the WESTERN SWAN HILLS

alberta's forgotten wilderness

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the Western Swan Hills —Alberta's forgotten wilderness

Oxbow on the Freeman River A. D. Raszewski

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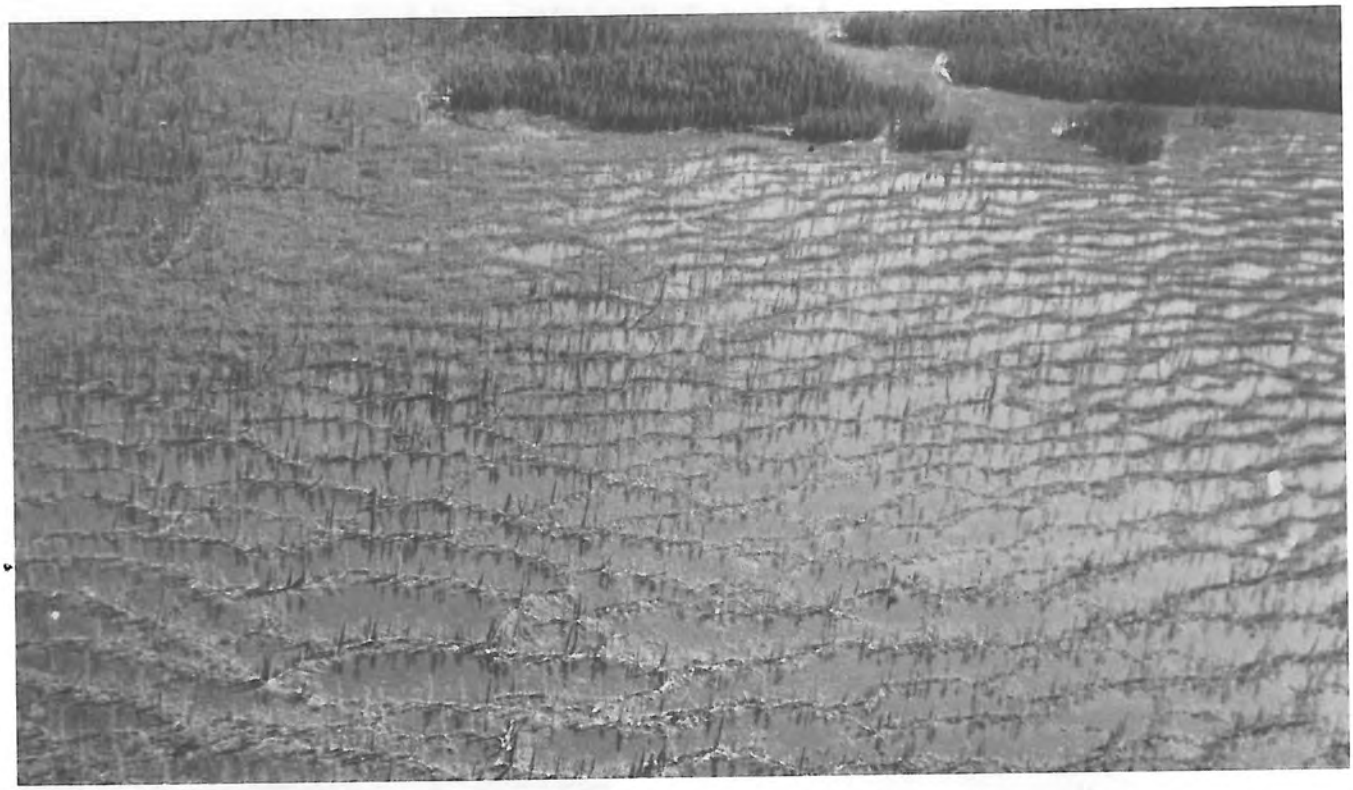

Patterned Fen

A. D. Raszewski

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INTRODUCTION

Alberta's existing *Wilderness Areas* (as defined by statute under the Wilderness Areas Act) all lie on the eastern slopes of the Rocky Mountains. Proposals for additional "Recreational Wildlands" in this region were put forward at the 1973 public hearings on land use and resource development in the eastern slopes of the Rocky Mountains, and are currently under consideration by the provincial government. There are other parts of the province, however, which are no less worthy of preservation. At present virtually the whole of the boreal forest to the north and east of the Rocky Mountain foothills is unprotected against inappropriate exploration and development. There the slopes are gentler and the scenery less spectacular than in the Rockies. Consequently the demand for recreational use has been less intense. Many Albertans believe that the boreal forest is still one great wilderness. As such, many argue that there is really no need to have areas set aside by statute as *wilderness areas, parks* or *ecological reserves*. Unfortunately, an inspection of what is actually happening in the field soon dispels this belief. All too frequently the forest is dissected at frequent intervals with access roads built by resource industries, particularly the petroleum and timber industries. These roads have made motorized access easy, with the end result that hunting has become difficult to control and populations of game animals have become seriously depleted in certain areas. At the same time the remaining old-growth stands of timber are threatened by large-scale timber dispositions, which are being granted before all of the intricacies of forest succession and its effects on wildlife are properly understood. There is a myth current in some government and industry circles that what are termed "overmature" stands of trees must be cut for the good of the forest and its inhabitants. Such stands are considered to be reservoirs of insect pests and diseases, and are thought to be useless for ungulates due to lack of forage. All this is oversimplified. Overdense stands with little ground cover and many diseased and dying trees certainly do occur in the boreal forest. However, this condition is not a consequence of great age but of excessive regeneration following fire, logging or other disturbance. In the 300-year-old stands of Englemann Spruce on Goose Mountain in the Swan Hills, the trees are well spaced and there is a diverse ground cover. These are some of the oldest stands of virgin timber in Alberta. At present there is nothing to prevent some civil servant from signing them away to a logging company.

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Why the Swan Hills?

The Swan Hills, particularly the western parts, are in certain respects unique among Alberta's wilderness areas. The summer rainfall here is higher than in most of Alberta with the result that the frequency of fires is low and there is a great deal of old-growth timber, some at least 300 years old. Many mountain and northern plants reach the eastern or southern limits of their ranges here. There also occur a few plants that are highly localized in Alberta, plants which are usually more characteristic of the wet belts of British Columbia. Wildlife, too, is diverse. The grizzly, most famous of all the Swan Hills creatures, is represented by a very large local race. Because the case for conservation of the hills rests so heavily on the uniqueness of its flora and fauna, we have included an extensive treatment of them in subsequent chapters.

Man has, until recently, been no more than a visitor to the Swan Hills. The main Indian settlements have always been on lower ground. Only with the opening of the oilfields came semi-permanent settlement. Even this will not persist. When the oil runs out - estimates range from 10 to 30 years - man will leave.

The impact of oil exploitation in the Swan Hills is unevenly distributed. Some areas near Swan Hills Townsite in the eastern part of the hills have been devastated. One can point to places where the area of cutlines of one kind or another is greater than that of the remaining forest. There has been extensive erosion and siltation of streams. And the labyrinth of oilfield roads provides total access for the motorized hunter. All in all, parts of the eastern Swan Hills provide a gross example of the end result of granting unlimited rights of access to resource companies. Certain of these companies have acted as if the land itself were of no value. The responsibility for failing to protect the land must also rest with successive Alberta governments.

But not all of the Swan Hills has been thus abused. There are broad areas still largely in a primitive state, particularly on the botanically more interesting western side of the hills. It is true that this entire area has been explored for oil, but the seismic lines are widely separated and have grown back considerably. They now function as game, foot, and horse trails. Vehicle access is difficult, even with 4-wheel drive, and often impossible after a summer rainstorm.

Consequently, the western Swan Hills function as a major refuge from human disturbance of large mammals, particularly moose, bears (both black and grizzly) and wolves. For the non-motorized moose hunter, who seeks a wilderness experience and is prepared to bring out his meat on his back or with horse or mule, the western Swan Hills are still among the most attractive hunting areas in Alberta. For the naturalist they offer much unexplored terrain where exciting new discoveries surely await. For the hiker accustomed to mountain trails, they offer a new kind of country, with rounded hills, gentle slopes, and a fascinating mosaic of forest types interlaced with muskeg and carr (shrubland).

The proximity of the Swan Hills to Edmonton (little more than 100 miles distant) suggests that their attractiveness for recreational use will increase. This emphasizes the need for government to consider the future of the area now, well before long-term dispositions for timber harvesting are granted.

D. Lindsay

RECOMMENDATIONS

1. Recreation Wilderness proposal

In a previous publication, "Wildlands for Recreation: 9 Areas on Alberta's East Slope", the need for two categories of wilderness in Alberta was pointed out: benchmark wilderness under the terms of the existing Wilderness Areas Act, and secondly, *recreational wilderness*, with hunting, fishing and horseback travel (forbidden in benchmark wilderness) . Our first and most important recommendation is that an extensive recreational wilderness should be designated in the western Swan Hills.

This recommendation should come as no surprise to government circles, for on 19th May 1970, Dr. J. Donovan Ross, then Minister of Lands and Forests, speaking in Edmonton at a public meeting of the Edmonton Chapter of the National and Provincial Parks Association, stated that the region around Goose Mountain might be suitable for establishment of a wilderness area when the Wilderness Areas Act had been passed.

In attempting to define the boundaries of this recreational wilderness (see the included maps) we have taken into account the areas of existing high oilfield activity and have avoided them. We have included the area of greatest botanical interest, which is around Goose Mountain, as well as certain other special features, such as the series of small lakes south of the crest line at about 3800 feet, and the steep screes and ravines cut by the northward-flowing streams. Part of our southern boundary is formed by the Freeman River; the rest is indicated by township lines. This represents a compromise. Ideally, conservation areas should be defined by their natural ecological and physiographic divisions, but the northern part of our area is poorly explored and we do not know with any precision where the natural divisions lie. Our proposed boundaries are therefore open to revision following research in the area.

The primitive recreation activities to be permitted in the recreational wilderness would include *non-motorized* hunting (including guided parties) for moose, deer, and upland birds. There should, however, be a strict prohibition on the killing of all bears in order that the area may function as a population reservoir for the unique Swan Hills grizzly. A prohibition on the killing of the grizzly alone would be unenforceable, since any hunter could put up the defence that he mistook a grizzly for a black bear. We considered the alternative possibility of defining a core area of benchmark wilderness with hunting forbidden to protect the grizzly bears, this area to be surrounded by a larger area of recreational wilderness. The effectiveness of this proposal seemed doubtful, however, because the bears range widely and their denning areas are not fully known. Also, it would be very difficult to enforce separate regulations for a core area. Given the circumstances, a general prohibition on the killing of bears over an extensive area would seem more effective and enforceable.

Major oilfields lie around the periphery of the proposed recreational wilderness. There are, or were, a few producing wells within its boundaries, and much of the land is under oil and gas lease or reservation. It would not be practical politically to suggest withdrawal of these rights before the production potential of the fields has been exhausted. On the other hand, it is unlikely that the petroleum industry will wish to make extensive intrusions within the proposed wilderness, as they have had every opportunity to exploit this land over the last two decades but have not done so to any great extent. We suggest that the holders of oil and gas leases within the recreational wilderness be assured that their rights will be maintained during the productive life of the oilfields, but that no new leases will be issued. Any applications by leaseholders to do additional exploration or to construct access roads for new wells within the recreational wilderness could be referred to the Wilderness Advisory Committee of the Department of Parks, Recreation & Wildlife, which in turn would advise other government departments and lessees on the means of minimizing damage to the land.

The activities of the forest industry pose the only long-term conflict with the proposal for a recreational wilderness in the western Swan Hills. We are convinced that the right course is to exclude the wilderness entirely from logging, so that the existing diversity of forest types - including very old stands - can be preserved. The following arguments support the preservation of old-growth forests.

(1) Genetic diversity of tree species should be maintained. As a greater proportion of the landscape becomes dominated by genetically homogenous stands of selected tree varieties, the likelihood of losing valuable genetic material will increase.

(2) Old stands are a good seed source for natural regeneration and artificial propagation, since the surviving trees in these stands are those that have stood the test of natural selection over a long period of time.

(3) Mature stands, being substantially at equilibrium with the local environment, can serve as "benchmarks" (i.e., indicators or monitors) and are potential sources of information on the effects of climatic changes and pollution effects. Mature stands are inherently superior

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Dwarf Raspberry D. E. Griffiths

as environmental control groups, by virtue of their stability.

(4) Generally, mature plant communities tie up nutrients more efficiently than do successional communities, even though annual productivity may be lower. Nutrients are leaving the system by erosion and leaching much more slowly than they would from successional communities. Mature stands are thus nutrient banks, which should be preserved for future periods when high productivity may be more essential than at present.

(5) Mature communities possess unique flora and fauna. Destruction of communities may amount to the destruction of whole habitats and can lead to the extinction of species. Aside from the aesthetic values, many species of organisms may be unknown sources of drugs or biological controllers of pests - or have other uses. Every extinction that occurs is a potential loss of resources of this sort.

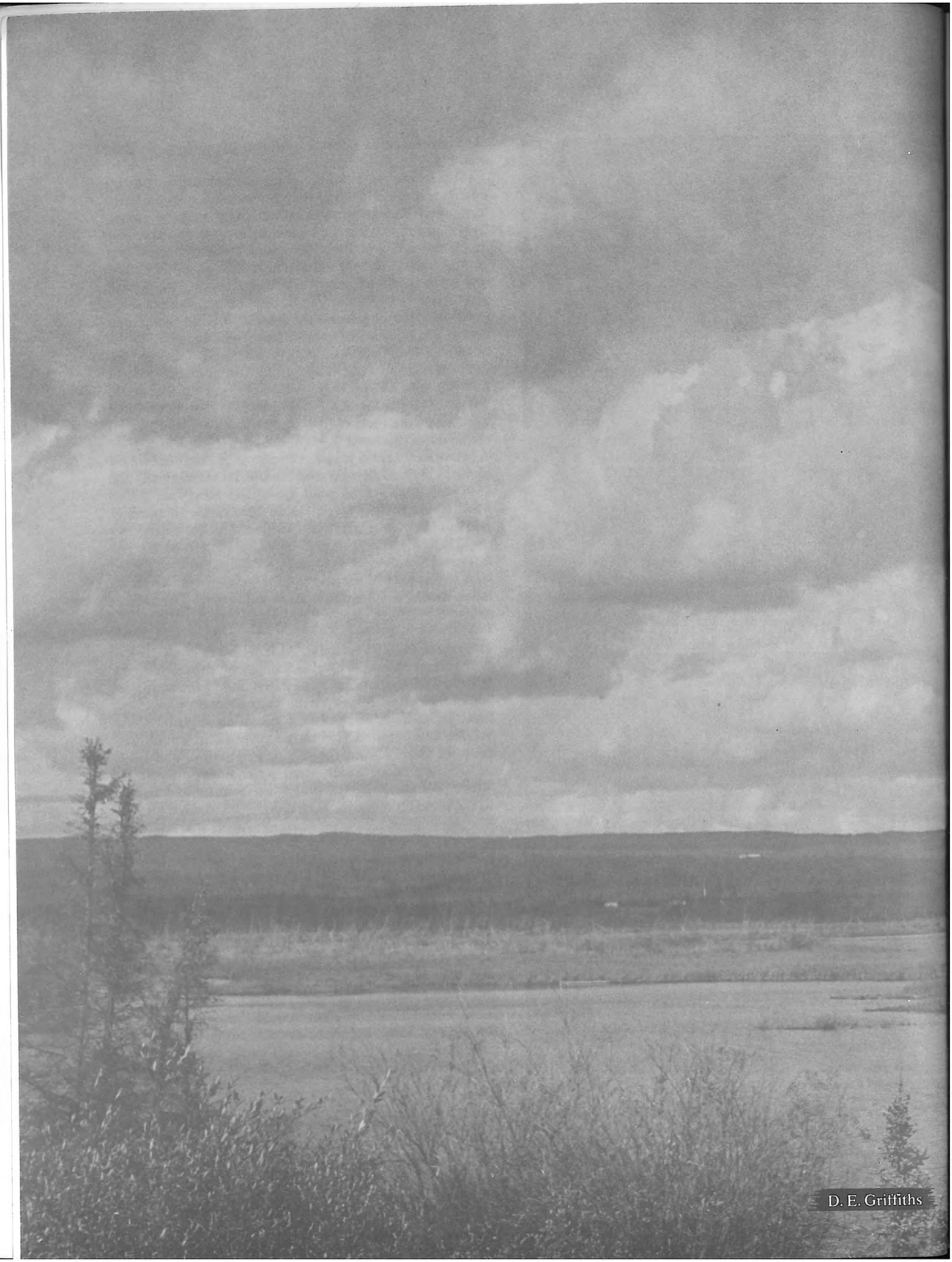
Motorized access to the recreational wilderness would be forbidden. Only one road should be maintained: the east-west unimproved road along the crest line which leads to the fire-tower on Goose Mountain. In summer and fall this road should be closed, except for emergency use. During winter, the road could be opened on request if logging companies need access to bring out logs from land to the west of the recreational wilderness. All other roads should be closed and allowed to revert to a natural state.

2. Freeman Lake Provincial Park proposal

We recommend the establishment of a provincial park centred on Freeman Lake and extending to the southeast boundary of the proposed recreational wilderness. Freeman Lake is presently the site of an Alberta Forest Service campground. It can be reached in about four hours of driving from the city of Edmonton, and likely will become more widely used by city residents in the future. We visualize *non-motorized* boating and fishing as the main recreational activities on this lake.

3. Goose Mountain Ecological Reserve

We support the proposal of the Alberta IBP-CT (International Biological Programme - Conservation Terrestrial) Committee for the establishment of a small ecological reserve for long-term scientific study on Goose Mountain. This is included within our proposed recreational wilderness area. The only conflict between recreational and research use that we can foresee, is that pack animals could damage vegetation around camp sites, thus interfering with studies on vegetational succession. This problem could be overcome by forbidding mounted parties to camp within the ecological reserve, although they could pass through it along defined trails.


D. E. Griffiths

DISCUSSION

This discussion will be presented under seven subheadings: (1) climate, (2) geology and soils, (3) vegetation, (4) animals, (5) Goose Mountain IBP site - a proposed ecological reserve, (6) Freeman Lake - a potential Provincial Park, and (7) resource utilization.

Climate

The climate of the Swan Hills is continental, with cold winters and short, cool summers. Goose Mountain lookout is the only climatic station in the proposed wilderness area; it is in operation from May through September, which is the general growing season. Precipitation is greatest in early July and lowest about six months later in mid-winter. The average May - September precipitation is nearly 20 inches. This is 6-8 inches greater than that received by adjacent stations at lower elevations such as at Whitecourt and Fort Assiniboine. The increase in precipitation on the western side of the Swan Hills is apparently due to localized air movements which tend to draw storms into the area. Total annual precipitation is estimated to be about 35 inches. July is the warmest month, while January is the coldest. The average May - September temperature at Goose Mountain is 9°C, which is 3°C cooler than the adjacent lower-elevation stations.

Geology and Soils

The Swan Hills are an erosional remnant, underlain by a series of non-marine sandstones, shales, and coals of Cretaceous age (65-136 million years old) and by hardened clays, shales, sandstones and gravels laid down during the Tertiary period (1.5-65 million years ago). The bedrock dips to the southwest and thickens in the same direction. The late Cretaceous Belly River Formation, the oldest bedrock unit to outcrop in the area (70-75 million years) is composed of freshwater sandstones, shales, and sandy shales with some coal seams. It is overlain by the Edmonton Formation, another late Cretaceous (65-75 million-year-old) unit of sandstones, shales, shaly sands, coal seams, and semi-indurated (fairly hard) clays. The overlying Paskapoo Formation, a Tertiary unit (probably Paleocene: 53-65 million years in age), is composed of sandstones, sandy shales, indurated and semi-indurated clays, and highly calcareous (limey) shales. The calcareous shales are resistant to erosion and form creamy-colored cliffs at several locations in the area. The Paskapoo Formation is overlain by an Upper Tertiary deposit (1.5-7 million years old) of coarse, unconsolidated gravel, which ranges in thickness from 1 to 40 feet. The deposit consists of waterworn, white to yellow, quartz-bearing cobbles up to eight inches in diameter. This gravel deposit forms the land surface throughout much of the area, especially at higher elevations. Where the cobbles do not cover the Paskapoo Formation, a greenish, bentonitic (volcanic ash-bearing) clay-shale often forms the surface. This clay-shale absorbs water readily to become a soft, greasy mud which frequently makes roads impassable in the area.

The area was apparently glaciated at least twice by southwestward-moving ice sheets during the Pleistocene Epoch (1.5 million years ago to the present) and deposits of till and glacial river sediments occur in the area. The ice reworked the surface deposits, especially the Tertiary gravels, and the distinction between till and Tertiary gravels is sometimes difficult to make. Glacial deposits appear to be restricted to altitudes of less than about 3500 feet.

The upland residual soils (soils formed in place) of the area are primarily orthic grey luvisols which have developed on glacial till and various fine-textured Tertiary deposits. On coarser-textured parent materials, brunisols and podzols generally develop. These soils are usually quite acidic and of low nutrient status; they develop under upland forest.

The lowland mineral soils are gleysols, predominantly stream deposited, low in organic matter, and typically mottled due to restricted drainage conditions. These soils are associated with the carr, lowland shrub, and muskeg forest vegetation types.

Soils having more than 12 inches of peat at the surface are classified as organic soils. Two types of organic soils, fen peat and bog peat, can be recognized in the area. The types correspond to the lowland fen and bog vegetation types. Under heavy peat layers, ice has been found in late summer, indicating that complete thawing does not always take place. However, the Swan Hills are well south of the southern boundary usually mapped for the disontinuous permafrost zone, and the characteristic ice-core mound or palsa-type peatlands have not been observed in the area. The subject of localized permafrost needs additional study.

Vegetation

Most of the proposed recreational wilderness is in the Lower Foothills section (B19a) of the Boreal Region in J.S. Rowe's classification of the forests of Canada. Small portions at lower elevation, in the southeast and northwest corners of the area, belong to the Mixedwood section (B18a) as shown on the vegetation type map, p. 29. The Lower Foothills Section is part of the transition between the Transcontinental Boreal Forest and the Rocky Mountain Subalpine Forest. The primary feature distinguishing the two sections is the presence of lodgepole pine in the Lower Foothills section, and the presence of aspen poplar in the Mixedwood section. In the Swan Hills the boundary between the two sections generally follows the 3000-foot contour.

The flora in the area is partly boreal (northern forest vegetation) and characteristic of much of the northern part of the continent. However, the Lower Foothills portion contains many species of cordilleran (Rocky Mountain) affinity. Such species include, for example, Engelmann spruce, subalpine fir, lodgepole pine, trailing raspberry, mountain laurel, white-flowered rhododendron, and tall bilberry. Many of these species are at the eastern limit of their ranges in the Swan Hills.

In the area Engelmann spruce hybridizes with white spruce, a boreal species, and subalpine fir hybridizes with balsam fir, also a boreal species. Fairly pure populations of Engelmann spruce and subalpine fir occur at the highest elevations in the area, in the vicinity of Goose Mountain. The spruce and fir of most of the area are hybrids, while in the Mixedwood portion fairly pure populations of white spruce and balsam fir occur. In this wilderness area proposal the term spruce is used to refer to the Engelmann-white spruce complex. The other spruce in the area, black spruce, is referred to as such.

Hybridization between lodgepole pine and jack pine, the boreal species, occurs primarily at lower elevations outside the area. Although some hybrid pines are apparent in the area, most are pure lodgepole.

Two plants of Pacific coast affinity, devil's club and false-mitrewort, occur in the area. These species are near their eastern limits here, and are associated with high rainfall situations found at higher elevations in the Lower Foothills portion of the Swan Hills.

The appended species list (Appendix I) contains further information on the flora of the area.

UPLAND VEGETATION TYPES

The distribution of the vegetation types in the area is related to altitude, drainage, and fire history. Spruce-fir forests generally occur at higher altitudes, on upland sites that have not burned recently. Similar sites with a more recent fire history support mixed coniferous but mainly lodgepole pine forests. At lower altitudes are mixedwood forests of white spruce and aspen.On alluvial sites along rivers, balsam poplar largely replaces aspen in mixedwood stands. Following severe fire on upland sites, brushfields dominated by shrubs and young trees are common. Poplar forests, dominated by aspen, often develop from these brushfields.

On poorly-drained lowland sites, muskeg forests on shallow peat are usually dominated by black spruce. A complex mosaic of bog and fen peatland types (muskegs), some with trees and some without, occurs on deeper peats. Shrublands on poorly-drained sites, along streams, and often around beaver dams, are termed carrs and are usually dominated by species of alder and willow. Shoreline communities of submerged and emergent plants ring the edges of small lakes.

Spruce-Fir Forest:

Forests dominated by a combination of Engelmann spruce, white spruce, and their hybrids and subalpine fir, balsam fir, and their hybrids are considered to be the climax forest type on upland sites in the area. Old lodgepole pine (175-225 years old) often occur in these forests, but pine regeneration is absent. Thus, lodgepole pine appears to be a seral species (one that will be replaced by others) on nearly all sites in the area, with the possible exception of some very dry situations. There is a trend to greater fir dominance at higher altitudes in the Lower Foothills portion, while spruce is generally dominant in the Mixedwood part.

Shrubs in the understorey of this vegetation type include low-bush cranberry, prickly rose, Labrador tea, tall bilberry, and cranberry. Herbs include twinflower, bunchberry, one-sided wintergreen, and the orchids heart-leaved twayblade and blunt-leaved orchid. The ground is often heavily carpeted with three feather mosses (*Ptilium crista-castrensis, Hylocomium splendens, Pleurozium schreberi*). Epiphytic (attached, but not parasitic) lichens of the genera *Usnea, Alectoria,* and *Parmelia* are common on the branches and trunks of the overstorey trees.

Spruce-fir forests 250-300 years old occur along the escarpment east of Goose Mountain. Forests this old are very rare in the boreal forest of Alberta because of the prevalence of fire. Fire seems to have occurred frequently throughout the history of the boreal forest in most of

From Goose Mountain

D. E. Griffiths

Alberta. Here, boreal forests appear to have escaped fire because of the greater precipitation the higher elevations receive. Owing to the presence of Engelmann spruce and subalpine fir, and a large number of cordilleran understorey plants, these forests are similar in appearance to the subalpine forests of the Rocky Mountains to the west.

Mixed Coniferous Forest:

This upland vegetation type is a finely-patterned mosaic involving the Engelmann-white spruce complex, the subalpine-balsam fir complex, lodgepole pine, and black spruce. The pattern of dominance appears related to fire history, with lodgepole pine and black spruce invading fire-caused clearings, and fir being particularly sensitive to fire. Lodgepole pine and black spruce show some association with shallow soils, the pine tending to predominate on the warmer, south-facing and west-facing sites, and the black spruce on the colder north-facing and east-facing sites, although they frequently occur together. Repeated mild fire disturbance appears to maintain this extensive vegetation type. In the absence of periodic fire the importance of lodgepole pine and black spruce declines.

The understorey vegetation to some degree reflects the pattern of the overstorey dominants. Shrubby plants include: Labrador tea, low-bush cranberry, green alder, skunk currant, cranberry, and blueberry. Common herbs are: trailing raspberry, bunchberry, twinflower, mitrewort, and stiff clubmoss. A heavy carpet of feather mosses (*Pleurozium schreberi, Ptilium crista-castrensis, Hylocomium splendens*) usually covers the ground. Other common mosses include *Dicranum polysetum* and, in wetter places, species of peat moss (*Sphagnum*).

Lodgepole Pine Forest:

Forests dominated by lodgepole pine commonly develop following fire. The forests are typically even-aged and range in age from recently established stands 20-30 years old to stands which are over 150 years of age. The younger stands are sometimes very dense and the intense competition between trees slows their growth markedly. The older stands are typically being replaced by spruce and fir, thus becoming mixed coniferous forest and, with sufficient time, spruce-fir forest. However, some dry sites with shallow soils have uneven-aged stands that appear to be self-perpetuating.

At the wet end of the soil moisture gradient, stands of lodgepole pine occasionally occur on peaty, lowland sites following fire. Closeness of seed souce for colonization appears instrumental in establishing such stands. The fate of these stands is not clear, but replacement by black spruce muskeg forest seems probable.

On upland sites typical understorey shrubs include: labrador tea, low-bush cranberry, buffalo-berry, bearberry, cranberry and blueberry. Common herbaceous plants are: bunchberry, trailing raspberry, one-sided wintergreen, twinflower, and stiff clubmoss. The three feather mosses (*Hylocomium splendens, Pleurozium schreberi, Ptilium crista-castrensis*) are dominant on the forest floor. The lichens *Cladina mitis* and various species of the genus *Cladonia* are quite common. Epiphytic lichens include species of *Alectoria* and *Usnea*.

Mixedwood Forest:

At lower altitude, primarily in the southeast and northwest corners of the area, occur forests dominated by white spruce and aspen poplar. Balsam fir occurs in small amounts in older stands. Balsam poplar tends to replace aspen on alluvial sites along streams and rivers, and on other wet sites where groundwater is moving.

The patterning of overstorey dominance is a mosaic of patches of needle-leaved coniferous trees and broad-leaved deciduous trees. Fire plays an important role here also. Aspen and balsam poplar, with their ability to resprout from the roots immediately after fire, are favored by the occurrence of fire. The white spruce and balsam fir must re-establish themselves by seed. Balsam fir is particularly sensitive to fire and the presence of balsam fir indicates a lack of fire for some time. Paper birch often occurs as scattered individual trees in these forests.

Typical shrubs in the understorey include: lowbush cranberry, snowberry, prickly rose, and red raspberry. Typical herbs include: dewberry, twinflower,bunchberry, bluebells, bluejoint grass, wild lily-of-the-valley, and pink wintergreen.

Under the conifers the forest floor is carpeted by the three feather mosses with *Hylocomium splendens* most common. Moss cover is generally very low under the broadleaved trees where the herb layer is typically well developed. Here the mosses are largely restricted to the bases of trees and to fallen logs where they escape the smothering effect of the annual leaf fall.

Species of *Alectoria* and *Usnea* are the dominant epiphytic lichens, while the moss *Orthotrichum speciosum* var. *elegans* is a common epiphyte on aspen and balsam poplar trunks.

Elderberry D. E. Griffiths

Poplar Forest:

Repeated burning of a forest stand largely eliminates white spruce and balsam fir, and results in stands of nerly pure aspen and balsam poplar at lower elevation. Fires usually occur in the fall or early spring, when all of the spruce and fir seed has been shed and lies on the ground. Destruction of the seed by fire may be instrumental in the origin of poplar forests. The aspen poplar produces "suckers" (new shoots) from roots, and fire, or other trauma, stimulates this suckering, thus ensuring its niche in this ecosystem.

Poplar forests in the area are restricted to the mixedwood portion at lower altitudes. The forests are often even-aged and range in age from 20-30 years to 100-110 years. The younger stands often develop from shrublands as discussed below. The oldest stands are generally being invaded by white spruce to some extent, the seed coming in from relatively distant sources. Poplars older than 50 years nearly all have heart rot, so that by age 75 and older they are quite susceptible to wind damage. Poplars older than 150 years are quite rare in the area. In the absence of fire these forests usually develop into mixedwood forests.

Typical understorey shrubs include: red-osier dogwood, low-bush cranberry, saskatoon, snowberry, prickly rose, and red raspberry. The herbaceous layer in poplar forests is well developed and contains a large number of species. Among the most prominent are: dewberry, pink wintergreen, wild strawberry, wild sarsaparilla,bluejoint grass, pea vine, and wild lily-of-the-valley. The smothering effect of the annual leaf fall appears to restrict mosses to tree bases and fallen logs. The mosses *Pylaisiella polyantha* and *Brachythecium salebrosum* form green "stockings" around tree bases. *Parmelia sulcata* and *Xanthoria fallax* are common epiphytic lichens, while the most common epiphytic moss is again *Orthotrichum speciosum* var. *elegans*.

Shrubland:

This is a heterogenous category and is commonly called "brush". The dominants are shrubs, tree saplings, and other transgressors that have colonized the areas following destruction of the original forest by fire. There is much variation within this vegetation type due to varying fire severity and to differences in soil drainage.

On upland sites in the mixedwood area of brush, many aspen and balsam poplar saplings and transgressor species are found. Common shrubs include: green alder, beaked willow, paper birch, red raspberry, and skunk currant. Typical herbs are: fireweed, bluejoint grass, dandelion, dewberry, golden corydalis, and several species of sedge (*Carex*). The mosses *Funaria hygrometrica, Ceratodon purpureus*, and *Polytrichum juniperinum* are common. The liverwort (*Marchantia polymorpha*) occurs commonly on charred wood.

As the aspen and balsam poplar saplings become trees, brush yields to poplar forest. If a white spruce seed source is close by, spruce seedlings soon become established, and a mixedwood forest develops.

On upland sites in the Lower Foothills portion of the area, lodgepole pine saplings and transgressors are most common. Black spruce also becomes established from seed from adjacent lowland areas that have not burned, or from mature upland black spruce that have old, or semi-serotinous (late-opening) cones. The semi-serotinous cones of both lodgepole pine and black spruce are fire-adaptive in that at least some of the seed is retained in the cone *on the tree* instead of all being shed on the ground. Thus, unlike the white spruces or fir, where all of the shed seed can be readily destroyed by a hot fire, these two conifer species retain their niche as pioneers in ecological succession through this evolutionary adaptation.

Common shrubs are: beaked willow, red raspberry, skunk currant, and blueberry. The following species of herbs are often found here: fireweed, dandelion, bluejoint grass, field horsetail, and sweet-scented bedstraw. *Ceratodon purpureus, Funaria hygrometrica,* and *Polytrichum juniperinum* are common mosses.

As the tree saplings mature, the shrubland gradually becomes a lodgepole pine forest or a mixed coniferous forest of lodgepole pine and black spruce. If an external seed source is close enough, white spruce and fir may also become established.

Although aspen and lodgepole pine are the primary colonizers of burned sites in the Mixedwood and Lower Foothills portions respectively, throughout the area white and Engelmann spruce establishment may follow directly after fire where large amounts of seed are available from adjacent unburned forests. Both spruce species are well adapted to bare mineral soil in full sun. Thus, shrublands in which the dominant tree saplings are white or Engelmann spruce, rather than aspen, balsam poplar, lodgepole pine or black spruce, do occur in the area.

Lowland shrubland:

In the revegetation of burned muskeg forest, black spruce saplings are most common, although lodgepole pine becomes established on some sites. The large number of black spruce transgressors and saplings common in this vegetation type indicates an eventual succession to muskeg forest. The dominant shrub species are: Labrador tea, dwarf birch, and several species of willow. Common herbs include: bunchberry, dwarf raspberry, bluejoint grass, northern reed grass and several species of sedge (*Carex*).

Even during a fire the wet soil protects the moss layer, and mosses of the previous vegetation type prevail.

Vegetation on disturbed sites:

Past petroleum exploration and extraction in the area has resulted in the disturbance of large areas due to the construction of seismic lines, well sites, pipeline routs, and roads. Along some seismic lines disturbance has involved little more than felling the overstorey trees. The understorey vegetation in such cases has remained relatively intact and the same tree species as in the adjacent forest are becoming re-established.

However, more commonly blading has removed all the vegetation from the cut and communities of the weedy (ruderal) plants have become established. This vegetation type has not been well sampled, hence the descriptions are somewhat anecdotal.

Blading is seldom deep enough to remove aspen and balsam poplar roots entirely; thus, root sprouts are common where these species have previously occupied the site. Lodgepole pine is a frequent invader of disturbed areas at the higher elevations. Both white and Engelmann spruce seedlings establish readily on disturbed mineral soil where a seed source is available.

Common ruderal shrub species are: Labrador tea, red raspberry and various species of willow (*Salix*). Common herbaceous species include: fireweed, bluejoint grass, rough cinquefoil, crane's-bill, dandelion, timothy, and wild strawberry.

LOWLAND VEGETATION TYPES

The lowland vegetation of the area can be divided into two broad categories: vegetation occurring on peat or organic soils (muskegs), and vegetation occurring on mineral soil.

Muskegs, Bogs, and Fens:

Muskegs can be further classified on the basis of their nutrient status and floristic composition into bogs and fens.

Bogs are acidic and low in essential nutrients. They are characterized by the presence of black spruce, members of the heath family (*Ericaceae*) such as Labrador tea, bog rosemary, and swamp laurel, and several species of what is commercially called "peat moss" (*Sphagnum*). Peat is formed primarily from the matting and eventual decaying of these mosses.

Some bogs in the area have scattered trees (treed bogs) while others have very few or none (open bogs). The reason for the difference is not clear but may be due to repeated fire, which appears to eliminate the trees from some bogs.

Because of the nature of the geological substrata and the continental climate, true bogs are rare in the area. By far the most common type of peatland is the fen. Fens are nearly neutral in pH and are comparatively nutrient rich. They are characterized by the presence of tamarack, willows, sedges (e.g. *Carex limosa, C. aquatilis*) and mosses such as *Tomenthypnum nitens* and *Aulacomium palustre*. Peat mosses (*Sphagnum*) are rare and the peat is formed by the sedges and other mosses.

As in bogs, some fens are treed and others open. Some open fens have a dense shrub layer (shrub fen), while others have few shrubs and are termed sedge fens.

Bogs and fens are points along a vegetational and nutrient status gradient. Many of the muskegs in the area are of an intermediate nature and are termed poor fens.

Patterned Fens:

Several of the muskegs contain a surface pattern of alternating ridges and hollows. All of the patterned muskegs (strangmoor, aapa moor) examined in the Goose Mountain area have been poor fens. In a typical patterned fen about three miles south of the Goose Mountain Lookout, the ridges are 5-25 feet wide and rise about two feet above the water level in the hollows. The hollows are 15-50 feet wide and the water in them is ½-4 feet deep. The patterned fens are located on low drainage divides and the surface of the peatland slopes in several directions. The ridges and hollows are oriented perpendicular to the direction of water flow.

Treed Bog D. E. Griffiths

Scattered, stunted black spruce and tamarack occur on some of the ridges, while others have low shrubs of dwarf birch, Labrador tea, bog rosemary and cloudberry. The ground is completely covered by mosses and the entire fen is underlain by a deep peat deposit. Along the edges of the hollows, on very wet peat, grow two species of insectivorous sundew (*Drosera anglica* and *D. rotundifolia*). Buckbean and several species of moss grow in the open water of the hollows.

How the ridge and hollow pattern is originated and maintained is not known. The association of these patterned fens with drainage divides is intriguing. This type of peatland is of particular interest to geomorphologists and hydrographers, as well as biologists. The Goose Mountain area contains excellent examples of this type of peatland which are the subject of continuing scientific research.

Muskeg Forest:

Muskeg forests occur on shallow peats usually adjacent to upland forests which are on mineral soil. True muskeg on deep peat often occurs further downslope. As with muskegs proper, muskeg forests can be further classified on the basis of nutrient status and

Open Bog

D. E. Griffiths

characteristic species into (a) acidic, nutrient-poor bog forests dominated by black spruce, and (b) pH neutral, nutrient-rich, fen forests dominated by tamarack. The latter are often called *tamarack swamps*. Intermediate situations containing a mixture of black spruce and tamarack are common.

The following is a description of a typical bog forest in the area. Black spruce 40-50 feet high are the dominant trees. The understorey contains numerous black spruce transgressors and saplings suggesting that the vegetation type is self-perpetuating or climax. Common shrubs include: Labrador tea, prickly rose, twining honeysuckle, cranberry, and cloudberry. Common herbs are: bunchberry, dwarf raspberry, horsetail, mitrewort, and coltsfoot. Hummocks of peat moss (*Sphagnum fuscum, S. magellanicum*) are common, but most of the forest floor is covered by the three feather mosses (*Hylocomium splendens, Pleurozium schreberi, Ptilium crista-castrensis*). The lichens *Cladina mitis* and *Peltigera aphthosa* are also common.

In the vegetation map we have categorized the vegetation types in a structural sense as: open muskeg, treed muskeg, and muskeg forest. Patterned peatlands are further designated with an *S* (strangmoor).

Carrs:

Wetland shrubland vegetation (carr) commonly occurs along streams and rivers and around the edges of lakes and beaver ponds. Such carrs are usually dominated by green alder, river alder and/or various species of willow, such as *Salix bebbiana, S. petiolaris,* and *S. lasiandra.*

The understorey commonly contains: bluejoint grass, fowl bluegrass, horsetail (*Equisetum palustre*), hedge nettle, and cow parsnip.

On the attached map, carr is primarily included in the shrubland map unit with upland shrubland. Small carrs are common throughout the area but are often too small to be mapped, and are frequently included in the muskeg forest type.

Shoreline Vegetation:

The edges of all of the small lakes and ponds are ringed by littoral (shoreline) communities of submerged and emergent plants rooted in mineral soil. Typical plants include sago pondweed, clasping-leaf pondweed, water milfoil, yellow pond lily, cattail, and bulrush. Outward from the open water, this community is usually surrounded by either carr or muskeg vegetation. Because of their small size relative to the map scale, littoral vegetation types are not shown on the vegetation map.

SWAN HILLS GRIZZLY (Ursus arctos horribilis)

The most inland race of the large grizzly bears of North America is found in the coniferous forests of north-central Alberta, with particular concentration in the Swan Hills. The status of these bears outside the Swan Hills requires study. There is certainly a small permanent population in the Pelican Mountains (east of Lesser Slave Lake), and grizzlies have been sighted to the north of the lake at various points from the Manning area eastwards to the Wabasca River. Recent reports from still further east, such as south of Fort McMurray and in the Pasqui Hills of northern Saskatchewan, remain unconfirmed and may possibly refer to misidentified black bears. To the west of the Swan Hills, grizzlies have been reported recently from the Meekwap Lake area, and it is possible that they range continuously in this direction to the mountains. In 1974 grizzlies were also reported to the south of the Athabasca River, where it had been assumed that they no longer occurred. All this may seem reassuring, but how much of this apparently extensive range may be ascribed to viable populations and how much to wandering individuals is not known. We therefore concur with the need for a detailed field survey of forest grizzly populations over several years, as is proposed by provincial and federal wildlife biologists.

The main concentration of forest grizzly bears in central Alberta continues to be found in the Swan Hills. The higher terrain, including Wallace Mountain and Goose Mountain (the latter with elevations in excess of 4500 feet), is prime bear country. Populations have also been recorded in the areas of Judy Creek and Christmas Creek, and bears may be encountered almost anywhere along the Freeman River. They are also reported from time to time from House and Deer mountains, from the neighbourhood of Sunset House and from the shores of Lesser Slave Lake (but now less frequently than in the days when fishing camps were widespread and provided an abundance of offal).

The distribution and population density of grizzlies in the Swan Hills has never been accurately assessed. In the 1950's Al Oeming estimated that there were at least 100 townships each capable of sustaining a maximum of 4 bears. This would give an overall population estimate of 400. Since the discovery of oil in this area, there has been significant human pressure on the grizzly population. Many bears have been shot after entering refuse dumps that were all too often sited inside the main confines of camps. The people responsible for the killing had the time-honoured excuse that their camp had been invaded by a bear and that human lives were threatened.

During the rabies scare of the 1950's, poison baits were distributed throughout the Swan Hills. Trappers have estimated that this may have reduced the grizzly population at that time by 50 percent. Because of this mortality, as well as the previously stated toll at dumps, Al Oeming was able to persuade the provincial government to grant complete protection for *all* bears in the Swan Hills. Protection was extended to all bears, since if black bears had remained legal game in the area, persons charged with killing a grizzly could always have put up the defence that they had mistaken the species of bear. Unfortunately this protection was rescinded four years ago by the provincial government, on the grounds that there is now a harvestable population. This action was premature, since the government does not have sufficiently reliable information on the size and dynamics of grizzly populations in the Swan Hills. A dispute has arisen between those government biologists who believe that forest grizzly populations have been increasing, and critics (such as Al Oeming) who claim that grizzly populations are continuing to decline. Such controversy can only be resolved by the accumulation and publication of detailed survey data, which we hope will be available in the near future.

Much has been written about the great size of Swan Hills grizzlies and there is, of course, authenticated data to corroborate this. On November 6th, 1944, Reinhold Eben-Ebenau, a guide, outfitter, and author from Slave Lake, shot what was then recorded as the largest grizzly in Canada, and listed as such in the records of the day. The skull of this giant male bear measured 16 6/16 inches long and 9 inches wide. At that time it was the third largest ever killed in America and certainly the largest in Canada. Then on May 10th, 1953, in almost exactly the same area (Section 24, Township 71, Range 6), an enormous male grizzly bear was shot by an elderly Indian woman, Bella Twin. The skull of this enormous bear measured 16 9/10 inches long and 9 14/16 inches wide. It was then officially recorded as the world record Grizzly skull. Since that time, due to the lumping of grizzlies as conspecific with the large brown bears of the west coast of North America, this great skull has been relegated to about third position. In May of 1957, at the Number 7 Swanson Lumber Camp, approximately 16 miles south of the present site of the town of Slave Lake, another enormous male Grizzly was illegally shot. The skull of this bear is in the possession of the University of Alberta and would rank as number five or six among the all-time record skulls of grizzly bears of North America. Again, the area of kill was in close proximity to that of the 1944 and 1953 record bears. It seems to be an area that grizzlies frequently travel through, as they come from the higher country to feed on the different vegetation of the lower zones.

Grizzly's Fate at Discovery Well May 1953 supplied by A. F. Oeming

The heaviest bear recorded by Al Oeming was a male, live-trapped in the spring of 1955 in the Goose Mountain area of the Swan Hills. The bear was thin and old, had poor teeth, and was badly scarred on the face from fighting (in fact, he had only one ear), yet he weighed 830 lbs. Had this bear been carrying his fall fat, he would easily have weighed in excess of 1000 lbs. An extremely large bear! The greater proportion of grizzly bears encountered in the Swan Hills are invariably young bears, one to three years of age. The older bears, the very large ones, are seldom seen or encountered—probably because they are extremely cautious in approaching bait areas where they can be observed.

It is interesting to note that these bears attain their enormous size despite a long inactive season during the winter months (due to the extremely heavy snowfall in the high country of the Swan Hills). If one contrasts the availability and quality of their food supply againts that of the west coast bears, it seems possible that these bears have been derived from much larger original stock. Thus, the theory has been advanced that these bears could, in fact, be a remnant race of the old plains grizzly. Skulls of Swan Hills and plains grizzlies were examined by the former Curator of Mammals of the National Museum of Canada, Dr. Austin Cameron, who considered that a very close relationship was indicated.

But more data will have to be accumulated. Other authorities consider that the boreal forest and plains grizzlies are distinct ecotypes whose common large size is not necessarily indicative of close genetic relationship. The shortage of skeletal material of the original plains grizzly will make the resolution of this problem difficult.

The food of the Swan Hills grizzlies, as of other bears, consists of grasses, roots, berries, insects, fish, carrion, and any prey, large or small, that is readily available. There is some evidence that mice, birds, deer, and particularly moose are taken when the opportunity presents itself. In good berry years the Swan Hills have an abundance of blueberries, cranberries, and raspberries. It has been reported by Monty Elford, a long-time ranger from High Prairie, that large male grizzlies dig out hibernating black bears, kill and eat them in the winter. Al Oeming has also, on two occasions, found tracks of what he assumed to be male bears (judging by the size of the track) roaming about the countryside in the dead of winter, sometimes in a snow depth exceeding six feet. This type of behaviour by large male grizzlies of the area has been corroborated to him by old Indian trappers and other veteran trappers and woodsmen. What else the bears live on at this time remains a mystery. There is only the clue from Monty Elford that they prey upon hibernating black bears.

Other than the solitary old males, all other grizzly bears of the Swan Hills region seem to den in November and do not emerge again until early April. Al Oeming reports that he has never seen tracks of bears emerging from hibernation in March, but has always encountered these by mid-April. Little is known of the denning areas of the Swan Hills grizzly, but a den was discovered by Ted Labby of Kinuso on the Moosehorn River in 1946.

The entire Swan Hills region, more than 10,000 square miles, has undergone dramatic changes. Oil is still being found and pipelines have been run through the country. The increased incidence of human intrusion is making inroads into what was once undisturbed grizzly range. The grizzly is a wilderness creature whose survival is difficult to ensure in areas of human activity. It is extremely important that a core area of grizzly range be protected from human intrusion and that bears not be hunted in this area. At present bears can be taken throughout the Swan Hills during a spring hunting season, when they are particularly vulnerable due to lack of cover. If our present estimates of what is called the "permissable harvest", based on very meagre data, should prove to be wrong, we may soon find that we have lost this unique forest race of grizzly before we are able to study and understand it.

MOOSE (Alces alces andersoni)

The moose is probably the most common, and most frequently hunted, big game animal in the Swan Hillls area. This largest representative of presently living cervids (the family of ruminant mammals containing deer and their relatives) has a circumpolar distribution, basically coinciding in its range with the vast expanses of boreal forest over the northern hemisphere. It is a typical inhabitant of various successional stages of the boreal forest, tending to avoid extensive stretches of mature climax coniferous stands.

The species *Alces alces* is subdivided into seven subspecies which are called moose in North America and elk in Europe. Four species inhabit the north American continent, while the remaining three old world elk live in Europe and Asia.

The Swan Hills area, as well as the other areas of Alberta, most of the Northwest Territories, part of the Yukon, British Columbia, Saskatchewan, and Manitoba, are occupied by the northwestern moose (*Alces alces andersoni* Peterson).

Originating in Asia, our moose came to North America over the Bering land bridge, which was formed repeatedly during the ice ages of the Pleistocene Epoch (2 million years ago to the present). Huge receding masses of ice during interglacial periods allowed moose, like many other animals from Asia, to penetrate and inhabit the North American continent.

D. Henry

A large North American bull moose can weigh up to 1800 lbs.; the cows up to 1300 lbs. The average weight of a mature moose from the Swan Hills area is somewhat lower, with bulls weighing on the average 1400 lbs. and cows 1000 lbs.

The moose is well adapted to life in a harsh subarctic climate. The long, powerful legs, which are lifted almost vertically, allow it to move in deep snow with relative ease. The large split hooves give it excellent support in muskegs that are impenetrable to other large animals. A thick undercoat and accumulation of fat under the skin assure good insulation from the biting cold of our winters.

Only the bulls of this species have antlers. Generally the size of antlers corresponds to the age of the bull. Usually the older bulls sport the larger, shovel-like antlers; as they become very old, the size often diminishes. The peak of antler development usually occurs between the ages of 5-8 years. At that age, bulls are in their prime. The size of antlers is also dependent upon the availability of nutrients during the period of antler growth.

Antlers are shed annually. In late November, older bulls start to shed theirs, followed by younger males in December or even January. By February most moose bulls are without antlers. However, antler regrowth starts almost immediately. The growing antlers are already visible by late April. They are covered with "velvet", a very sensitive, thin skin rich in blood vessels that carry building materials, particularly calcium, for the new antlers. Toward the end of August regrowth of the antlers is generally finished, and the velvet skin dries up and is rubbed off. During that time bulls can be seen furiously rubbing and striking their antlers against young trees and shrubs. Once the velvet is removed, the moose are ready for the battles of the rut.

The rut, or mating period, for Swan Hills moose usually starts around the middle of September, peaks at the end of September to the beginning of October, and is over by late October. During this period the bulls use their antlers in battles for dominance. Some of these fights end in serious wounds. Examinations by Andrew Raszewski of bulls shot by hunters revealed several with deep punctures on their flanks and with broken ribs. (One 12-year-old animal had a punctured and collapsed lung as well as several broken ribs. In spite of these wounds the animal was well-healed and in very good physical condition.)

During the rut, bull moose are quite restless, travelling great distances in search of cows in oestrus. Many of them, particularly the younger bulls, lose their usual wariness and can be approached more easily than during other months of the year.

Bull moose do not gather harems like elk but stay with one cow for a few days, mate, and then move along in search of another willing cow.

During the rut bulls do little feeding, and the hectic and almost constant activity results in a rapid loss of the fat reserves accumulated during the spring and summer. The stomachs of many bulls shot in the Swan Hills during the rut contained only minimal amounts of food, mainly grasses. This is rather unusual for moose because they are basically browsers; grasses, under normal conditions, form only a minor component of their diet.

After the rut, the bulls become very wary. In November sightings of bull moose are very infrequent. During this time the bulls rest and feed intensively after the hectic time of rut. Only the very young males, which may not have participated in the rut, are frequently sighted.

During the growing season (late spring, summer, and early fall) moose can be observed in the Swan Hills area in almost every type of habitat. They are more evenly dispersed over the entire area than during the late fall, winter, and early spring. However, the large areas of very dense coniferous forest are generally avoided by moose during the growing season. The greatest chance of seeing moose at this time is in areas containing beaver ponds or other natural bodies of shallow water with a rich growth of aquatic and shore vegetation, surrounded by mixed forest. Cows with calves seem to favour this type of habitat. Another favorite habitat type are burned-over areas in the third or fourth year of re-growth. These are areas where moose find an abundance of succulent young growth.

In late fall or early winter, depending on the snow conditions, Swan Hills moose generally shift from the higher elevations to willow flats or lowland muskegs, where they can find food during the winter. As shelter from chilling winds and snow, they favor thick coniferous stands surrounding their winter feeding areas ("wintering yards"). Here the moose sometimes concentrate in great numbers. In one yard, Andrew Raszewski counted 28 moose. In spring, when the snow begins to melt, the moose disperse in all directions from the wintering grounds. They wander in search of open places where the spring growth is beginning, and particularly to slopes with southern or western exposures. Here the snow melts earliest. Also, they migrate to sedge-covered muskegs, where the snow melts faster than in shaded forests.

In late April and May cow moose give birth to single or twin calves. The rate of twinning seems to vary from year to year. For instance, in 1968 most of the cows were observed leading twins, while in 1970 single calves were most frequently seen.

During the calving period the cows and their young remain in seclusion in well-sheltered areas. They move very little when undisturbed and remain in a relatively small area for a period of several weeks. Moose cows nurse their young for an average of five to six months, sometimes longer. However, the calves begin browsing when only a few days old and the amount of vegetation in their diet constantly increases. By September they have switched almost entirely to a diet of plants.

As mentioned previously, the moose is basically a browser. In the Swan Hills area they feed mainly on willows, especially in the winter when willows comprise almost 98 percent of their diet. Willows growing in muskegs and along water bodies are preferred. Upland willow species appear to be browsed only rarely. Other plants frequently eaten by moose are: paper birch, aspen (especially the bark), balsam poplar, bracted honeysuckle, low-bush cranberry, red-osier dogwood, saskatoons, and fir where available. Alder is browsed only in some localities of the Swan Hills area. Sedges, blueberries, fireweed, various herbs, and some grasses compose the remainder of the Swan Hills moose diet. They have not been observed feeding on aquatic vegetation in the lakes in the Swan Hills area, although in other parts of North America waterlilies, pondweed, and other aquatics compose a large portion of their summer diet.

Wolves and the Swan Hills grizzly are known to prey on moose in this area. Several wolf kills were examined by Andrew Raszewski and one case of a grizzly bear killing a moose cow was described to him by a reliable eye witness in 1968.

The moose population in the Swan Hills area as a whole fluctuates periodically, and is believed to have been in decline during the past five years. Hunting pressure in the areas opened up by oilfield access roads seems to be the main reason for this decline.

Elk D. Henry

OTHER MAMMALS

In addition to the grizzly bear and moose, the Swan Hills is home to a large number of small mammals such as mice, voles, shrews, bats, hares, squirrels, and porcupine, as well as many species of fur bearers. Coyotes, wolves, lynx, and black bears also inhabit this region. The mule and white-tailed deer are common. A list of mammals of the Swan Hills area is given in Appendix II.

BIRDS

Knowledge of the birds in the Swan Hills, particularly in the proposed recreational wilderness, is limited. Few amateur bird watchers have visited there, and only one ornithological research study (Pendergast, 1969) has been carried out. An annotated check list included as Appendix III is based mainly on three brief mid- and late-summer field trips by Graham and Deirdre Griffiths, and notes which Andrew Raszewski kept from 1967-70 during his moose study.

The bird fauna of mixedwood and coniferous forest is quite distinct, with the coniferous forest supporting a smaller number of species. The species differences are most marked among woodland species. For instance, the ruffed grouse belongs to the mixedwood, the spruce grouse to the coniferous; likewise the black-capped and boreal chickadees, cedar and bohemian waxwings. The distribution of waterbirds is more closely related to the character of the wetlands than to the surrounding vegetation.

Abundance is indicated in Appendix III, but this information should be regarded only as provisional at this time. Common and scientific names follow the latest (1973) revision of the A.O.U. (American Ornithologists' Union) check-list of North American Birds.

REPTILES and AMPHIBIANS

No reptiles are known to occur in the Swan Hills, although the range of the garter snake (*Thamnophis sirtalis*) does extend north to the Peace River. However, there is little suitable habitat for it in the Swan Hills.

We have positively identified only one amphibian, the wood frog (*Rana sylvatica*). In the second and third weeks of July very young tadpoles (species unknown) were seen in a number of pools along the abandoned south access road to Goose Mountain between 3800 and 3900 feet elevation. The western toad (*Bufo boreas*) and the boreal chorus frog (*Pseudacris triseriata maculata*) are to be expected in the proposed recreational wilderness.

Red Fox D. Henry

Black Bear D. Henry

Sandpiper D. E. Griffiths

FISH

Within the proposed wilderness most of the rivers are in their hadwaters and are consequently little more than small streams. The group of lakes extending west and south from Freeman Lake are all less than one mile in their long dimension, and are quite shallow. They are all connected by outlet streams, directly or indirectly, to the Freeman River. Because much of the water originates from muskegs, it is usually quite brown from various tannins leached from this.

Sport fishing here has so far been insignificant, primarily because of access difficulties, although rainbow trout, arctic grayling, mountain whitefish, and pike are known to occur. There has never been a detailed fish survey of the Swan Hills, but a list of the known fish species, compiled from provincial fisheries data and from collecting sites given in "The Fishes of Alberta" by Paetz and Nelson, is given in Appendix IV. The presence of common loons on at least some of the small lakes indicates that small fish are probably also found in them.

Freeman Lake D. E. Griffiths

D. E. Griffiths

GOOSE MOUNTAIN IBP SITE - A PROPOSED ECOLOGICAL RESERVE

The following is a brief history of government actions relating to the Goose Mountain "International Biological Program (IBP) Area" in the Swan Hills. An IBP Area is a tract of land for which an "International Biological Programme CT (Conservation Terrestrial) Check Sheet" survey has been completed. The Goose Mountain IBP Area is No. 2.4 in the *Canadian National Directory of IBP Areas* (La Roi & Babb, 1974). IBP/CT check sheets and other descriptive accounts are on file at the Alberta Ecological Survey, c/o Department of Botany, University of Alberta, Edmonton.

29 January 1970. The Goose Mountain area was proposed as a major ecological reserve for the western Swan Hills by the Alberta Consulting Panel of the Canadian IBP/CT Subcommittee in a letter to the chairman of the Natural Areas Committee, Alberta Department of Lands and Forests.

2 March 1970. The Natural Areas Committee met and agreed to forward the IBP/CT proposal to the Deputy Minister, with its own recommendations that (1) the proposal be circulated to the divisional directors, and that (2) natural areas policy be discussed with the minister.

23 March 1970. The chairman of the Natural Areas Committee met with the deputy minister to discuss IBP/CT and the Goose Mountain proposal in the larger context of natural areas policy. It was agreed to circulate the proposal to the divisional directors.

26 May 1970. A briefing on the aims and purposes of IBP/CT was given by representatives of the CT panel to the divisional directors and other staff of the Department of Lands and Forests.

10 December 1970. A holding reservation by the Lands Division for conservation purposes, with no disposition without referral to the Natural Areas Committee (HLC4), was placed on the Goose Mountain area. This reservation could not, however, nullify timber license W2-L41, which had been issued on 27 March 1969. The official designation was then as a "Proposed Ecological Reserve."

4 October 1971. At a meeting of the Natural Areas Committee the Alberta Forest Service took the position that the area of the Goose Mountain reservation must be reduced to permit total protection, i.e. to avoid conflicting dispositions within the area.

Winter 1971-72. A series of meetings between the regional coordinator of the CT Panel and the Alberta Forest Service was held to adjust the boundaries of the proposed ecological reserve. No final decision was made pending field inspections proposed for June 1972.

25 February 1972. The Natural Areas Committee recommended to the deputy minister and Mineral Sales Referral Committee that a proposed petroleum drilling project not be allowed within the Goose Mountain reservation area. The recommendation was approved.

1972-1973. Continued discussions of proposed boundary changes, but no meetings to finalize these.

22 October 1973. Regional coordinator of IBP/CT Panel discussed boundary revisions with Alberta Forest Service. The status of timber commitments in the area had to be clarified.

23 November 1973. Revised boundaries excluding the area under timber license were agreed upon by the regional coordinator of the IBP/CT Panel and the Alberta Forest Service, and were then referred to the Natural Areas Committee.

4 January 1974. Boundary revisions of the Goose Mountain area were discussed and approved by the Natural Areas Committee. The HLC4 reservation was replaced by an RLC5, i.e. reservation restricting use by Lands Division for conservation, with no agricultural disposition and no other disposition without referral to the Natural Areas Committee. This is the best protection that the government can afford the area *at the present time* since the Public Lands Act *does not apply* to the green zone (the forested part of the province under the jurisdiction of the Alberta Forest Service).

Engelmann—Spruce D. E. Griffiths

Freeman Lake D. E. Griffiths

FREEMAN LAKE - A POTENTIAL PROVINCIAL PARK

An area of four square miles encompassing Freeman Lake has been set aside as a recreational and wildlife reserve by the provincial government. There is already a small forest service campground (10 sites) and picnic area on the southeast corner of the lake. However, the surroundings are far from pristine. Several active oil wells are visible; a large water pumping station operates within a hundred yards of the campground; and the lake's outlet, Freeman Creek, has been dammed, raising the water about six feet above its former level. This has been done to permit the daily removal of 400,000 barrels (44,100,000 imperial gallons) of water without causing excessive fluctuation in the water level. The water is used for steam injection in a number of oil wells. Gravel roads and cut lines for hydro and pipelines also intrude the forest adjacent to the lake.

In spite of these intrusions, the reserve is an attractive location for a natural park experience that does not require the participant to be an experienced outdoorsman or backpacker. It should also be kept in mind that the industrial developments are not of a permanent nature. Once the oil has been extracted the installations can be removed and natural regeneration allowed to take place.

The lake itself is L-shaped, and measures 1¼ miles north-south by just over 1 mile east-west. It has a surface area of 496 acres, and a shoreline length of 4.24 miles. The maximum depth is about 13 feet. Water flows in from three inlet streams, while there is only one outlet. Along the northwest shore the ground is low and covered by muskeg forest. Elsewhere the shoreline is rather steep, with firm banks of sandy gravel and cobblestones. It is densely forested with predominantly black spruce and lodgepole pine.

Damming seems to have had two major effects on the lake.

1) The exposed east and south shores are being subjected to a certain amount of erosion. A narrow band of dead trees (many fallen) and stumps stand in shallow water. Behind these, waves are eating away at the soft sand and gravel, undermining the roots of trees now at the water's edge. Many such trees have now been blown down by the wind, or are leaning. It is difficult to predict how long erosion will continue before a new shoreline becomes stabilized.

2) Prior to the dam construction, muskeg extended quite far out into the lake on the northwest side. Rising water has killed the spruce (many of which are still standing), and converted the muskeg into an extensive sedge bed, except for one small hump of higher ground that has now

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D. Henry

become an island. The sedges appear to be suitable nesting habitat for grebes, loons, and possibly some ducks.

According to provincial fisheries reports, pike (also known as jackfish) are the only large fish in Freeman Lake. Presumably there are also smaller species, perhaps minnows or suckers, which serve as prey for the pike and loons.

At the present usage level (primarily by the residents of Swan Hills, and perhaps some hunters in the fall) the campground vegetation does not show signs of deterioration from trampling. However, the effect of any increased useage will need careful watching. There is room for the campground to be enlarged in the future. A short, wooden dock indicates some boat use; however, since it is at the bottom of a steep slope with no direct road access, the boats launched must be small. We recommend that no motorized boats be permitted on this lake. Their noise and speed would detract from the lake's atmosphere of quiet remoteness, and would also be detrimental to nesting waterbirds.

Since much of the reserve area is well-drained, it is suitable for the development of hiking and interpretive trails radiating out from the campground. On the lake itself, canoeing and fishing would be acceptable activities. As the water remains cold throughout the summer, this lake is unattractive for swimming.

The proposed recreational wilderness area is still largely blanketed by oil and gas leases and drilling reservations (see resource map). However, the peak of exploration activity has long since passed. It is unlikely that major new finds will be made within the boundaries of the area: it has been extensively explored in the past two decades. Most of the old seismic lines are now regenerating and function as trails for man and beast. Many of the more interesting shrubs and herbs can be found growing along them, and they provide good browse for moose and deer.

In the present situation of declining conventional oil reserves it would be unrealistic to demand premature withdrawal of the oil and gas industry's rights in this area. Rather we must await their relinquishment as the fields become exhausted. The main concern in the interim should be to minimize the construction of new roads, and to ensure that abandoned roads are closed off and allowed to regenerate. We suggest that all applications to conduct exploration or construct access roads for new wells within the proposed recreational wilderness be referred to the Wilderness Advisory Committee of the Department of Parks, Recreation & Wildlife to ensure that the interests of the wilderness and its users are given due weight and any potential conflicts brought to public attention at an early stage. As a general rule, any new access roads should be constructed along the shortest possible route from existing roads outside the wilderness area.

The main conflict which the Government must resolve is between the wilderness value of the western Swan Hills and the activities of the forest industry. The area is entirely forested, with the exception of wet muskeg and a few scree slopes on the north-facing scarp of the Swan Hills ridge. We believe that logging must be excluded from the proposed recreational wilderness. Current methods of timber harvest using large machinery and excessively large clear-cuts are an unacceptable multiple-use in an area whose prime uses are wildland recreation and preservation of the complete forest fauna and flora. In most of Alberta it may be argued that well-executed logging simulates the periodic natural destruction of the forest by fire, and does not disturb the natural succession of vegetation and fauna. But at the higher elevations in the western Swan Hills natural fires are relatively rare. There is much forest in a climax state of equilibrium, forest which should be preserved for purposes of research as well as for its intrinsic interest and the value of its fauna and flora. At present the area enjoys no protection from the encroachment of logging except for a reservation placed on land in the proposed ecological reserve (as shown on the map of non-mineral land use

commitments). However, the long-term value of such administrative protection is doubtful.

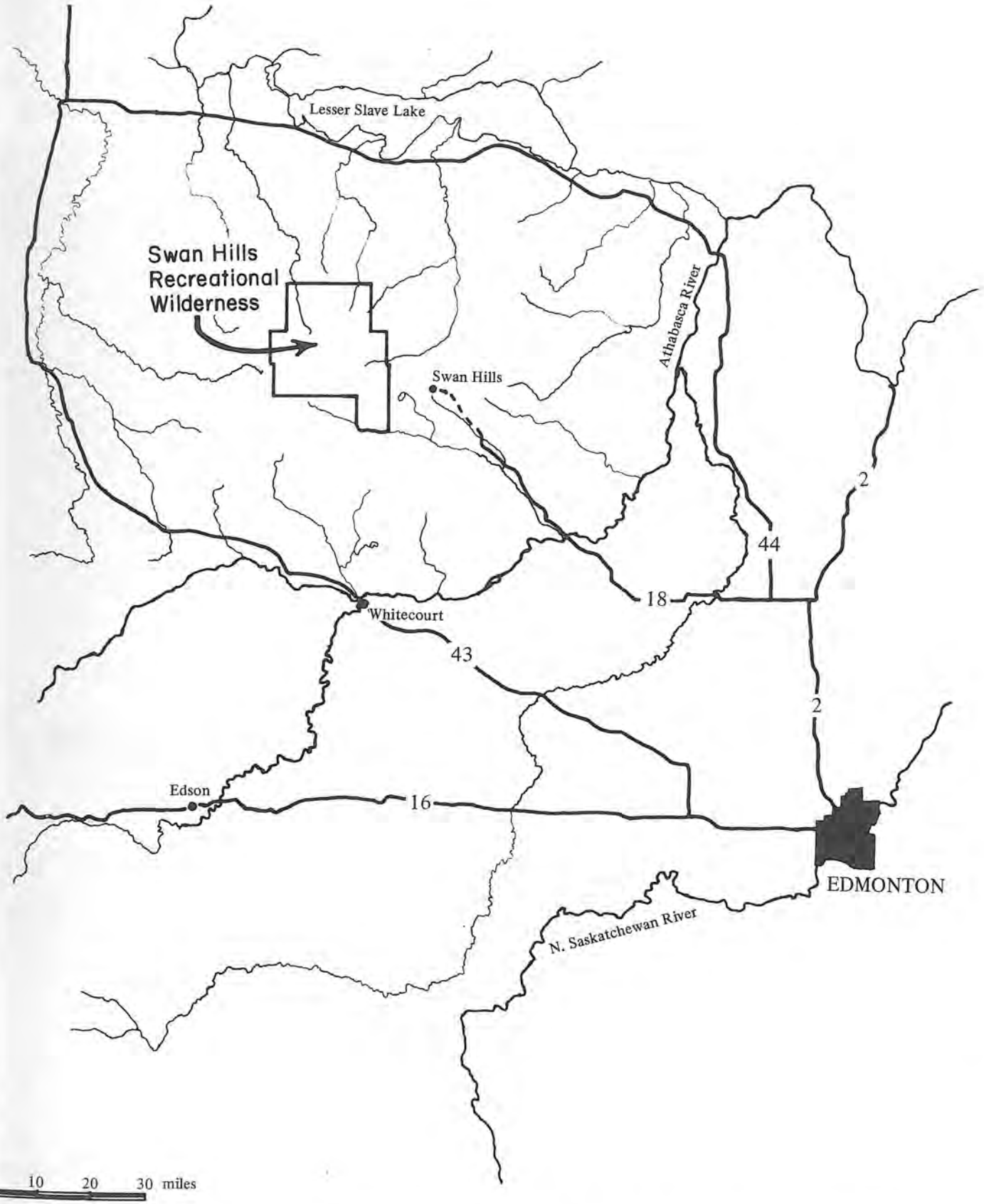
There are two current timber licenses within the proposed recreational wilderness (as shown on the map of non-mineral land use commitments). Western Construction and Lumber Company Ltd. hold a license (W2-L41) which allows them to log on the south slopes of Goose Mountain. To accomodate this disposition the Department of Lands and Forests truncated the area originally proposed for the ecological reserve into the two fragments shown on the attached map of non-mineral land use commitments. There also is a second current timber license (S1-L43 to Imperial Lumber Co.) on the eastern side of the proposed wilderness area. These licenses do not constitute a long-term commitment to allow logging within the recreational wilderness, because the companies' timber quotas can be re-allocated on lands outside the proposed boundary.

A forest management area is expectd to be established soon under an agreement with Simpson Timber Co. The proposed boundaries of this area extend from Whitecourt to the northern boundary of Whitecourt Forest, thus overlapping the southern part of the proposed recreational wilderness and including as well the potential park site at Freeman Lake. However, it is likely that details of the boundaries of the Forest Management Area can be renegotiated. The area north of the Freeman River is quite remote from the company's mill, and hence will be costly to exploit. It contains a high proportion of shrubland and marginally economic forest with much black spruce (a species that rarely grows to commercial size in Alberta). An exchange for economically more attractive lands nearer the mill could probably be negotiated without difficulty.

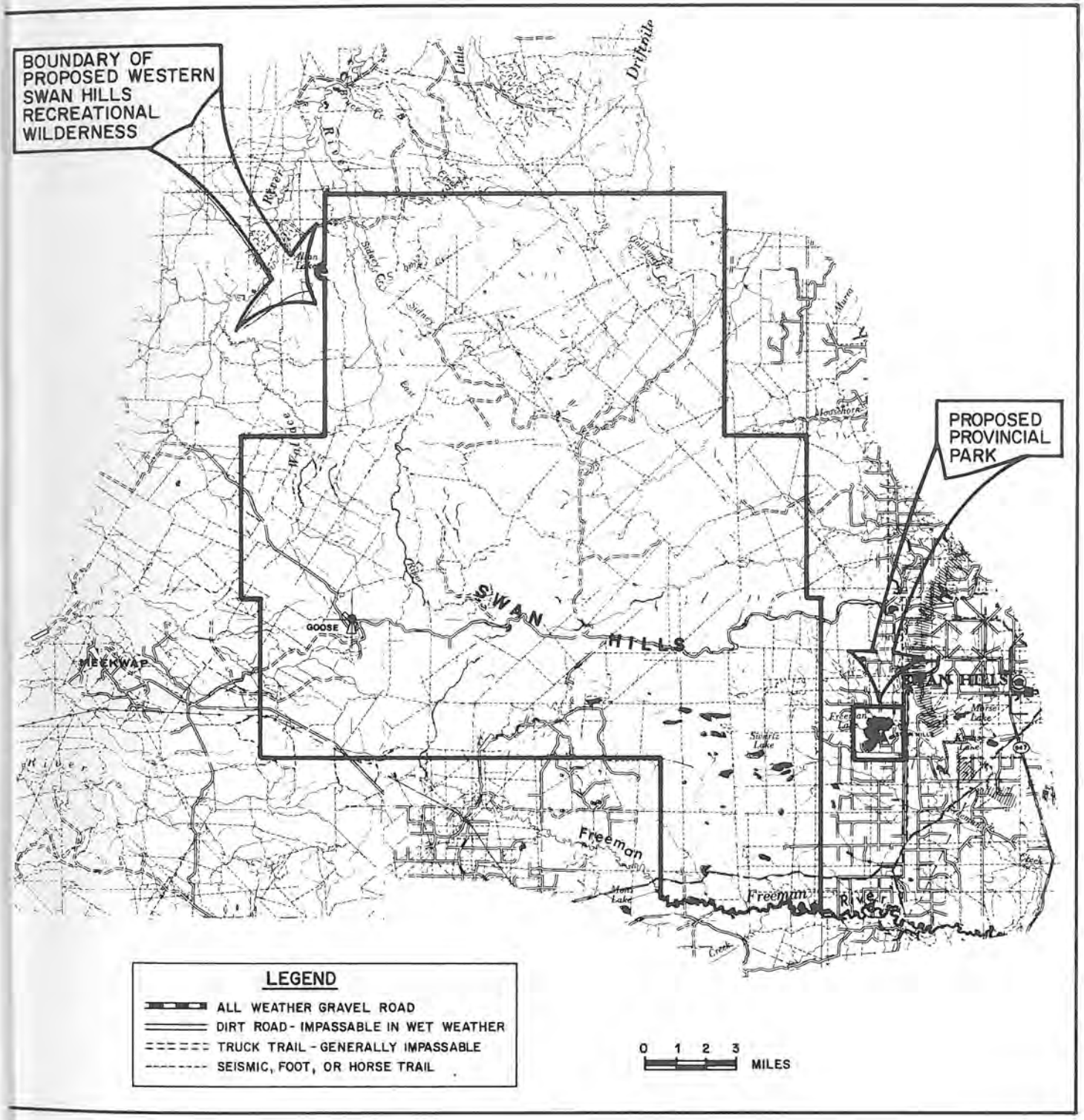
Another use in conflict with the conservation of wilderness is the extraction of sand and gravel. There are three current sand and gravel leases in the proposed recreational wilderness, one near the Goose Mountain road and two on the south boundary. The latter are required to service the access roads for nearby oil wells, and may be accepted until the oil companies withdraw. The lease near the Goose Mountain road will expire at the end of 1975 and should not be renewed. There is also a sand and gravel reservation, not exploited to date, in the name of the Department of Highways within the proposed Goose Mountain ecological reserve. Obviously this use of the land would be contradictory to its preservation as an ecological reserve and the reservation should therefore be relinquished.

We are informed by the Department of Mines and Minerals that there have been no mineral dispositions in the proposed recreational wilderness.

Mule Deer D. Henry



Regional location of the proposed Swan Hills Recreational Wilderness.


BOUNDARY OF PROPOSED WESTERN SWAN HILLS RECREATIONAL WILDERNESS
PROPOSED PROVINCIAL PARK
SWAN HILLS
GOOSE
MEEKWAP
Freeman
Freeman River
LEGEND
ALL WEATHER GRAVEL ROAD
DIRT ROAD - IMPASSABLE IN WET WEATHER
TRUCK TRAIL - GENERALLY IMPASSABLE
SEISMIC, FOOT, OR HORSE TRAIL
0 1 2 3
MILES

NOTES

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Moose - Andrew D. Raszewski

Other Mammals, Reptiles and Amphibians, Fish, Freeman Lake - Deirdre E. Griffiths

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Graham C.D. Griffiths
Richard P. Pharis
..... January 1976

GLOSSARY

Bentonite - a rock component of the clay minerals montmorillinite and beidellite, formed through weathering of volcanic ash.
Blading - use of an earth-moving vehicle with lowered blade, so that the topsoil is disturbed.
Brunisol - brown soils not classifiable in any more specific group of soils.
Climax - the last and most stable stage of vegetational succession.
Conspecific - belonging to the same biological species.
Cordillera - encompassing term for several major mountain ranges (the western Canadian cordillera includes the Rocky Mountains and parallel ranges extending west to the Pacific coast).
Ecotype - morphological type within a species determined by adaptation to a particular habitat.
Fen - muskeg of roughly neutral pH (neither acidic nor alkaline).
Gleysol - group of soils consisting of mottled grey or brownish colloidal clay, without or with only a thin (less than 3 inches) enriched layer above this.
Leached - dissolved out by percolation of water.
Luvisol - group of soils in which clay is the main accumulation product.
Palsa - mound of peat 3-6 metres high containing ice lens.
Permafrost - permanently frozen layer of ice below ground surface.
Podzol - group of soils consisting of organic surface layer above grey leached layer resting on dark illuvial (B-horizon) layer containing leached minerals.
Ruderal - weed growing in disturbed sites.
Scree - slope consisting of stones or rock fragments without continuous soil cover.
Seismic line - narrow straight cut made through forest during seismic testing in the course of oil and gas exploration.
Sere - one of the series of stages in vegetational succession before attainment of the climax stage.
Serotinous - releasing seed late (especially under the stimulus of heat).
Shale - easily fractured rock formed by consolidation of clay, mud or silt in relatively unmodified state.
Tannin - acidic substance of plant origin (hydroxyl derivative of aromatic hydrocarbon).
Till - unstratified glacial debris, including clay, silt, sand, gravel, and boulders.
Transgressor - individual plant established outside the normal vegetational community in which its species grows.

White flowered rhododendron D. E. Griffiths

APPENDIX I. Plants

Listed are some vascular plants found in the Swan Hills area, including those mentioned in the text and others of special interest. (All notes refer to range or status of special note within Alberta only).

1. Alder (Green)-*Alnus crispa.*
2. Alder(River)-*Alnus tenuifolia.*
3. Anemone (Yellow) - *Anemone richardsonii.* Eastern limit of a Rocky Mountain species.
4. Angelica - *Angelica genuflexa.* Near eastern limit of a Pacific coast species.
5. Aspen-trembling aspen-*Populus tremuloides.*
6. Bearberry - *Arctostaphylos uva-ursi.*
7. Bedstraw(Marsh)-*Galium palustre.* Very rare in Alberta. Known from only two locations: Jasper National Park and Swan Hills.
8. Bilberry - tall bilberry - *Vaccinium membranaceum.*
9. Birch (dwarf) - *Betula glandulosa.*
10. Birch (paper) - *Betula papyrifera.*
11. Bishop's cap - *Mitella pentandra.* Eastern limit of a Rocky Mountain species.
12. Bluebells - *Mertensia paniculata.*
13. Blueberry - *Vaccinium myrtilloides.*
14. Bog rosemary - *Andromeda polifolia.*
15. Buckbean - *Menyanthes trifoliata.*
16. Buffalo-berry - *Shepherdia canadensis.*
17. Bulrush - *Scirpus validus.*
18. Bunchberry - *Cornus canadensis.*
19. Buttercup - *Ranunculus uncinatus* var. *parviflorus.* Eastern limit of a Rocky Mountain species.
20. Cattail - *Typha latifolia.*
21. Cinquefoil - rough cinquefoil - *Potentilla norvegica.*
22. Cloudberry - *Rubus chamaemorus.*
23. Clubmoss - *Lycopodium selago.* Isolated occurrence. Other Alberta locations, in Rocky Mountains and extreme northeast corner.
24. Clubmoss - stiff clubmoss - *Lycopodium annotinum.*
25. Coltsfoot - *Petasites palmatus.*
26. Corydalis - golden corydalis - *Corydalis aurea.*
27. Cranberry - *Vaccinium vitis-idaea.*
28. Cranberry - low-bush cranberry - *Viburnum edule.*
29. Crane's-Bill-*Geranium bicknellii.*
30. Currant - skunk currant - *Ribes glandulosum.*
31. Dandelion - *Taraxacum officinale.*
32. Dewberry - *Rubus pubescens.*
33. Devil's Club - *Oplopanax horridum.* Near eastern limit of a Pacific coast species. Very local in Alberta.
34. Dogwood - red osier dogwood - *Cornus stolonifera.*
35. Elderberry - *Sambucus pubens.* Rare east of Rocky Mountains. Near eastern limit.
36. Fern - broad spinulose shield fern - *Dryopteris assimilis.* A Rocky Mountain species near its eastern limit in central Alberta.
37. Fern-northern beech fern-*Dryopteris phegopteris.* Rare in Alberta. At eastern limit. One of two locations east of the Rocky Mountains.
38. Fir (alpine) - *Abies lasiocarpa.* Eastern limit of a Rocky Mountain species. Hybridizing with *Abies balsamea.*
39. Fir (balsam) - *Abies balsamea.* Commonly found in mixed poplar-spruce woods.
40. Fireweed - *Epilobium angustifolium.*
41. Fowl bluegrass - *Poa palustris.*
42. Bluejoint grass - *Calamagrostis canadensis.*
43. Northern reed grass - *Calamagrostis inexpansa.*
44. Hawkweed - *Hieraceum gracile.* Eastern limit of a Rocky Mountain species.
45. White hawkweed - *Hieraceum albiflorum.* Eastern limit of a Rocky Mountain species.
46. Hedge nettle - *Stachys palustris* var. *pilosa.*
47. Honeysuckle-bracted honeysuckle- *Lonicera involucrata.*
48. Honeysuckle-twining honeysuckle-*Lonicera dioica* var. *glaucescens.*
49. Horsetail-*Equisetum scirpoides.*
50. Horsetail-field horsetail-*Equisetum arvense.*
51. Jacob's ladder - *Polemonium coeruleum.* Eastern limit of Rocky Mountain species.
52. Labrador tea - *Ledum groenlandicum.*
53. Leather leaf - *Chamaedaphne calyculata.* Southern limit of a northern species.
54. Lettuce - white lettuce - *Prenanthes alata.* Isolated occurrence. Other Alberta locations in southwest corner of Rocky Mountains.
55. Yellow pond Lily-*Nuphar variegatum.*
56. Wild Lily of the Valley - *Maianthemum canadense* var. *interius.*
57. Menziesia - *Menziesia glabella.* Eastern limit of a Rocky Mountain species.
58. Mitrewort - *Mitella nuda.*
59. Mitrewort - false mitrewort - *Tiarella trifoliata.* Rare in Alberta. Known in Alberta only from Swan Hills and west of Whitecourt. Eastern limit of a Pacific coast species.
60. Mountain laurel - *Kalmia polifolia* var. *microphylla.* Other Alberta locations in Rocky Mountains and far northeast corner.
61. Orchid - blunt-leaved orchid - *Habenaria obtusata.*
62. Parsnip - cow parsnip - *Heracleum lanatum.*
63. Pine - lodgepole pine - *Pinus contorta.*
64. Pondweed - sago pondweed - *Potamogeton pectinatus.*
65. Pondweed - clasping-leaf pondweed - *Potamogeton richardsonii.*
66. Poplar (balsam) - *Populus balsamifera.*

67. Pussy-toes - *Antennaria umbrinella.* Southeastern limit of a northern species.
68. Raspberry - dwarf raspberry - *Rubus acaulis.*
69. Raspberry - red raspberry - *Rubus strigosus.*
70. Raspberry - trailing raspberry - *Rubus pedatus.*
71. Rhodendron - white rhododendron - *Rhododendron albiflorum.* Eastern limit of Rocky Mountain species.
72. Rose - prickly rose - *Rosa acicularis.*
73. Rush - *Juncus filiformis.* Southern limit.
74. Rush - wood rush - *Luzula acuminata.* Only Alberta location.
75. Sarsaparilla - wild sarsaparilla - *Aralia nudicaulis.*
76. Saskatoon - *Amelanchier alnifolia.*
77. Snowberry - *Symphoricarpos albus.*
78. Speedwell - *Veronica alpina* var. *unalaschensis.* Eastern limit of a Rocky Mountain species.
79. Spruce (black) - *Picea mariana.*
80. Spruce (Engelmann) - *Picea engelmannnii.* Eastern limit of a Rocky Mountain species. Hybridizing with *Picea glauca.*
81. Spruce (white) - *Picea glauca.*
82. Strawberry - wild strawberry - *Fragaria virginiana.*
83. Sundew - *Drosera anglica.*
84. Sundew - *Drosera rotundifolia.*
85. Sweet-scented bedstraw - *Galium triflorum.*
86. Tamarack - *Larix laricina.*
87. Timothy - *Phleum pratense.*
88. Timothy - mountain timothy - *Pheleum alpinum.* Eastern limit.
89. Twayberry - heart-leaved twayberry - *Listera cordata.*
90. Twinflower - *Linnaea borealis.*
91. Twisted stalk - *Streptopus streptopoides* var. *brevipes.* Only Alberta location. Eastern limit of a Rocky Mountain - Pacific coast species.
92. Vine - pea vine - *Lathyrus ochroleucus.*
93. Water milfoil - *Myriophyllum exalbescens.*
94. Willow - beaked willow - *Salix bebbiana.*
95. Willowherb - alpine willowherb - *Epilobium alpinum.* Eastern limit of a Rocky Mountain species.
96. Wintergreen - one sided wintergreen - *Pyrola secunda.*
97. Wintergreen - pink wintergreen - *Pyrola asarifolia.*

Mosses of special interest:

1. Peat moss - *Sphagnum majus.* Rare in Alberta. Other Alberta location in Wood Buffalo National Park.
2. *Pohlia proligera* - Only known Alberta location.

Cougar B. Horejsi

APPENDIX II.

Annotated list of mammals

1. Cinereous shrew [*Sorex cinereus*]: one individual observed in dense sedge and grass near a small stream at about 3800 feet elevation, this species is probably widely distributed in both mixedwood and coniferous forest, along streams and in muskegs.
2. Saddle-backed shrew [*Sorex arcticus*]: to be expected in similar habitat to the previous species, but prefers wetter ground.
3. Water shrew [*Sorex palustris*]: to be expected along streams, and by lakes and ponds.
4. Dusky shrew [*Sorex vagrans*]: to be expected in mixedwood and coniferous forest, stream margins, hummocky muskeg.
5. Pygmy shrew [*Microsorex hoyi*]: occurs probably mainly on drier ground in mixedwood and coniferous forest, and also in second growth.
6. Little brown bat [*Myotis lucifugus*]: to be expected in mixedwood and coniferous forest, especially near openings such as lakes and stream valleys.
7. Silver-haired bat [*Lasionycteris noctivagans*]: to be expected in mixedwood and coniferous forest, especially near openings.
8. Pale big brown bat [*Eptesicus fuscus*]: to be expected in mixedwood and coniferous forest, especially near openings.
9. Hoary bat [*Lasiurus cinereus*]: to be expected in mixedwood and coniferous forest, especially near openings.
10. Varying hare [*Lepus americanus*]: to be expected mainly in mixedwood forest, and in second growth on burns.
11. Woodchuck [*Marmota monax*]: to be expected in more open areas of mixedwood forest, along streams and roads.
12. Northern chipmunk [*Eutamias minimus*]: in mixedwood and coniferous forest especially in sunny, shrubby openings; observed on Goose Mountain (A. Oeming).
13. Red squirrel [*Tamiasciurus hudsonicus*]: common in coniferous forest, and in mixedwood in and near stands of spruce.
14. Flying squirrel [*Glaucomys sabrinus*]: to be expected in mature coniferous and mixedwood forest.
15. Beaver [*Castor canadensis*]: fairly common along streams in mixedwood forest, less numerous in coniferous forest.
16. White-footed Mouse [*Peromyscus maniculatus*]: all types of habitat in mixedwood and coniferous forest with the exception of bogs and wet muskegs.
17. Lemming vole [*Synaptomys borealis*]: in bogs, muskegs, stream and lake margins primarily in coniferous forest.
18. Red-backed vole [*Clethrionomys gapperi*]: in mixedwood and coniferous forest, sometimes muskegs and bogs.
19. Phenacomys vole [*Phenacomys ungava*]: to be expected in mixedwood forest, occasionally in muskegs.
20. Meadow vole [*Microtus pennsylvanicus*]: to be expected in mixedwood forest, in grass and sedge along stream and lake margins, and in young second growth.
21. Chestnut-cheeked vole [*Microtus xanthognathus*]: to be expected on well-drained ground in habitats similar to the previous species.
22. Muskrat [*Undatra zibethicus*]: common on rivers and lakes.
23. Jumping mouse [*Zapus hudsonicus*]: to be expected primarily in mixedwood forest in both moist and dry wooded sites.
24. Porcupine [*Erethizon dorsatum*]: scarce (Jim Robison).
25. Coyote [*Canis latrans*]: fairly common in both mixedwood and coniferous forest.
26. Wolf [*Canis lupus*]: fairly common (up to 12 in a pack have been seen), in both mixedwood and coniferous forest.
27. Red fox [*Vulpes fulva*]: primarily in more open, dry shrublands and old burns.
28. Black bear [*Euarctos americana*]: fairly common, especially in mixedwood forest.
29. Grizzly bear [*Ursus arctos horribilis*]: see preceding detailed account.
30. Marten [*Martes americana*]: fairly common in coniferous forest (A. Oeming and J. Robison).
31. Fisher [*Martes pennanti*]: frequent in coniferous forest.
32. Short-tailed weasel [*Mustela erminea*]: common everywhere in both mixedwood and coniferous forest.
33. Least weasel [*Mustela rixosa*]: quite common in both coniferous and mixedwood forest.
34. Mink [*Mustela vison*]: quite common in both mixedwood and coniferous forest.
35. Wolverine [*Gulo luscus*]: in small numbers in dense coniferous forest and associated muskegs.
36. Striped skunk [*Mephitis mephitis*]: can be expected in coniferous forest, especially where there are openings and close to water.
37. Otter [*Lutra canadensis*]: occasional in larger streams and lakes with fish.
38. Cougar [*Felis concolor*]: a few tracks have been seen (A. Raszewski); all types of habitat, though tends to

avoid very wet ground.

39. Lynx [*Lynx canadensis*]: occurs in both mixedwood and coniferous forest, probably more common in the former.
40. Mule deer [*Odocoileus hemionus*]: fairly common in both mixedwood and coniferous forest where food is available (oil and gas exploration has undoubtedly increased shrub and herb forage for this species).
41. White-tailed deer [*Odocoileus virginianus*]: has spread into the Swan Hills since 1950 (R. Eben).
42. Elk [*Corvus canadensis*]: a few are found in the Swan Hills, but they are unlikely to stay long in the higher country of the proposed Recreational Wilderness (Jim Robison).
43. Moose [*Alces alces*]: see preceding detailed account.
44. Woodland caribou [*Rangifer caribou*]: no recent records, but old shed antlers have been found in some muskegs (R. Eben).
45. Wood bison [*Bison bison athabascae*]: extinct in this area since the early 19th century; a few skulls have been found (R. Eben).
46. Mountain goat [*Oreamnos americanus*]: a single animal, presumably a wanderer, was once shot on Goose Mountain (A. Oeming).

Bull and Cow Moose B. Gilbert

APPENDIX III.

Annotated list of birds

1. Common loon [*Gavia immer*]: fairly common; mostly on lakes 1 mile or more in length, and with fish; summer nester.
2. Red-necked grebe [*Podiceps grisegena*]: uncommon; probably nests on Freeman Lake; more common during spring and fall migration.
3. Horned grebe [*Podiceps auritus*]: uncommon; probably nests on Freeman Lake.
4. Eared grebe [*Podiceps nigricollis*]: fairly common; nests on Freeman Lake and probably some others in that area.
5. Western grebe [*Aechmophous occidentalis*]: rare; most likely to be seen during spring migration; could nest on Freeman Lake.
6. Pied-billed grebe [*Podilymbus podiceps*]: probably rare; so far seen only during fall migration.
7. Whistling swan [*Olor columbianus*]: not recorded; expected on Freeman Lake during spring and fall migration.
8. Canada goose [*Branta canadensis*]: not recorded; expected on Freeman Lake during spring and fall migration.
9. White-fronted goose [*Anser albifrons*]: not recorded; expected on Freeman Lake during spring and fall migration.
10. Snow goose [*Chen caerulescens*]: recorded on migration, late October 1970 and 1971 (D. Pattie).
11. Mallard [*Anas platyrhynchos*]: fairly common during spring and fall migration; no nesting observed.
12. Green-winged teal [*Anas crecca*]: common nester on low elevation lakes; status in proposed wilderness area not known.
13. Blue-winged teal [*Anas discors*]: fairly common nester on low elevation lakes; status in proposed wilderness area not known.
14. American widgeon, baldpate [*Anas americana*]: very rare.
15. Northern shoveler [*Anas clypeata*]: fairly common on lower elevation sloughs; status in proposed wilderness area not known.
16. Redhead [*Aythya americana*]: fairly common nester; Freeman Lake.
17. Canvasback [*Aythya valisneria*]: rare; nesting? - on Tea Lakes to the southeast.
18. Ring-necked duck [*Aythya collaris*]: rare; nesting? - on Tea Lakes to the southeast.
19. Lesser scaup [*Aythya affinis*]: not recorded; expected at least during migration, especially on Freeman Lake.
20. Common goldeneye [*Bucephala clangula*]: fairly common nester on most lakes.
21. Bufflehead [*Bucephala albeola*]: uncommon nester.
22. Common merganser [*Mergus merganser*]: rare; well grown young have been observed on the Freeman River in late July.
23. Goshawk [*Accipiter gentilis*]: uncommon; in dense forest both mixedwood and coniferous; year-round resident.
24. Cooper's hawk [*Accipiter cooperii*]: uncommon; in dense forest both mixedwood and coniferous; summer nester.
25. Sharp-shinned hawk [*Accipiter striatus*]: rare; in dense forest both mixedwood and coniferous; summer nester.
26. Marsh hawk [*Circus cyaneus*]: rare; seen only on migration.
27. Red-tailed hawk [*Buteo jamaicensis*]: rare; prefers mixedwood forest and burns.
28. Broad-winged hawk [*Buteo platypterus*]: not recorded; expected in mixedwood forest.
29. Golden eagle [*Aquila chrysaetos*]: observed during fall migration(20th-30th September)(R. Eben).
30. Bald eagle [*Haliaeetus leucocephalus;*]: observed during fall migration (20th-30th September) (R. Eben).
31. Osprey [*Pandion haliaetus*]: no recent observations; one former nesting record (R. Eben).
32. Gyrfalcon [*Falco rusticolus*]: not recorded; expected anywhere in winter.
33. Peregrine falcon [*Falco peregrinus*]: not recorded; expected anywhere during migration.
34. Merlin [*Falco columbarius*]: not recorded; expected in mixedwood forest as summer nester.
35. American kestrel [*Falco sparverius*]: very common; prefers dry shrubby areas such as old burns; summer nester.
36. Spruce grouse [*Canachites canadensis*]: very common; prefers dense coniferous forest; year-round resident.
37. Ruffed grouse [*Bonasa umbellus*]: very common; prefers lower elevation mixedwood forest; year-round resident.
38. Sharp-tailed grouse [*Pedioecetes phasianellus*]: fairly common on old burns and shrub areas at higher elevations (R. Eben).
39. Willow ptarmigan [*Lagopus lagopus*]: occasional in winter in muskegs and along streams; in large numbers in 1931/1932 (R. Eben).
40. Great blue heron [*Ardea herodias*]: not recorded; to be expected in summer at any lakes with fish.
41. American bittern [*Botaurus lentiginosus*]: not recorded; to be expected in summer at any lakes with dense sedge beds, e.g. Freeman Lake.

42. Sandhill crane [*Grus canadensis*]: frequent overhead migrant, rarely stopping; this species used to nest in the vicinity of Fort Assiniboine; recent ground observations include one pair of adults seen by Peter Achuff on a string bog a few miles SE of Goose Mountain (54° 43' N, 116° 01' W) in the third week of May 1971; and one pair in a similar bog E of Highway 18 and 22 miles S of Swan Hills town at the end of May 1968 (A. Raszewski). It is possible that one or two pairs may nest on one of the remote bogs in the proposed wilderness.
43. Sora rail [*Porzana carolina*]: fairly common; wherever there are dense sedge beds adjoining open water, e.g. Freeman Lake; summer nester.
44. Killdeer [*Charadrius vociferus*]: uncommon; openings created by oil industry; summer nester.
45. Common snipe [*Capella gallinago*]: fairly common; wet sedge lands along streams, and muskegs; summer nester.
46. Spotted sandpiper [*Actitis macularia*]: fairly common; mainly frequents lake edges; summer nester.
47. Solitary sandpiper [*Tringa solitaria*]: common; mainly along streams and in wet fen muskegs; summer nester.
48. Greater yellowlegs [*Tringa melanoleuca*]: common; frequents open muskegs and also streams; summer nester.
49. Lesser yellowlegs [*Tringa flavipes*]: fairly common; similar habitat to the previous species; summer nester.
50. Pectoral sandpiper [*Calidris melanotos*]: uncommon; spring and fall migrant in open wetlands.
51. Least sandpiper [*Calidris minutilla*]: rare; spring and fall migrant.
52. Dowitcher [*Limnodromus griseus*]: rare; in open muskegs; summer nester.
53. Semipalmated sandpiper [*Calidris pusilla*]: very rare; spring and fall migrant.
54. Wilson's phalarope [*Steganopus tricolor*]: rare; small lakes with marshy borders; summer nester.
55. Ring-billed gull [*Larus delawarensis*]: not recorded; expected as migrants, and also possibly non-breeding summer residents.
56. Bonaparte's gull [*Larus philadelphia*]: not recorded; expected at muskeg bordered lakes as summer nester.
57. Common tern [*Sterna hirundo*]: uncommon; summer observations on Freeman Lake.
58. Black tern [*Chlidonias niger*]: rare; summer observations on lakes.
59. Great-horned owl [*Bubo virginianus*]: common; both mixedwood and coniferous forest; year-round resident.
60. Hawk owl [*Surnia ulula*]: uncommon to rare; prefers open muskegs during the breeding season; many wander long distances in winter.
61. Pygmy owl [*Glaucidium gnoma*]: a few observations; can be expected in winter in mixedwood and coniferous forest.
62. Snowy owl [*Nyctea scandiaca*]: winter visitor in variable numbers in open areas of all types.
63. Barred owl [*Strix varia*]: not recorded; can be expected in small numbers in dense mixedwood and coniferous forest; year-round resident.
64. Great gray owl [*Strix nebulosa*]: rare; in mixedwood and coniferous forest; year-round resident, but may wander widely in winter.
65. Long-eared owl [*Asio otus*]: not recorded; can be expected primarily in mixedwood forest; summer nester.
66. Boreal owl [*Aegolius funereus*]: not recorded; can be expected in mixedwood forest; year-round resident.
67. Saw-whet owl [*Aegolius acadicus*]: fairly common; prefers mixed wood forest; year-round resident.
68. Common nighthawk [*Chordeiles minor*]: common; primarily in openings created by the oil industry; summer nester.
69. Belted kingfisher [*Megaceryle alcyon*]: common; along streams and rivers with fish and high banks; summer nester.
70. Common (yellow-shafted) flicker [*Colaptes auratus*]: common; openings created by the oil industry and also sparsely treed, but fairly dry, muskegs; summer nester.
71. Pileated woodpecker [*Dryocopus pileatus*]: rare; dense mixedwood forest primarily; year-round resident.
72. Lewis' woodpecker [*Asyndesmus lewis*]: very rare; frequents burned areas; most likely to be seen during migration seasons.
73. Yellow-bellied sapsucker [*Sphyrapicus varius*]: common; mixedwood forest; summer nester.
74. Hairy woodpecker [*Dendrocopus villosus*]: common; mixedwood forest; year-round resident.
75. Downy woodpecker [*Dendrocopus pubescens*]: fairly common; mixedwood forest; year-round resident.
76. Northern 3-toed woodpecker [*Picoides tridactylus*]: fairly common; primarily in dense, coniferous forest; year-round resident.
77. Black-backed 3-toed woodpecker [*Picoides arcticus*]: not recorded; expected in dense, coniferous forest primarily; year-round resident.
78. Eastern kingbird [*Tyrannus tyrannus*]: uncommon; old burns and other brush openings in mixedwood

forest; summer nester.

79. Say's phoebe [*Sayornis saya*]: very rare; 1 bird (probably adult) along ridge road several miles E of Goose Mountain fire tower on July 20, 1974. It could have nested at the tower clearing where there are a couple of buildings.
80. Yellow-bellied flycatcher [*Empidonax flaviventris*]: fairly common; mixedwood and coniferous forest; summer nester.
81. Alder flycatcher [*Empidonax alnorum*]: fairly common; thick alder and willow growth along streams and rivers; summer nester.
82. Least flycatcher [*Empidonax minimus*]: common; mixedwood forest; summer nester.
83. Western wood pewee [*Contopus sordidulus*]: fairly common; mixedwood forest; summer nester.
84. Olive-sided flycatcher [*Nuttallornis borealis*]: uncommon; burned-over land in both mixedwood and coniferous forest, also open muskegs; summer nester.
85. Tree swallow [*Iridoprocne bicolor*]: locally common, e.g. Goose Mountain fire tower; summer nester.
86. Bank swallow [*Riparia riparia*]: locally common where there are suitable banks for nesting; summer nester.
87. Barn swallow [*Hirundo rustica*]: very common wherever there are buildings; summer nester.
88. Gray jay [*Perisoreus canadensis*]: very common; most numerous in coniferous forest and muskeg; year-round resident.
89. Blue jay [*Cyanocitta cristata*]: not recorded; expected in mixedwood forest; year-round resident.
90. Common raven [*Corvus corax*]: very common in winter; occasionally in twos at other seasons, usually in coniferous forest.
91. Common Crow [*Corvus brachyrhynchos*]: fairly common; mixedwood forest primarily; summer nester.
92. Clarke's nutcracker [*Nucifraga columbiana*]: occasional in winter, spring and fall.
93. Black-capped chickadee [*Parus atricapillus*]: very common; in mixedwood forest; year-round resident.
94. Boreal chickadee [*Parus hudsonicus;*: very common; in coniferus forest; year-round resident.
95. Red-breasted nuthatch [*Sitta canadensis*]: uncommon; mainly in coniferous forest, also mixedwood; summer nester.
96. Brown creeper [*Certhia familiaris*]: rare; both coniferous and mixedwood forest; migrates to some extent.
97. House wren [*Troglodytes aedon*]: common; mixedwood forest; summer nester.
98. Winter wren [*Troglodytes troglodytes*]: locally common; coniferous forest with shrubby clearings, edges of burns; summer nester.
99. Long-billed marsh wren [*Telmatodytes palustris*]: rare; beside water where there are reeds, rushes or cattails for nesting; summer nester.
100. Robin [*Turdus migratorius*]: uncommon; seems to prefer mixedwood forest near water; summer nester.
101. Varied thrush [*Ixoreus naevius*]: fairly common during migration; otherwise only two locations in summer: 1) several birds (the only one clearly seen was an adult) were observed between 4,500' and 4,600' near the summit of Goose Mountain (54°45'N, 116°02'W) on July 21-22, 1974 by D.E. and G.C.D. Griffiths. This section of spruce-fir forest is very old (many trees 300 years) and very humid; mosses carpet the ground deeply, while lichens hang from the branches. 2) where Highway 18 comes very close to the Freeman River (54°30'N, 115°05'W) about 14 miles SE of Swan Hills town there is quite a large stand of very large old trees (mostly white spruce) on low ground near the river (elevation approximately 3,000'). Here A. Raszewski observed a small number of adults in May and June. In neither case was nesting confirmed; however, this seems quite probable and would be the first evidence of this species breeding east of the Rocky Mountains.
102. Hermit thrush [*Catharus guttatus*]: fairly common; both mixedwood and coniferous forest, but somewhat more in the former; summer nester.
103. Swainson's thrush [*Catharus ustulatus*]: common; both mixedwood and coniferous forest; summer nester.
104. Grey-cheeked thrush [*Catharus minimus*]: not recorded; expected in mixedwood and coniferous forest; spring and fall migration only.
105. Veery [*Catharus fuscescens*]: rare; predominantly mixedwood forest; summer nester.
106. Mountain bluebird [*Sialia currocoides*]: uncommon; openings with suitable nest trees, and also reported at the Goose Mountain fire tower; summer nester.
107. Townsend's solitaire [*Myadestes townsendi*]: not recorded; can be expected anywhere during migration seasons.
108. Golden-crowned kinglet [*Regulus satrapa*]: common; primarily coniferous forest, also spruce stands in mixedwood; wanders south in winter.
109. Ruby-crowned kinglet [*Regulus calendula*]: rare; both mixedwood and coniferous forest; summer nester.
110. Water pipit [*Anthus spinoletta*]: uncommon; only

as a migrant coming down sometimes in openings created by oil industry.

111. Bohemian waxwing [*Bombycilla garrula*]: common; primarily coniferous forest, occasionally mixedwood; summer nester.
112. Cedar waxwing [*Bombycilla cedorum*]: common; mixedwood forest, stream borders, shrubby burnland; summer nester.
113. Northern shrike [*Lanius excubitor*]: rare; occurs only as spring and fall migrant.
114. Loggerhead shrike [*Lanius ludovicianus*]: rare; shrubby burnlands; summer nester.
115. Solitary vireo [*Vireo solitarius*]: fairly common; primarily mixedwood forest; summer nester.
116. Red-eyed vireo [*Vireo olivaceus*]: uncommon; mixedwood forest; summer nester.
117. Philadelphia vireo [*Vireo philadelphicus*]: not recorded; expected in mixedwood forest; summer nester.
118. Warbling vireo [*Vireo gilvus*]: rare; mixedwood forest; summer nester.
119. Black and white warbler [*Mniotilta varia*]: not recorded; expected in mixedwood forest, especially near water; summer nester.
120. Tennessee warbler [*Vermivora peregrina*]: very common; mixedwood forest especially near shrubby wetlands; muskegs and stream borders in coniferous forest; summer nester.
121. Oranged-crowned warbler [*Vermivora celata*]: not recorded; expected in mixedwood forest; summer nester.
122. Yellow warbler [*Dendroica petechia*]: common; shrubby areas along streams and on burnland; summer nester.
123. Magnolia warbler [*Dendroica magnolia*]: uncommon; mixedwood forest and young coniferous second-growth on burnland; summer nester.
124. Cape May warbler [*Dendroica tigrina*]: not recorded; expected in coniferous forest and edges of burns; summer nester.
125. Yellow-rumped warbler (myrtle phase) [*Dendroica coronata*]: very common; mixedwood and coniferous forest; summer nester.
126. Audubon's warbler [*Dendroica coronata audubonî*]: rare; chiefly as a migrant in mixedwood forest.
127. Black-throated green warbler [*Dendroica virens*]: not recorded; expected in mixedwood and coniferous forest; summer nester.
128. Bay-breasted warbler [*Dendroica castanea*]: fairly common; mixedwood and to lesser extent coniferous forest; summer nester.
129. Blackpoll warbler [*Dendroica striata*]: fairly common; primarily in coniferous forest; summer nester.
130. Ovenbird [*Seiurus aurocapillus*]: rare; mixedwood forest with light undergrowth; summer nester.
131. Northern waterthrush [*Seiurus noveboracensis*]: fairly common;shrubby stream margins primarily; summer nester.
132. Connecticut warbler [*Oporornis agilis*]: fairly common; mixedwood forest near water, and shrubby stream margins; summer nester.
133. Mourning warbler [*Oporornis philadelphia*]: rare; mixedwood forest with dense undergrowth; summer nester.
134. Yellowthroat [*Geothlypis trichas*]: common; shrubby stream margins primarily; summer nester.
135. Wilson's warbler [*Wilsonia pusilla*]: rare; shrubby margins of streams; summer nester.
136. Canada warbler [*Wilsonia canadensis*]: rare; shrubby margins of streams; summer nester.
137. Redstart [*Setophaga ruticilla*]: rare; shrubby stream margins and second growth on burns in mixedwood forest; summer nester.
138. Red-winged blackbird [*Agelaius phoeniceus*]: common only where there are cattail beds, e.g. Freeman River; summer nester.
139. Rusty blackbird [*Euphagus carolinus*]: very common; shrubby stream margins and fairly dry muskegs; summer nester.
140. Brewer's blackbird [*Euphagus cyanocephalus*]: fairly common; roadsides; shrubby second growth on burnland; summer nester.
141. Common grackle [*Quiscalus quiscula*]: not recorded; to be expected near lakes and streams; summer nester.
142. Western tanager [*Piranga ludoviciana*]: not record-

Moose in Winter — A. D. Raszewski

ed; to be expected in mixedwood forest; summer nester.

143. Rose-breasted grosbeak [*Pheucticus ludovicianus*]: uncommon; mixedwood forest; summer nester.
144. Evening grosbeak [*Hesperiphona vespertina*]: fairly common; mixedwood forest; summer nester.
145. Purple finch [*Carpodacus purpureus*]: rare; mixedwood forest; summer nester.
146. Pine grosbeak [*Pinicola enucleator*]: fairly common; dense coniferous forest; nesting probable; migrates in winter.
147. Gray-crowned rosy finch [*Leucosticte tephrocotis*]: only one record, of an adult male caught at Swan Hills town in the late summer by A. Raszewski; should occur as an infrequent winter visitor.
148. Pine siskin [*Spinus pinus*]: very common; coniferous forest; summer nester.
149. Common redpoll [*Acanthis flammea*]: fairly common; spring and fall migrant.
150. Hoary redpoll [*Acanthis hornemanni*]: not recorded; to be expected with flocks of common redpolls.
151. Red crossbill [*Loxia curvirostra*]: fairly common; dense coniferous forest; wanders widely in winter.
152. White-winged crossbill [*Loxia leucoptera*]: common; dense coniferous forest; wanders widely in winter.
153. Dark-eyed junco (slate-coloured phase) [*Junco hyemalis*]: very common; coniferous forest, dry muskegs, and to a lesser extent mixedwood forest near spruce; summer nester.
154. Tree sparrow [*Spizella arborea*]: not recorded; to be expected during spring and fall migration.
155. Chipping sparrow [*Spizella passerina*]: very common; along roads, shrubby openings created by oil industry, young second-growth on burns; summer nester.
156. Clay-coloured sparrow [*Spizella pallida*]: rare; young second-growth on burns; summer nester.
157. Harris' sparrow [*Zonotrichia querula*]: rare migrant; a bird seen in coniferous forest on Deer Mountain (54°55'N, 115°10'W) in June by A. Raszewski seemed to be very late for a migrant.
158. White-throated sparrow [*Zonotrichia albicollis*]: very common; mixedwood forest; summer nester.
159. Fox sparrow [*Passerella iliaca*]: fairly common, at least along Freeman River; summer nester.
160. Swamp sparrow [*Melospiza georgiana*]: fairly common; shrubby margins of streams and muskegs; summer nester.
161. Song sparrow [*Melospiza melodia*]: uncommon; shrubby margins of streams and lakes, oil clearings; summer nester.
162. Snow bunting [*Plectrophenax nivalis*]: fairly common; winter visitor in open areas.

D. E. Griffiths

APPENDIX IV.

Annotated list of fish

1. Arctic grayling [*Thymallus arcticus*]: Driftpile, Freeman, East Prairie, and Swan Rivers; apparently absent from Freeman Lake.
2. Mountain whitefish [*Prosopium williamsoni*]: Freeman River; apparently absent from Driftpile and Swan Rivers and Freeman Lake.
3. Rainbow trout [*Salmo gairdneri*]: Freeman River; apparently absent from Driftpile and Swan Rivers and Freeman Lake.
4. Northern pike or jackfish [*Esox lucius*]: Swan and Freeman Rivers, Freeman Lake; apparently absent from Driftpile River.
5. Lake chub [*Couesius plumbeus*]: Swan and Freeman Rivers; apparently absent from Driftpile River and Freeman Lake.
6. Fathead minnow [*Pimephales promelas*]: Swan River; apparently absent from Driftpile and Freeman Rivers and Freeman Lake.
7. Pearl dace [*Semotilus margarita*]: Swan River; apparently absent from Driftpile and Freeman Rivers and Freeman Lake.
8. Longnose sucker [*Catostomus catostomus*]: Swan River; apparently absent from Driftpile and Freeman Rivers and Freeman Lake.
9. White sucker [*Catostomus commersoni*]: Swan and Driftpile Rivers; apparently absent from Freeman River and Freeman Lake.
10. Burbot [*Lota lota*]: Swan River; apparently absent from Driftpile and Freeman Rivers and Freeman Lake.
11. Brook stickleback [*Culaea inconstans*]: Freeman River; apparently absent from Swan and Driftpile Rivers and Freeman Lake.
12. Spoonhead sculpin [*Cottus ricei*]: Freeman River; apparently absent from Swan and Driftpile Rivers and Freeman Lake.

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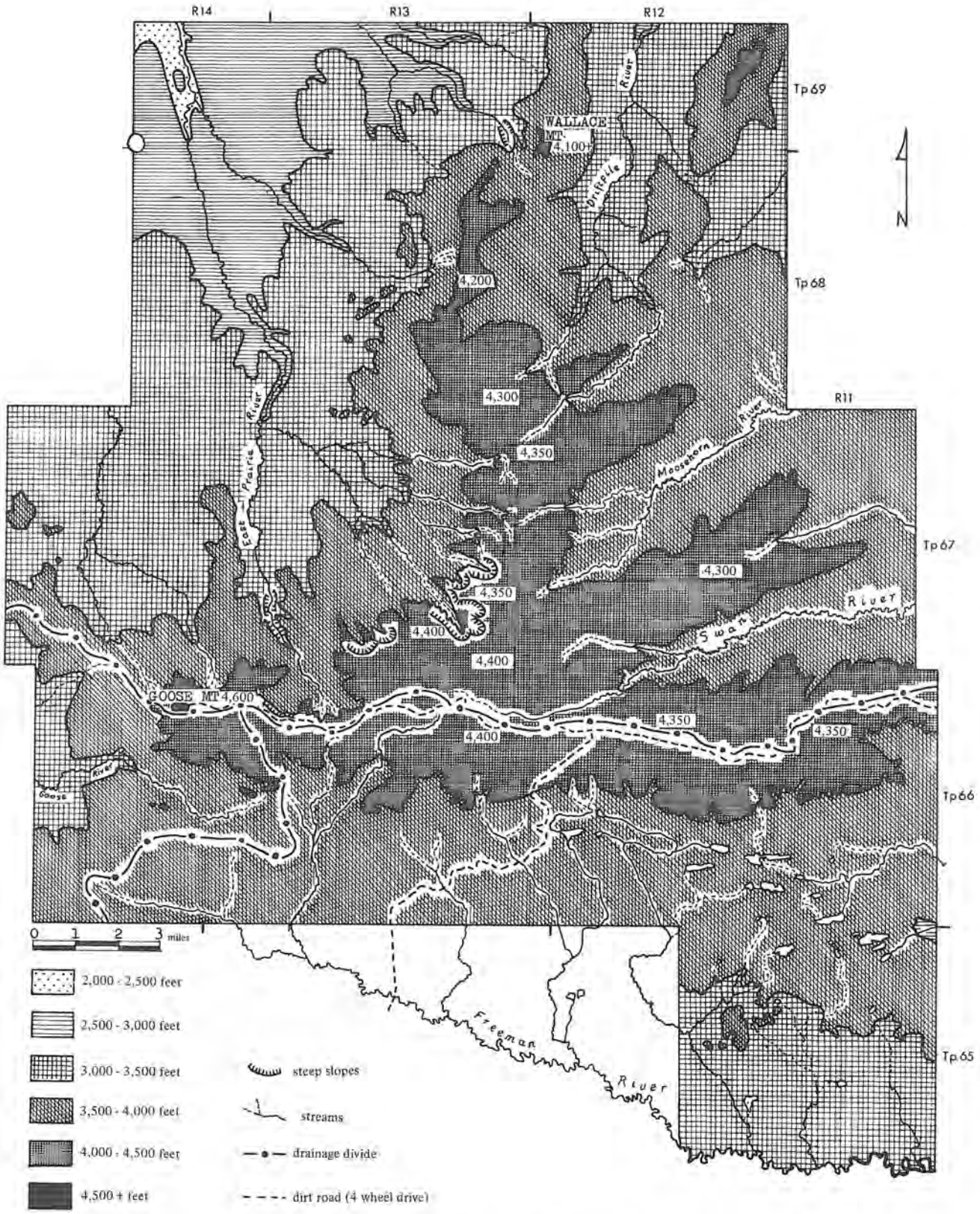
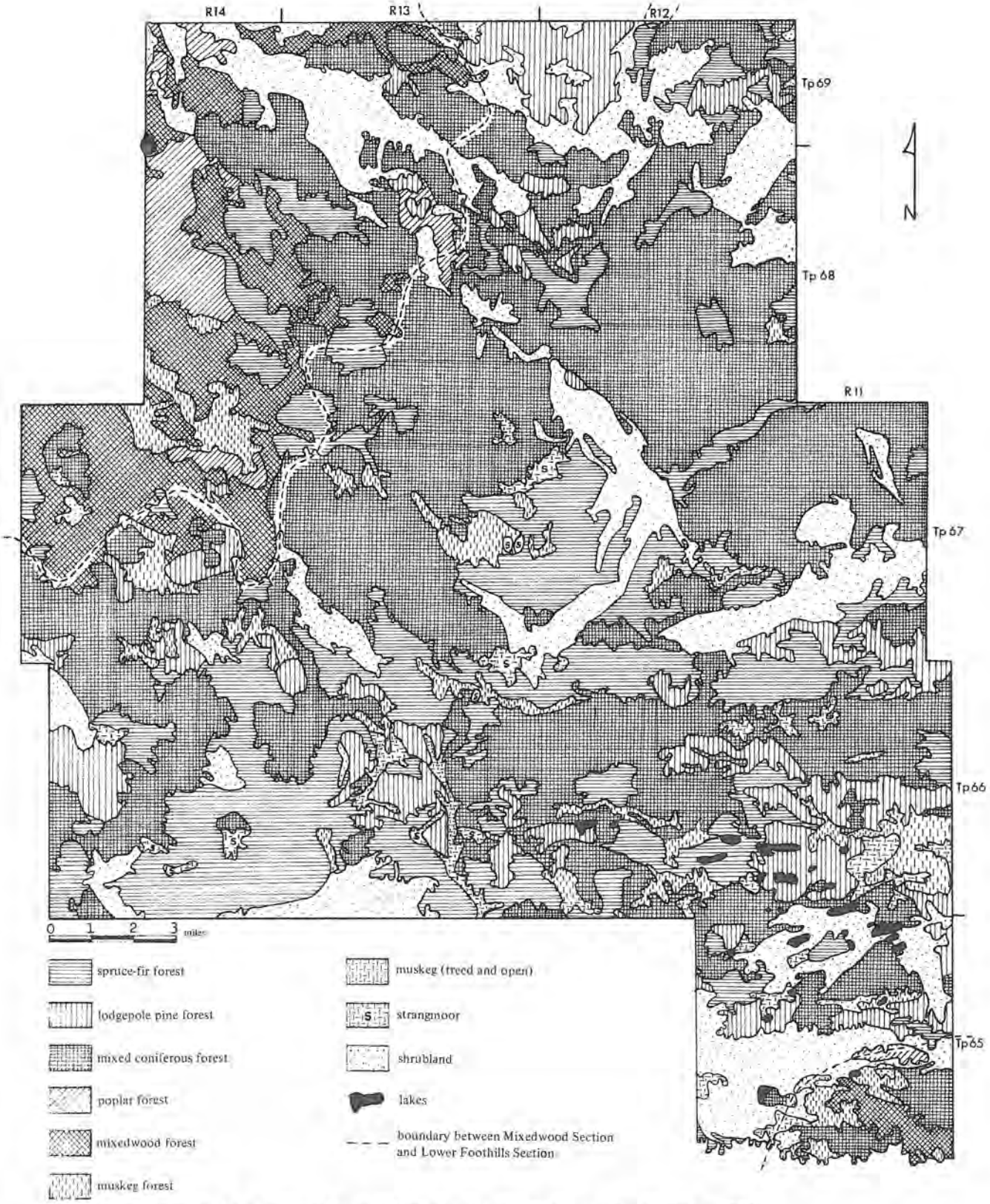
Near Goose Mountain

D. E. Griffiths

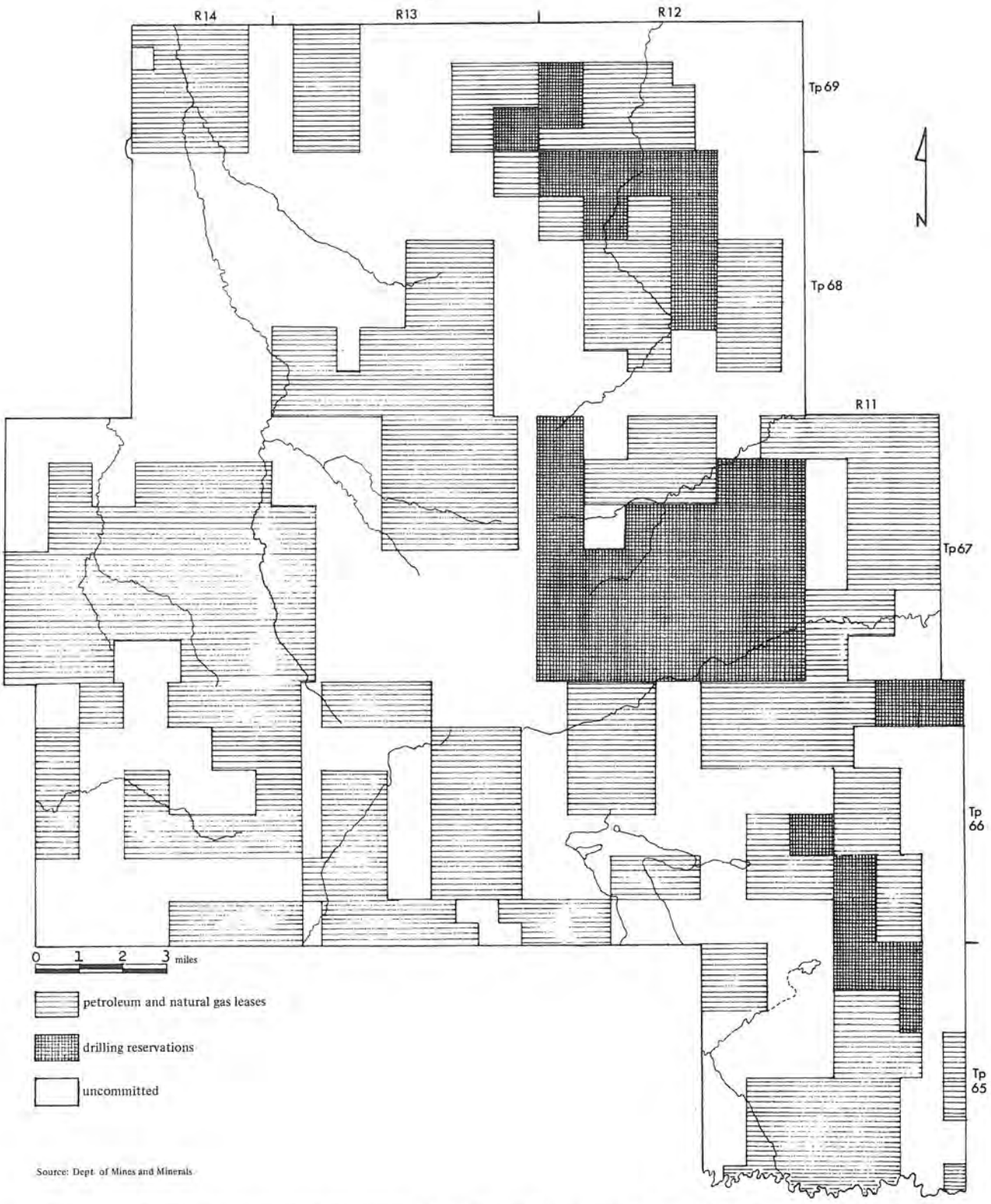


Topographic features of the proposed Swan Hills Recreational Wilderness.

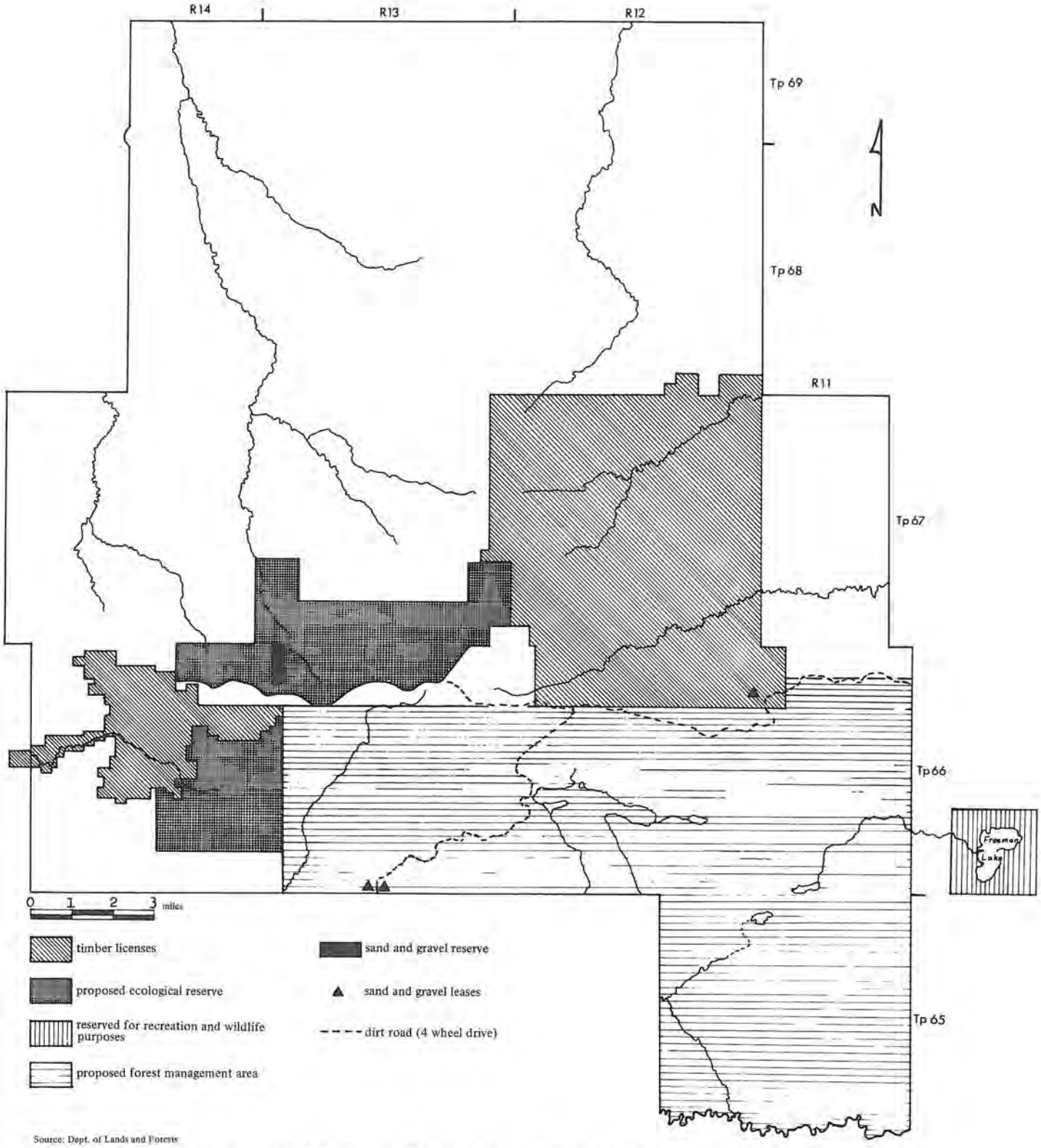


Vegetation types in the proposed Swan Hills Recreational Wilderness. (as of spring 1974)

(Source: Dr. Peter Achoff)



Petroleum and natural gas rights in the proposed Swan Hills Recreational Wilderness. (as of June 24, 1974)



Source: Dept. of Lands and Forests

Current land-use in the proposed Swan Hills Recreational Wilderness. (1974)

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The *Western Swan Hills* Study is the fourth of a series. The first three (*Elbow-Sheep Headwaters, Nine Wildland Recreation Areas on Alberta's East Slopes* and *Willmore Wilderness Park*) have been published and are available from the Alberta Wilderness Association. They were part of a presentation to the provincial government's Public Hearings on "Land Use on the Eastern Slope of the Rockies" in the summer of 1973.

The present Study, *Western Swan Hills* is a joint venture by two of Alberta's most active conservation organizations. It has been formally presented to the provincial government as the first step in obtaining protection for the wildlife and wildland qualities inherent in the Swan Hills of Alberta. Individual support is also needed however, and we urge you to make your views on the Western Swan Hills known to the Premier of Alberta, the Honourable Peter Lougheed.

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ii) provide a vehicle through which Albertans may speak to their elected representatives and government officials on matters concerning wilderness conservation and management.

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