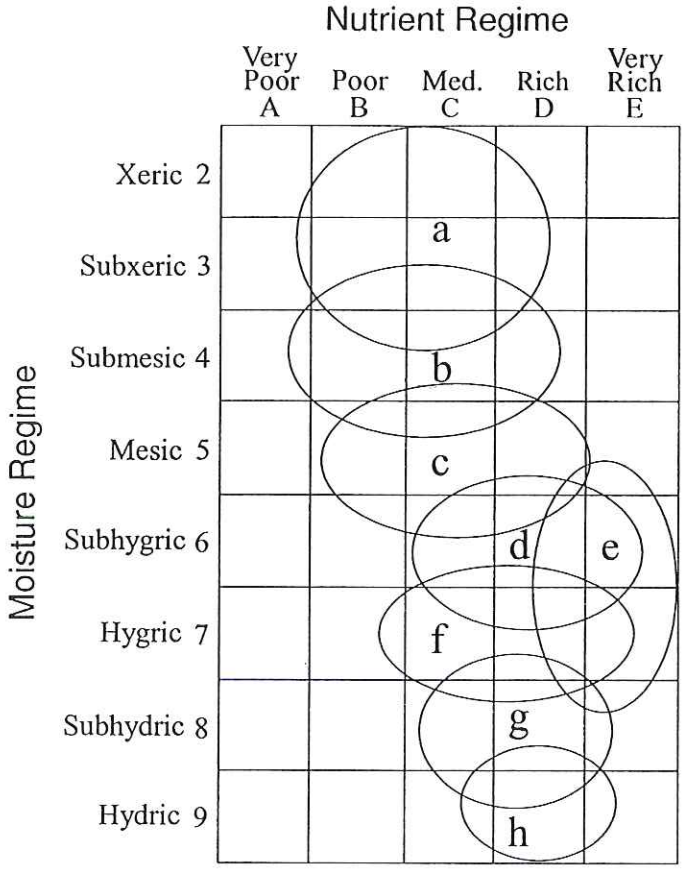



**Figure 3.5 Ecological units for the Upper Foothills (concluded).**

## ECOSITES OF THE MONTANE NATURAL SUBREGION




Ecosites

a = **grassland**
subxeric/medium

b = **bearberry**
submesic/medium

c = **hairy wild rye**
mesic/medium

d = **dogwood**
subhygric/rich

e = **meadow**
subhygric/very rich

f = **horsetail**
hygric/rich

g = **fen**
subhydric/rich

h = **marsh**
hydric/rich

**Figure 3.6** **Edatope (moisture/nutrient grid) showing the location of ecosites for the Montane.**

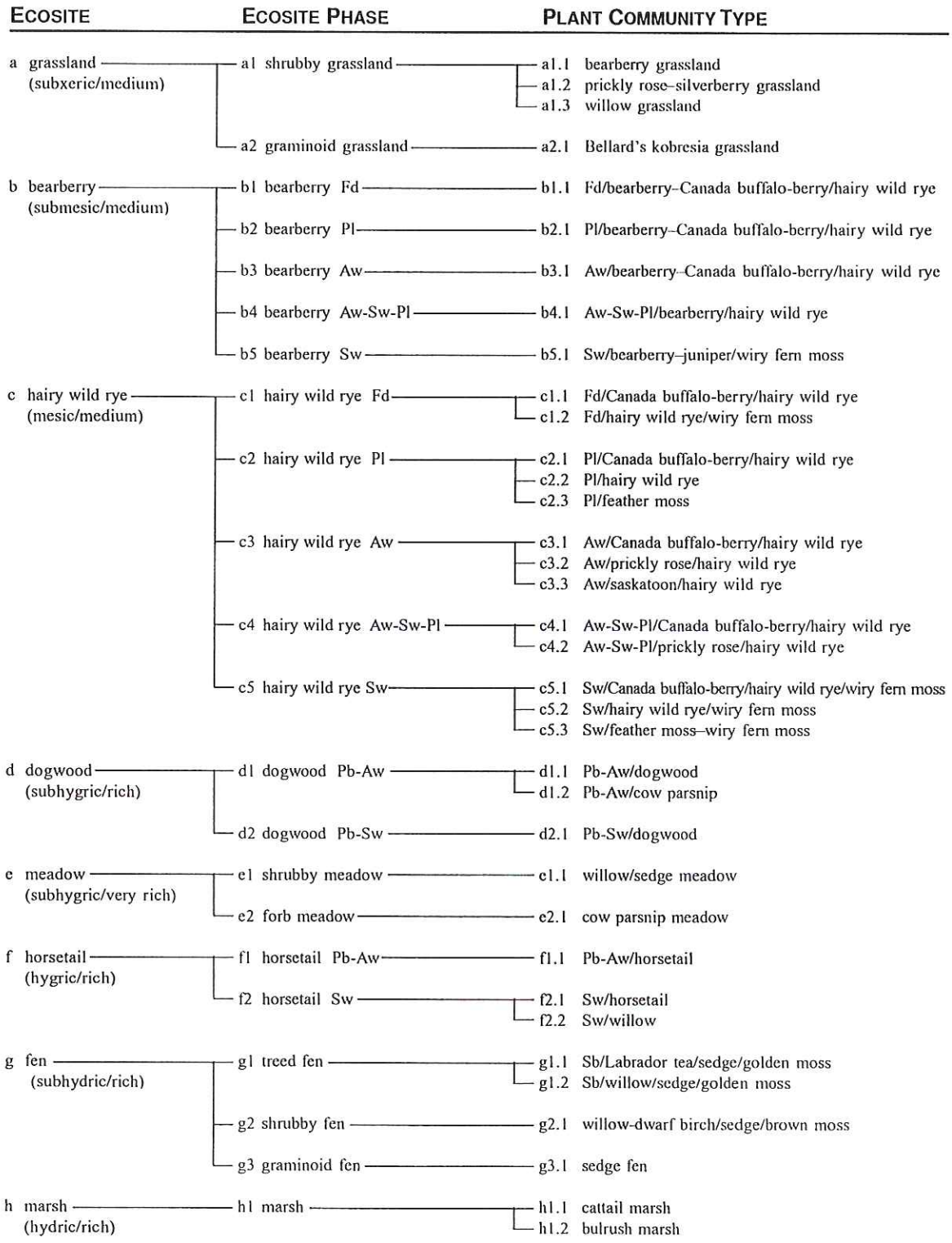
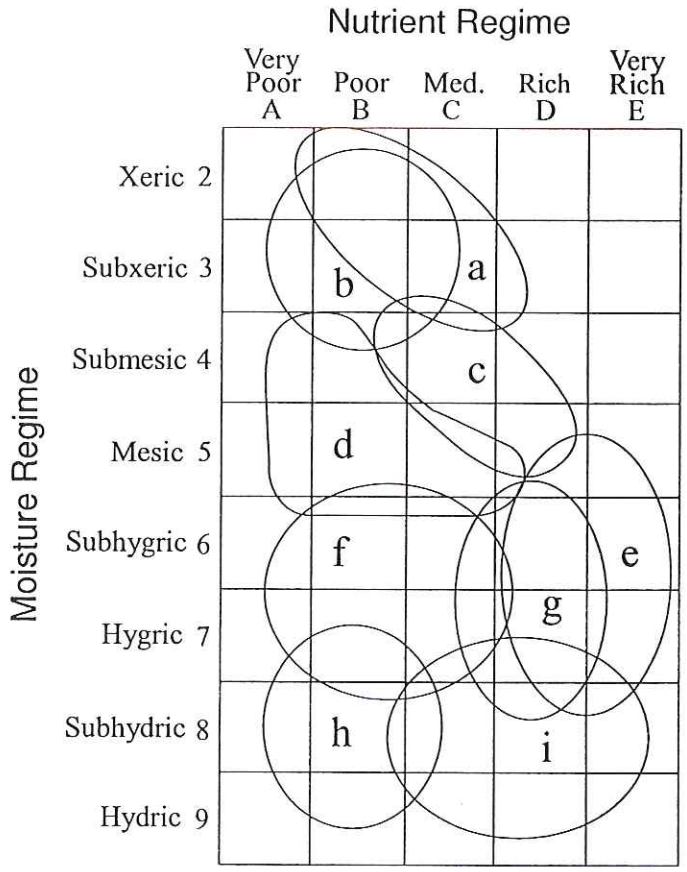



**Figure 3.7 Ecological units for the Montane.**

## ECOSITES OF THE SUBALPINE NATURAL SUBREGION




Ecosites

a = **grassland**
subxeric/medium

b = **bearberry/lichen**
subxeric/poor

c = **hairy wild rye**
submesic/medium

d = **rhododendron–mesic**
mesic/medium

e = **meadow**
subhygric/very rich

f = **rhododendron–subhygric**
subhygric/medium

g = **horsetail**
hygric/rich

h = **bog**
subhydric/poor

i = **fen**
subhydric/rich

**Figure 3.8** **Edatope (moisture/nutrient grid) showing the location of ecosites for the Subalpine.**

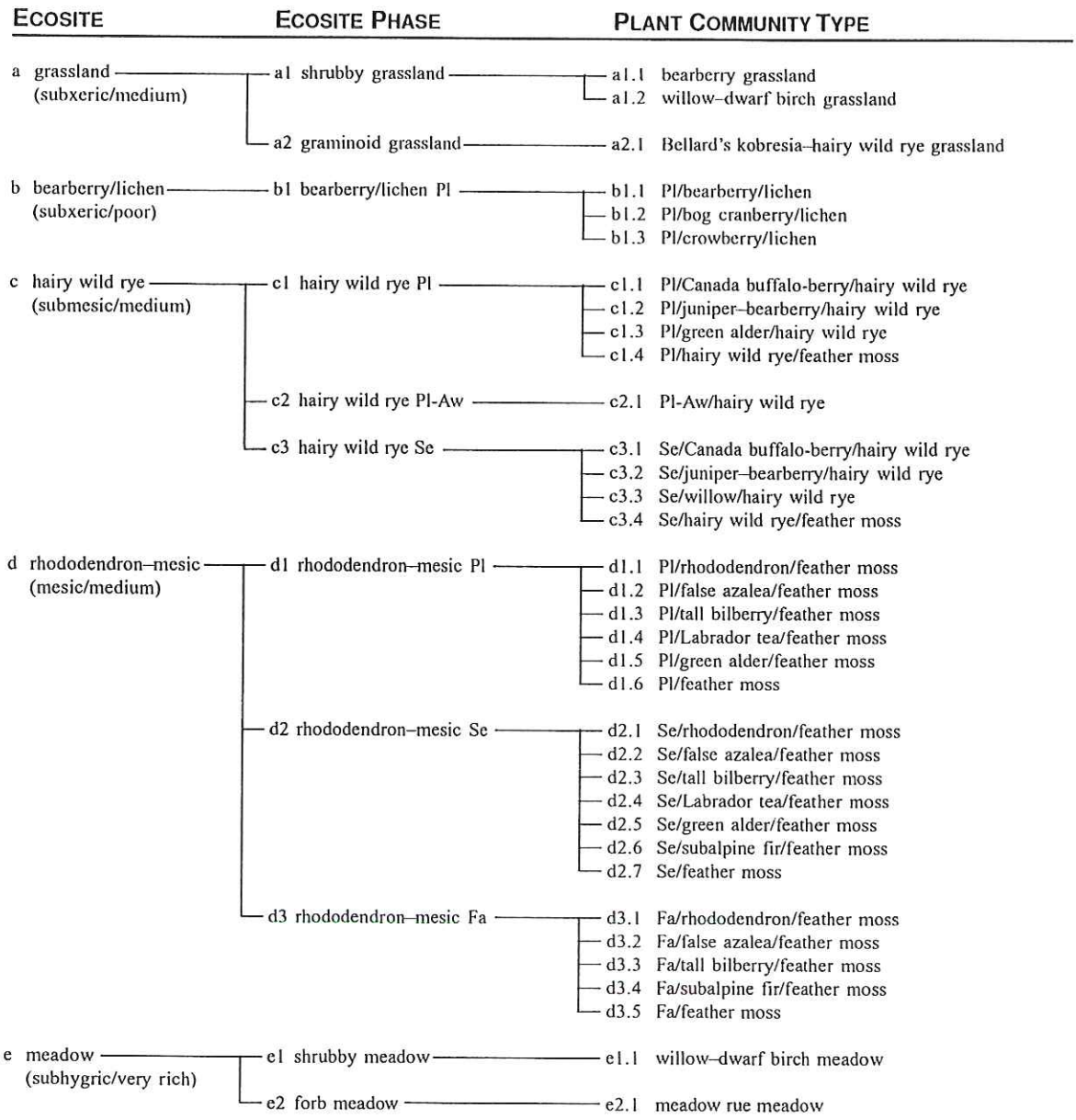



**Figure 3.9 Ecological units for the Subalpine.**

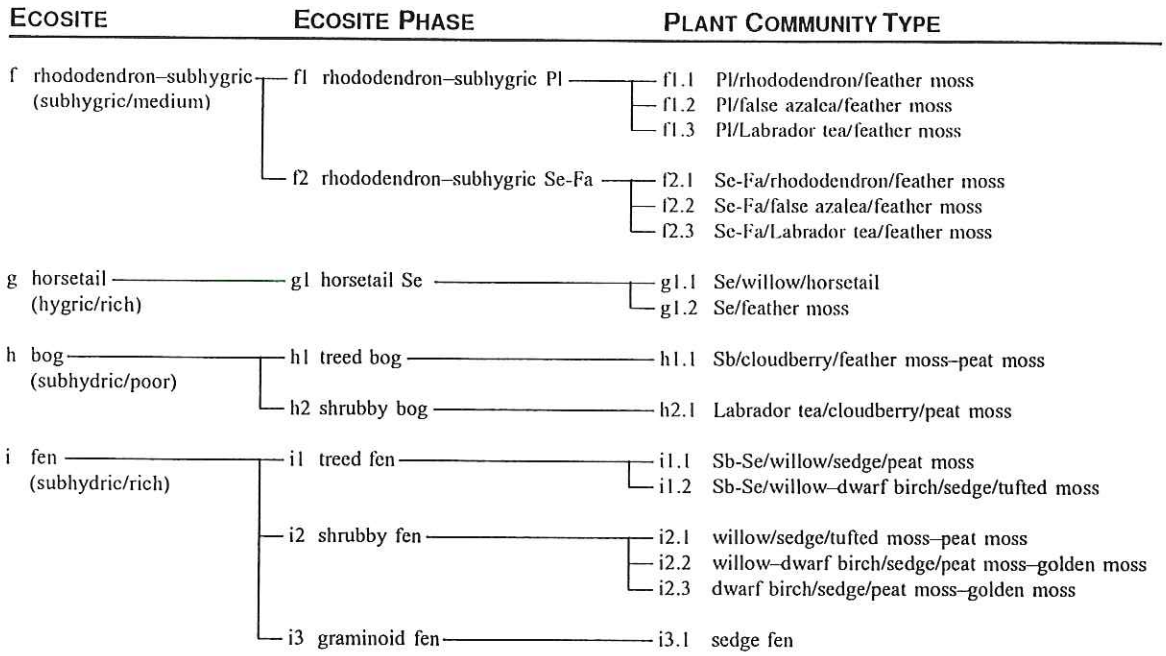



**Figure 3.9 Ecological units for the Subalpine (concluded).**

# STOP 3

## CARDINAL RIVER COALS LTD.
## Luscar Alberta
## MINESITE HIGHLIGHTS - 1996

**MINING:**

- Historical Mining at Luscar: 1921 - 1955
- Cardinal River Coals Ltd. Start Up: 1968
- Markets: Japan, Asia, Europe & South America
- Coal Quality: Medium-Volatile Bituminous Metallurgical
  "AA" Rating by Japanese Mills for 10 years
- Production: Annual Capacity - 3.0 Million Tonnes
  50 Millionth CST produced - July, 1995
  1995 Rock Production - 33 Million CY
- Employment: Current = 450 plus 35 students
- Reserves: 17 million CST (Cardinal River Coals)
  100 million RMT (Cheviot mine project)
- Reclamation Objectives: Wildlife Habitat
  Recreational Opportunities
  Forestry (commercial and noncommercial)
  Watershed Protection

**LAND USE ASPECTS:**

- Mineral Surface Lease Area: 10,600 Acres (4,290 hectares)
- Surface Disturbance to Date: 4,700 Acres (1,903 hectares)
- Reclamation Underway/Complete: 1,890 Acres (766 hectares)
- Overlap With Weldwood FMA: 330 Acres (134 hectares)
- Non-Trophy Sheep Hunt: Black Powder/Shotgun Special License
- Public Access Trails: Five "Designated Routes" established through the mine surface lease
- Fishing Opportunities: Lac Des Roches (50-B-6 Pit), public access by walking trail

# STOP 3

## WILDLIFE ASPECTS:

- Fisheries:
  - 50-B-6 pit reclaimed to a self sustaining sub-alpine sportfishing lake.
  - currently open as a catch and release fishery under Provincial Regulation.
  - additional lake developments planned for future (seven currently proposed).
  - stream enhancement undertaken on West Jarvis and Sphinx Creeks and the Gregg River.

- Wildlife:
  - bighorn sheep habitat extended and supports 360+ sheep on site in fall pre-rut season.
  - assisted Fish & Wildlife in 1989, 1990, 1992 and 1995 with sheep transplants to Nevada and Oregon (124 sheep).
  - mule deer population of about 110+ on site.
  - elk moving on to site in last 2-3 years numbering 50+.
  - annual wildlife monitoring programs.
  - regional sheep monitoring program completed in 1995.
  - 1990 Order of the Bighorn Recipient for wildlife conservation.

## FORESTRY ASPECTS:

- High Elevation Reforestation:
  - central mine areas reclaimed with topsoil over about 15% of area to create "Tree/Shrub Islands" for deer/elk habitat requirements.

- Lower Elevation Reforestation:
  - with recent expansion of mine permit, reforestation efforts increased to return equivalent areas of forest cover and "productive" forest as before mining.

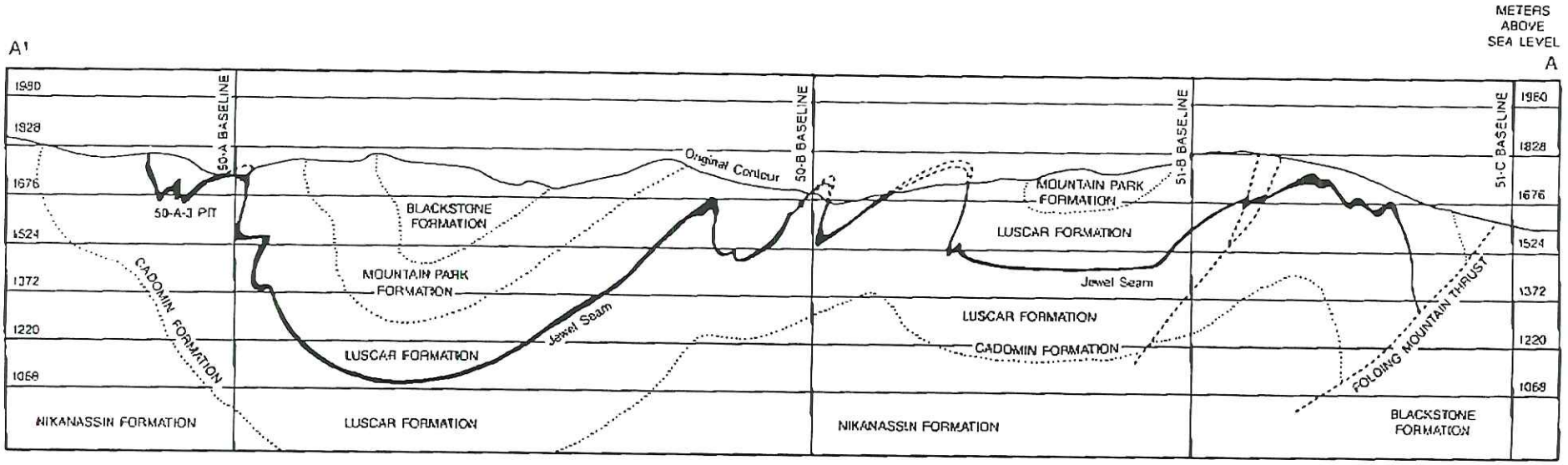
- Reforestation Program:
  - native deciduous and coniferous species
  - seed and cuttings collected onsite
  - stock grown by commercial forest nurseries
  - seedlings planted by professional tree planters
  - future programs will consist of 125,000 seedlings per year

## Seed Mixture

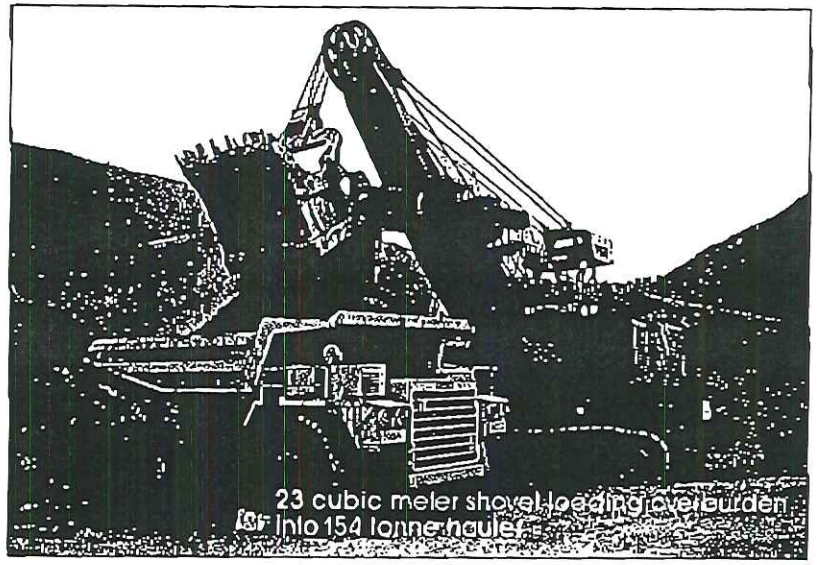
| WEIGHT % | SEED TYPE |
|---|---|
| 4.2 | Red Fescue (Arcta) |
| 3.9 | Hard Fescue (Durar) |
| 16.7 | Smooth Bromegrass |
| 7.4 | Slender Wheatgrass |
| 6 | Alpine Bluegrass |
| 13.9 | Northern Wheatgrass |
| 5 | Annual Ryegrass |
| 4.2 | Alsike Clover |
| 11.3 | Alfalfa (Rangelander) |
| 12.5 | Sainfoin |
| 6.6 | Sweet Clover |
| 8.3 | Cicer Milkvetch |

## Native Woody Species

| | |
|---|---|
| CONIFEROUS | Engelmann Spruce |
| | Lodgepole Pine |
| | Alpine Fir |
| PRIMARY DECIDUOUS | Trembling Aspen |
| | Balsam Poplar |
| SECONDARY DECIDUOUS | Dwarf Birch |
| | Willow |
| | Green Alder |
| | Shrubby Cinquefoil |
| | Wild Rose |
| | Silverberry |
| | Buffaloberry |
| | Elderberry |




A¹ - A illustrated on page 10.



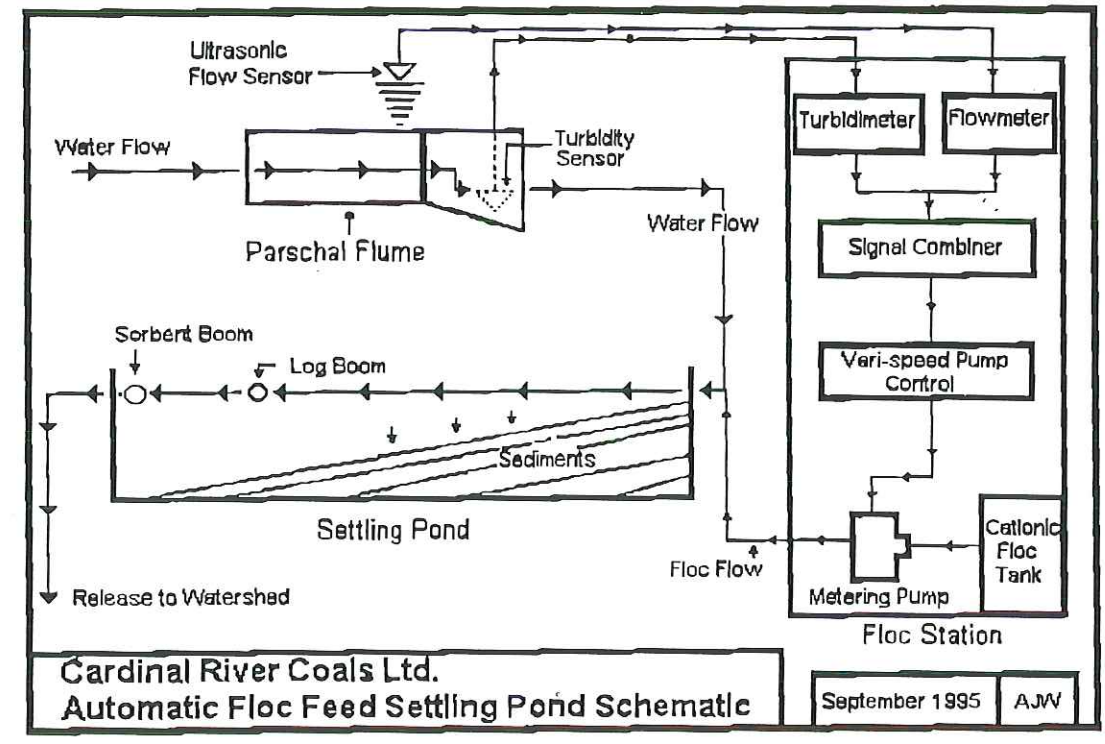

STOP 3

## WATERSHED PROTECTION:

There are 10 water treatment impoundments currently operated on the mine. The attached map shows the locations of the facilities. Surface runoff and pit pumping are collected and directed to the impoundments for treatment prior to discharge to natural drainages. Treatment consists of allowing sufficient time for the removal of suspended particles, with this process being assisted, when necessary by the addition of chemical flocculants at the inflow. Diversion of natural drainages around mining areas is also used to minimize water impacts.

In 1995 a total of 1878 measurements in routine monitoring were completed to ensure compliance with the minesites Clean Water Licence under AEPEA. Every sample was analyzed for total suspended solids with a visual check for oil and grease. A gravimetric analysis for NFR and pH were conducted a minimum of once a week. Monthly analysis were also conducted for total Iron and Nitrite/Nitrate-Nitrogen.

In 1987 construction of Lac Des Roches was completed and the lake started to fill. Lac Des Roches is the first mountain lake created that has been naturally colonized by native fish from downstream. The lake is relatively cold and deep with a small littoral zone. Therefore, its fish production capabilities are limited. The lake has been opened to public fishing under the Provincial Fishing Regulations.



## WILDLIFE HABITAT RECLAMATION RECOMMENDATIONS

### Bighorn Sheep

| | |
|---|---|
| - Major winter range for 140 nursery herd | 40 - 60 ha |
| - Major winter range for 40 rams | 7+ ha |
| - Escape terrain for winter range | 39 - 40 °<br>3+ Benches<br>500 m long |

- Need high quality forage established adjacent to escape terrain
- High quality forage provided through the use of agronomic species
- Escape terrain provides mineral licks through groundwater seeps

### Deer and Elk

- Establishment of tree islands interspersed with grasslands.
- Recommended ratio: 60% grasslands and 40% forest.
- Forest provides sight protection and thermal cover.
- High quality forage provided through the use of agronomic species

### Other Species

- Talus slopes and rock/debris piles left as habitat for small mammals such as marmots, pikas and weasels.
- Sightings of carnivores increasing: grizzly bear, cougars, wolves and coyotes.
- Variety of birds utilize the reclaim landscape.

# Reclamation to Wildlife Habitat at Cardinal River Coals Ltd.



*by Beth MacCallum, Bighorn Environmental Design*

In the late seventies, Cardinal River Coals Ltd. was the first company in Alberta to submit a plan to reclaim a coal mine primarily for wildlife habitat. The original plan targeted the 4 ungulates — bighorn sheep, deer, elk and moose for reclamation. The wildlife habitat design incorporated the following concepts (Acott 1983):

- 40% tree and shrub cover; 60% grasslands
- forage was to be commercially available; self-sustaining over the long term and to provide high nutrition for wildlife.
- tree and shrub cover was to provide concealment, thermal protection, straight-line interruption and be a source of nutritious browse.
- tree islands were to be planted to encourage wildlife use throughout the disturbed landscape where distances were judged to be too great for secure travel by wildlife.
- the success of the reclamation was to be monitored by annual population surveys.

This last point is important in that a direct wildlife inventory conducted over the years can then be used to direct and refine ongoing reclamation plans.

By the mid-eighties, so many bighorn sheep had voluntarily colonized the mine site that CRC supported a study of bighorn sheep which was completed as a master's thesis under Dr. V. Geist (MacCallum 1991). This work looked at the health of the animals, how they used the mine seasonally and spatially and how the mine site functioned as a bighorn habitat. Some recommendations regarding refining reclamation for bighorn sheep habitat included size recommendations for grasslands, maintenance of high walls, provision of a variety of grasses and legumes, provision of mineral licks, rock pile development and development of a post-mining management plan. These guidelines helped to refine the reclamation techniques for those areas to be primarily reclaimed to bighorn habitat. Other areas are designated to be reclaimed primarily for deer and elk use. Some areas have habitat features suitable for all three species (in the vicinity of Lac des Roches). The common habitat feature for these three ungulates is the presence of grasslands which provide winter forage opportunities. Shrublands developed along riparian areas provide browse for moose and deer, and travel corridors for elk and grizzly.

Each area must be evaluated for its inherent environmental limitations and opportunities; the reclamation plan must be developed to reflect these conditions. This is an essential step as the desired end use must be made clear at the outset for an effective design. Landscapes planted for aesthetic reasons may be attractive, but they also may not provide optimum or even effective wildlife habitat.

*LANDSCAPE FEATURES* — Some landscape features that encourage wildlife use include:

- Open pit (mountain) mining. Coal in the mountains occurs in pockets. This results in islands of original habitat left on the surface. This original tree and ground cover represents mature landscape elements which can be used in a wildlife habitat design. Islands of original tree and ground cover encourage wildlife to use the mine during the process of active mining.
- "Talus" or free-dumped rock at high angles provide travel corridors and bedding sites for bighorn sheep; marmot and pika habitat.
- Benched high walls provide sheep escape terrain, mineral licks, and nesting habitat for raptors.
- Grasslands provide forage for sheep, deer, elk, grizzly, high density small mammal populations, habitat for avian predators

. . . *continued on page 32*

(kestrel, harrier), habitat for small mammal predators (coyotes, foxes) and non-game birds.

- Shrub/tree plantings provide browse for moose and deer, escape/thermal cover for elk, deer and moose, and song bird habitat.

- Rock piles/logging trash provide habitat for small mammalian predators.

*UNGULATE/LANDSCAPE INTERACTION* — The advantages of using ungulates as the target wildlife species include:

- The proximity of healthy populations of ungulates which provide a reservoir of animals for voluntary colonization.

- Ungulates provide a prey base for carnivores (wolves, coyotes and grizzlies).

- Ungulates will interact with grassland development by providing an alternate nutrient cycle and increasing productivity of the grassland as compared to an ungrazed system.

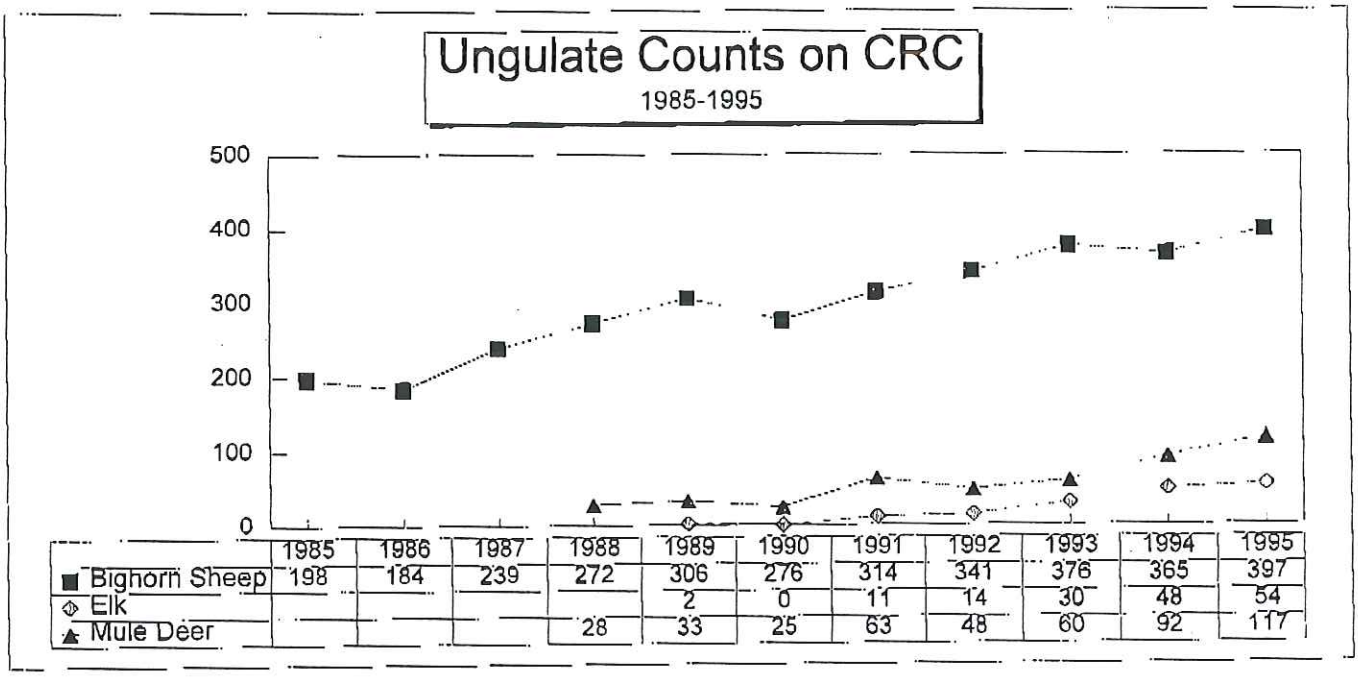
- Ungulates provide an immediate measure of success that can be used for ongoing planning and design.

- Ungulates have large home ranges and need a variety of landscape features and vegetation types to fulfill their habitat requirements. This forces the planner to operate at a landscape level. Habitat for ungulates provides habitat for many associated species.

*SUCCESS?* — The maximum number of bighorn sheep on the reclaimed landscapes in the fall of 1993 was 471. This represents a doubling of the population since 1985 despite removing 92 sheep during the non-trophy hunts and removing 76 sheep to be transplanted to Nevada in the same time. In the winter of 1994 there were 30 elk using the reclaimed landscape and 100 mule deer. Cardinal River Coals Ltd. has clearly created new winter range through its reclamation activity and the wildlife populations are responding positively. On the older reclaimed landscapes there are hoary marmots, golden-mantled ground squirrels, pikas, bluebirds, kestrels and other animals. Ravens and Great-horned owls have nested on the high walls. Grizzly bears use the mine site every spring and fall. Wolves visit occasionally as do wolverines.

Currently Cardinal River Coals Ltd. is supporting a study whose purpose is to understand how the sheep from the mine interact with the adjacent populations. This information will provide a context to understand how a new habitat and a new population of animals integrates with the existing ecosystem. Nineteen sheep have been radio-collared and 38 sheep tagged for the purpose of this study. The other agencies that support the study are Gregg River Resources Ltd., Jasper National Park, The Sport, Recreation, Parks and Wildlife Foundation, The Wildlife Enhancement Fund, and Alberta Environmental Protection, Fish & Wildlife Services.

*REGULATORY FRAMEWORK* — In 1973 the Land Surface Conservation and Reclamation Act was passed and in subsequent years a set of regulations was passed for each extractive industry — oil and gas, coal mining and the tar sands. This legislation was significant in that it required coal mines to submit an end use reclamation plan prior to approval of new developments. At that time the expectation was to "reclaim to equal value." This idea gradually evolved to that of "equivalent value." In the new Alberta Environmental Protection and Enhancement Act (AEPEA) the phrase "equal or equivalent" value is used. Equivalent land capability is defined as the ability of the land to support similar values. The land use does not necessarily have to be identical. This shift in thinking has allowed landscapes to be designed deliberately for wildlife; these landscapes will look different than those designed for other land uses which also happen to "accommodate" wildlife.




| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bighorn Sheep | 198 | 184 | 239 | 272 | 306 | 276 | 314 | 341 | 376 | 365 | 397 |
| Elk | | | | | 2 | 0 | 11 | 14 | 30 | 48 | 54 |
| Mule Deer | | | | 28 | 33 | 25 | 63 | 48 | 60 | 92 | 117 |