





species in this community are black spruce (*Picea mariana*) with Labrador tea in the low shrub layer. Much of the forest floor is covered by feathermosses (e.g. *Aulacomnium* sp.). Effects of fire in this community vary depending on the severity of the fire. A severe burn could kill all forbs, except those with very deep rhizomes like *Equisetum sylvaticum*. After a less severe fire, there is a gradual succession from larch/sedges to black spruce/feathermoss.

The modular forest type for the boreal mixedwood forest in this part of Canada is the White Spruce/Aspen forest. Soils in this community are Orthic Grey Luvisols. This forest type is characterized by a co-dominance of white spruce and aspen, and a rich diversity of forbs. Again, fire affects the character of the community. Without fire, the aspen is eventually overgrown by white spruce. Fire prevents succession to white spruce, resulting in aspen-dominated stands.

Slides of characteristic plant species found in the boreal mixedwood forest were shown. The short discussion which followed related to old-growth forests, which were defined as forests with an uneven age and size distribution and lots of deadfall, with many trees older than are usually found in the area. Old growth jackpine forests can be found where conditions are so dry that succession to white spruce does not occur.

## Northern Uplands and River Valleys

*Speaker: Matt Fairbarns*

Rivers and uplands provide an element of habitat diversity in the northern Boreal Forest. Rivers provide a corridor of somewhat disturbed, more open habitats where erosion is often visible. Depositional environments vary from coarse cobbles to finer clay and sand areas downstream, where shorelines are dominated by willows. Shoreline marshes are uncommon because of scouring and depositional activity but lowland backwater and open wetlands occur sporadically. Slides were shown of the Peace-Athabasca delta, which is one of the largest inland freshwater deltas in the world.

Local geology is the major determinant of vegetation composition in many areas. The saline, marine deposits of northern Alberta support particularly interesting vegetation types such as the Peace and Hay River lowlands. These wet meadow complexes have a surprising number of species more commonly associated with southern areas of the province. Gumweed and owl's-clover were two mentioned.

The highlands provide another unique and interesting habitat. Here a greater proportion of till deposits, cooler temperatures and higher rainfall allow subarctic species to populate plateaus and summits. Better growing conditions and decreased fire incidence provide an environment conducive to "old growth" forests. Several upland areas exhibit large

amounts of seepage. Glacial flutings are characteristic of high plateau areas.

In the Birch Mtns., tree growth consists mainly of conifers, with aspen in better drained situations. The forests are stressed by such factors as permafrost, and "drunken" forests and shorter tree stature result. The Birch Mtns. are unusual amongst these boreal uplands in that they have a number of large lakes.

The Cameron Hills have a number of stunted growth forests which are characterized by heath-like plants. There are a number of small, slough-like areas, and lakes contain a surprising diversity of aquatic vegetation.

Other unusual habitats discussed included crag and tail formations south of Lake Athabasca, dissected kames near the Saskatchewan border and sinkholes in NE Alberta and Wood Buffalo Nat. Park.

Impacts on these vegetation types include grazing in saline meadows (which has resulted in severe degradation of some habitats); seismic line and oil & gas development particularly in NW Alberta; oilsands extraction facilities; and forestry. Forestry to date has not had a major impact on vegetation except in localized areas such as Swan Hills and Pelican River. The impact of oilsands development is severe but very localized. Linear disturbances, such as seismic lines, introduce migration corridors for weeds, exhibit windthrow and are frequently littered with slash.

## The Athabasca Sand Dunes

*Speaker: Dr. Ellen Macdonald*

The hydrologic erosion of the Athabaskan sandstone and the subsequent wind transport and deposition, has led to the accumulation of sand on the Athabasca plain and the formation of active dunes in Saskatchewan and Alberta. The over 320 sq. km. (in Sask.) active sand dunes bear a very distinctive flora, derived from arctic and boreal origins. Extreme selection pressures since the end of the last glaciation have resulted in active speciation processes that have led to 10 endemic taxa. The flora also includes about 50 species considered rare in Saskatchewan.

Disturbance due to sand movement is the major factor affecting the long-living plants. The vegetation in this severe environment is also patterned by water availability and nutrient availability, which are critical for establishment. Therefore we may suspect mycorrhizal associations to also be of importance.

The shoreline of Lake Athabasca provides an unstable habitat; only some adapted species (*Calamagrostis* sp., *Carex aquatilis*) resist the ice and wave push. The beach ridge is colonized by some grasses and shrubs, including *Salix planifolia*. Its close relative *S. tyrrelli*, occurs inland on the dunes and is one of 4 endemic willows. Along the beaches we also find *Elymus mollis*, a maritime disjunct sp., and

*Stellaria longipes*, a chickweed, and 'parent' of the endemic *S. arenicola*.

Farther away from the open water, active dune fields offer many different habitats. The rolling dunes are temporarily stabilized by grasses and willows. The presence of a thick coat of old desiccated roots at the base of the willow trunk indicates the former substrate level.

The most stable habitats are colonized by trees and shrubs. But even this well established vegetation is sometimes taken over by the dunes. Invading ridges of sand are inhabited by some specialized grasses, such as an endemic form of *Tanacetum huronense* var. *floccosum*. In the extensive and relatively stable region we find the endemic *Armeria interior*, a close relative of an arctic coastal species *A. maritima*.

The future of this desert-like region surrounded by wetlands, seems to be secured by the intent to create a Wilderness Provincial Park, as recently announced by the Province of Saskatchewan. In Alberta, this type of ecosystem occurs over a smaller area and part of it has been declared an Ecological Reserve, but if we want to preserve the integrity of this unique landscape and dynamic biota, a larger protected area is desirable.

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### **Workshop A: Impacts of Forestry Activities on Northern Ecosystems**

*Speaker: Dr. Joan Snyder*

Dr. Snyder began the workshop by stating the case for increased research in the area of northern ecosystems - the need to know more about forestry mosaics and how they operate, as well as species diversity, soils, vegetation interactions after logging, and macro/microclimates within them.

We also need to know what the effects of logging will be on these ecosystems, in order for forest management to occur. The mixedwood region probably gets the most impact from logging e.g. the Al-Pac logging issue - a very controversial one. Inventory work has been done by CFS in the Al-Pac FMA area, but to date, the report is unpublished. Daishowa, another pulp and paper company, say they will regenerate aspen, and manage their forests after cutting.

A lot of research has been done in the area of forest inventory as it relates to the trees themselves, but data is lacking on the ecosystems.

Areas of forest management which need research include: getting a better understanding of the site, land tenure, better access, more concern for total use and multiple use issues. The management of snowshoe hares and shrub growth under trees, was also mentioned, as well as the following questions:

- should we manage what we have and not what we

wish we had?

- who pays for more expensive logging?

- can we protect the understory?

Managing forests is a complex issue, and inadequate research in order to make educated decisions re management, are a very real problem.

Any logging requires planning for regeneration within 10 years.

- are there any studies in the past 10-15 years on regeneration?

- any field plots?

An employee with Alta. Forest Service commented that companies must reseed or replant after logging, and by the 10th year, show adequate reforestation of a site. New rules as of March 1, 1991 state that companies are now responsible for establishing reforestation, and getting it to a certain height until the 20th year after cutting. These new standards have been developed on the basis of research.

Dr. Snyder questioned the amount of research that has actually been done. She then initiated a discussion of the impact of forestry operations on coniferous forests in Sweden. In that country, coniferous forests have been intensively explored; about 57% of the country is treed, and much of the land is privately owned.

About 40 species of vertebrates that breed or feed in coniferous forests in Sweden, are now endangered. Another 50+ species of plants are near extinction, with 20-30 more on the endangered list. The decline is due in part to Sweden's Forest Act (1980) which stipulates that all owners, large and small, must have a minimum amount of acreage to harvest each year. Owners are also encouraged to use N fertilizers on their land, and to replant with foreign species (e.g. *Pinus contorta*). Lodgepole pine is susceptible to fungal infections, which may affect its growth.

Woodlot owners are also given government incentives to drain wooded wetlands; Sweden aims to drain 40% of all wooded wetlands over the next 20 years.

The cutting of mixedwood forests and replacement with coniferous forests will result in major habitat losses. The loss of insects, for e.g., reduces overall biodiversity significantly. About 100 species of beetles require broad-leaved trees for their survival; these will be lost if the food web is tampered with.

Evidence for the reduction in biodiversity which may occur as a result of forestry activities includes 1) loss of genetic diversity, and 2) loss of species diversity. Research appears to indicate that a certain amount of diversity is necessary to ensure the 'intactness' of forest diversity. The big fear is that one or more 'keystone' species (one which is fundamental to the functioning of the whole system), might be lost.

Old-growth forests in Sweden are now nearly all gone. The few that are left are state-owned and/or on

steep slopes. High elevation forests are the last strongholds for bears, wolverines, and pine martens; all these species are now showing declines. New Swedish policy allows for all these areas to be logged.

The controversial issue of clearcutting was introduced next - clearcutting of large tracts of land is considered the norm in many countries. It results in "islands" of old-growth forest which may not be large enough to support species diversity.

Do we need large tracts of old growth and large tracts of clearcut, or small islands of each? We may need corridors between islands of wilderness, in order to support biodiversity. The analogy to the Giant Panda situation in China was given (where populations of pandas are now isolated from one another, and cannot sustain themselves during adverse environmental conditions).

Finland is allowing some selective cutting of its forests. This type of cutting allows for a more natural type of regeneration. It is also less damaging to cut in winter. Sweden would like to reduce the size of their cuts, but they have invested so heavily in large-scale machinery, they are caught in an economic trap. The pulp industry in Sweden is in fact, probably the largest in the world. They have removed the quality of forest with quantity cutting.

- what scale of cutting does Sweden allow? 300-400 hectares maximum/site

- what scale of cutting does Alberta allow? About 100 hectares maximum/site

J. Johnson (AFS), commented that cut sizes in Footner Forest have decreased to an average of 11 ha. He argued that a natural burn produces an even-aged stand, much like clearcutting, but on an often immense scale (250,000 ha. in his area). A forester's objective, he said, is to cut smaller areas, not to change the age of the trees, with the aim of increasing biological diversity.

Dr. Snyder replied that it is still however, the mandate of most companies to remove older stands first (harbour insects and disease).

The difference in Sweden is that production is the key to survival of small woodlot managers there. Here in Canada, production is in the hands of large corporations and private industry.

Fire will create fire-proof sites and fire-susceptible sites. This retains old-growth stands. Foresters target old growth stands i.e. can select for what they choose to cut.

- what about prescribed burning in Banff Nat. Pk.? Fires are allowed to burn in Nahanni Nat. Pk. Reserve

Fire suppression is not that successful in the boreal ecoregion. We may want to maintain large tracts, for preservation of species such as caribou.

In W-central Alberta, regeneration is occurring after logging. Get huge amounts of terrestrial lichen

within 20 years. After logging, the arboreal component is gone completely however. In lowlands, lichen richness and abundance is not present.

Most of W-central Alberta has 90-120 year aged stands; few old growth stands are left. Lichens may be indicators of stand condition. Certain species of arboreal lichens disappear after 100-150 years (not enough old trees left for them).

Nutrient levels affect regeneration success. Logging depletes certain nutrients or essential elements in forested areas. The importance of mycorrhizal relationships should not be underestimated.

- are replanted forests more susceptible to fire? Perhaps, scarification dries out the terrain. On a scale of burning ratio, old growth stands are least susceptible to fire.

There is a danger of generalizing or oversimplifying ecosystem effects, due to extreme site diversity in the boreal ecosystem. Site-specificity should influence management of the region.

FMA's are only allowed to give up 2-3% of land, for other uses (e.g. for ecological reserves, old growth). The Bruntland Commission suggests 12% protected lands. However FMA's can remove more than 2-3%, as long as companies are compensated for the loss.

A misconception about FMA's: cannot remove timber from all of lease areas, because of inaccessibility and unsuitability (e.g. wetlands).

- will there be more public input on FMA's? Yes, there will be positive changes in this regard. The oil industry is willing to cooperate in the management of lands. They want a "win-win" situation, i.e. what you can't win through legislation, you can win voluntarily.

The ERCB is a strong regulatory board. Industry knows it must cooperate, or it will face a review panel. The new Natural Resources Conservation Board may be a very positive move in the right direction.

- will cutting our forests reduce moisture in itself, combined with wetland drainage? It may lead to an acceleration of global warming and its effects.

## **Workshop B: Old Growth in the Northern Forests**

*Speaker: Matt Fairbarns*

Matt began the workshop by pointing out that it is only in the last few years that the northern half of the province has been committed to forest harvest, but not much in the way of large scale commitment has occurred in the north until now. One of the problems is in the definition of "old growth forest" as seen by foresters. Old school foresters view old growth forests through the following definitions:

1. overmature and decadent stands
2. dominant trees have exceeded their biological rotation age
3. ecologically unstable

4. lack vigour and crown growth
5. decadent, susceptible to insect and diseases attack - a major fire threat

Instead of a strict definition of "old growth forest", he looked at the characteristics of old growth stands as follows:

1. High, long canopies
2. High canopy volume and surface area
3. Specialized habitats especially for cavity-nesting birds
4. Large number of unseen and unknown species, e.g. insects
5. Old growth is not restricted to forests. Peatlands may be many years old and are a form of old growth, as well as areas such as the white birch/crowberry area near Lake Athabasca, jackpine/lichen stands, large areas of old aspen may persist for many years and due to heartrot, provide nesting sites for cavity-nesting birds
6. Age alone cannot be used to define old growth. An 80-90 yr. old stand of mixedwood can be old growth, while conifers may be much older
7. Old growth forests leave a legacy after fire, even serious fires, which does not happen with clearcutting. Conifer regeneration is patchy and open areas increase diversity
8. Cryptogamic species provide higher diversity than do vascular plants.

During the discussion of these characters it was agreed that the need for criteria to measure old growth is often impractical. Matt uses identification of successional trends, but succession occurs on a gradient including soil changes, canopy gaps, debris on ground and in streams. All play vital, but unsynchronized roles in succession. Foresters use productivity to measure old growth, however, timber value is not necessarily restricted to old growth stands.

Many areas which are not old have a large mass, and the location of stands is significant, i.e. a stand in the uplands may be quite different in mass than a stand of the same age in another area.

After clearcutting, an old growth stand is essentially gone forever; once it is lost to cutting and planting, it will never become old growth again and the length of time between cutting varies between different areas. In addition, hybrids often occur and therefore planting after clearcutting is no guarantee of what species will result (it has been shown that genetic differences and mutations can occur within very small areas).

One of the basics of boreal and foothill ecology is the vegetation associations. The boreal forest consists mostly of aspen/conifers, while in the uplands, the aspen fades out and lodgepole pine dominates. With long intervals of fire absence, aspen clones may become weakened and after fire, pine will come in first. The role of microclimate is important, again showing

the large number of factors which play a part in succession.

Old growth forests should not be looked at simply as trees but as habitats. Perhaps old growth could be defined when a specific species is found in an area. In other words, we can't look at it in terms of plants alone. Structure and composition are all important, but indicator species which live in very specific habitats might be considered in defining old growth rather than using age. In other words these are old communities, rather than "old trees".

The discussion then turned to the significance of area size. We cannot protect everything and must face the fact that some species will be lost. What area size is practical? This is almost impossible to answer. Wide-ranging species which depend on old growth may be most at risk. For e.g., how much land is required for a herd of woodland caribou, how many animals is it practical to save, would a herd of, say, 700 be enough for breeding purposes? A species like this would probably require an area too large to protect and therefore this species is endangered. Would it be more practical to protect a large number of small areas with corridors as opposed to fewer large areas? Because no one knows, it would be practical to protect both large and small areas rather than commit ourselves to one type and find out too late that it will not work. There will have to be some compromises and certain areas may be easier to protect than others. We must also look at the uniqueness of old growth stands in regard to indicator species. This also means that younger stands should be considered for protection as well. We require an index of, as well as a measure of, old growthness. Perhaps we could pick a township with a high number of old growth stands and work towards protection.

The matter of protection is urgent. We cannot wait for a database. As George LaRoi said, "We cannot fiddle around while Rome burns." We must try and establish that in forest management areas, old growth be harvested last, however the ground rules of foresters is to cut old growth and "decadent" stands first. Therefore we do not have much time.

Steps we might look at:

1. Change in forestry practice. Once brought into the system, a forest will never be allowed to reach old growth again. Then to me, old growth stands should be harvested last, not first.
2. Try for representative 12% of all types of forest, not just old growth. In this regard, we will have to identify special areas.
3. Preserve landscapes with old growth and younger stands so that the younger stands will eventually become old growth.
4. Use of corridors and buffers could be implemented with old growth stands in the centre.

5. Edge effects as well as the protected area itself must be considered when considering area size.
6. Fire, insect and disease management should be a consideration.

### **Workshop C: Peatland Drainage**

*Speaker: Derek Johnson*

There are approximately 13 M. ha. of peatland in Alberta of which 4 M. ha. have the potential when drained, to be productive. Excessive moisture in the rooting zone of peatland trees retards growth.

In Alberta, there are 8 experimental drainage sites: 1) Athabasca-Ft. McMurray, 2) Salteaux River, 3) Kimiwan I, 4) Kimiwan II, 5) Manning, 6) Goose River, 7) McLennan 28, and 8) Wolf Creek.

**Athabasca-Ft. McMurray** - A coniferous swamp on shallow peat. It has a high nutrient status. Natural growth in the control section of this site has been extremely slow in the past 35 years, and regeneration of coniferous species is lacking. Growth rings in conifers on the drained sections of the mire show increased girth after drainage, above the levels considered good by the forestry service.

**Valleyview** - This is the largest of the drainage sites (135 ha). Ditch spacing at this site is 30, 40, or 50 m. Drainage ditches were dug with a modified backhoe to a depth of 90 cm. Spoil piles revegetate very quickly with *Calamagrostis inexpansa*, and eventually become overgrown by black spruce, tamarack, aspen and balsam poplar. Aspen seedlings have also invaded the drier surface between drains, and eventually this site will become a mixedwood forest.

**Goose River** - Parameters measured at this site include:

- a) Soil temperature at 5 different depths
- b) Weather - temperature, precipitation
- c) Peat subsidence after drainage
- d) Changes in ground vegetation following drainage
- e) Tree growth following drainage
- f) Water samples were collected upstream and downstream for chemical analysis and suspended sediments
- g) Ditch mounding experiment - vegetation was removed and spoils were mounded between drains, creating a convex surface. Site was reseeded with tamarack, lodgepole pine, Siberian larch, white and black spruce
- h) Thinning and fertilizing trials under various thinning regimes and fertilizer treatments.

This site is a good candidate for drainage as it has good access and shallow peat, it is black spruce dominated, and the trees are of younger age which respond better to drainage.

**Wolf Creek** - This site is not as suitable for drainage as the peat is deep, averaging 4.0 m, tamarack is

a predominant species on the site, and the trees are older. Plots were established here in 1986, with the objective of measuring post drainage effects in 5 years (1991). Funding for this project has been cut and it is unknown at present whether this work will be carried out.

#### Conclusions

Cost benefits for drainage of Alberta peatlands is site specific. It appears to be economical at Wolf Creek but not Goose River. Ditch spacing, which is expensive, needs to be carefully designed to provide the optimum drainage with the fewest drains. Final thought: If climate change occurs as anticipated then peatland drainage issues become totally academic.

### **Workshop D: Protected Areas in the Northern Forests**

*Speaker: Peter Lee*

In 'World Conservation Strategy (1980)' and its sequel 'Caring for the World (1990)', the United Nations' International Union for the Conservation of Nature and Natural Resources stated that two mutually supportive components are necessary for sustained economic prosperity: integrated resource management, and a comprehensive network of specially protected areas.

#### What is a Protected Area?

Debate continues over the definition of "protected area", but Alberta government guidelines specify the following:

1. Protection of landscape, features, ecosystems and/or species must be a fundamental reason for the area's establishment, and management guidelines must be instituted to ensure the long-term protection of the area's inherent values;
2. The area must be legislated.

Recently, the Canadian Council on Ecological Areas published a similar definition.

Even with a generally accepted definition of protected areas, there is a lack of political will to establish them. Appeals to both emotion and logic have not been successful. Ecologist Stan Rowe has suggested that setting land aside contravenes conventional (pro-development) thinking. Noting that "Those who want to do nothing, can find enough uncertainty to avoid doing anything." Peter stated that lack of biological information, or poorly managed (i.e. scattered, inaccessible) information, should not prevent the establishment of protected areas.

#### Percentages of Protected Areas

The goal of the World Wildlife Fund is to conserve Canada's biological diversity by protecting a representative sample of each of the country's natural regions

by 2000 A.D., which would amount to about 12% of Canada's total land area. Similarly, according to Peter, Alberta's goal should be to make its protected area system representative of the province's ecological diversity. Legally protected areas in Alberta, broken down by ecological unit, are as follows:

Grassland	0.4%
Parkland	0.6%
Foothills	0.2%
Boreal Forest	10.4%
Rocky Mountain	55.9% (National Parks)
Canadian Shield	1.5%

The total percentage of protected land covers only 9.5% of Alberta, however.

In the boreal forest, according to region, the breakdown is:

	% of Total Land in Province	% of Protected Area
Subarctic	5	13.1*
Hay River	5	38.1*
Peace River	5	59.6*
Mixedwood	40	0.3
Kazan Uplands	1	0.0
Athabasca Plain	2	2.5

\*( All in Wood Buffalo National Park)

The total percentage of protected land in the boreal forest region of Alberta is 10.0%.

Note that the mixedwood forest region, in which most forestry operations occur, is minimally protected at 0.3% while occupying 40% of the boreal forest ecoregion. In view of this limited protection, it is important that environmentally significant areas be identified when Forestry Management Agreements (FMAs) are being drawn up.

### Ecologically Significant Areas

Of all the large amounts of data that can be collected for an FMA in the face of imminent forest development, the general kind of information provided by inventories of environmentally significant areas (ESAs) is the most urgent and useful. [An ESA is an ecosystem or ecosystem segment whose natural characteristics and processes should be maintained]. Criteria for identifying ESAs include the presence of significant, rare, or endangered species, habitats with limited representation, areas of unusual or high biological diversity, undisturbed areas, corridors for movement of wildlife and important hydrological systems. Consideration of such features permits the relative value of the site to be assessed. ESAs may be identified from 1) the existing literature, 2) aerial photos (which reveal vegetation and landform diversity, major stands of old-growth forest, interesting features), and 3) field analysis and reconnaissance.

Collecting data on ESAs also has the advantage of being comparatively inexpensive. Costs for an ESA have been estimated at \$1.80/sq. mi. as compared to \$180.00/sq. mi. for timber assessment and \$85.00/sq. mi. for wildlife.

Once identified, ESAs should be protected, either by circumscription within legal boundaries, within which human activity is prohibited (i.e. a protected area), or for less significant areas, specifying the use of sensitive harvesting techniques. When ESAs have been designated as being in need of legal protection, the questions arise of determining boundaries or of "bigness" of the area. Despite adequate information in the literature, once again conventional attitudes militate against protection. For e.g., the forest industry, Alberta Forest Service and government all maintain that the oldest and poorest condition timber should be removed in the first cut, wherever feasible. Citing old-growth forests and river valleys as in prime need of protection in the boreal forest ecoregion, Peter Lee said, "Old growth needs to be protected by design, not by default."

### Conditions for Signing of Forestry Management Agreements

The following conditions should be met before FMAs for northern forests are signed:

1. A timber inventory should be done (to establish economic justification for cutting).
2. Public involvement and consensus should take place.
3. Other resource interests should be considered, e.g. nonrenewable resources, recreation, and tourism.
4. Adequate environmental protection must be assured, which might include a range of options, from protected areas, to areas in which sensitive logging only is permitted.

Questions from the floor covered such topics as:

- the inadequacy of definitions of protected areas (species do not respect boundaries)
- whether land in well-protected areas, e.g. Rocky Mountains, should be exchanged for more protected land in underprotected ecoregions. The consensus was no.
- on the question of more effective lobbying for protected areas:
  - whether the ANPC should become more involved.

[It was agreed that cooperation and compromise are needed to work with industry and government]

Local lobbying can be effective. For e.g., staff with the Footner Forest, Alberta Forest Service have formed ecological committees to identify areas determined by ecological rather than administrative boundaries. Spokespeople from two natural history societies offered botanical expertise in determining significant elements in the Footner Forest.





