BIOPHYSICAL INVENTORY
OF
CHINCHAGA WILDLAND PARK

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EXECUTIVE SUMMARY

Chinchaga Wildland Park is one of Alberta's newest additions to the protected areas network. The greater Chinchaga area was identified in 1995 as an Environmentally Significant Area in the Foothills Natural Region of Alberta. A portion of the area was subsequently designated as a Wildland Park in December 1999. With its current boundaries, Chinchaga Wildland Park encompasses approximately 800 km^2 (80,000 hectares) of wilderness in a disjunct outlier of the Foothills Natural Region in northwest Alberta. The Chinchaga River itself forms the Park's northern boundary, extending south to the slopes of Halverson Ridge. Elevations in the Park range from 650 m adjacent to the Chinchaga River to 915 m at the height of land atop Halverson Ridge.

Located approximately 100 km west of Manning, Chinchaga Wildland Park is extremely isolated and remote. There is no formal road access into or within the Park, however considerable oil and gas exploration activity in the past has resulted in a network of seismic lines that can, and are, traversed by 4x4 vehicles. The Park is predominantly in the Lower Foothills Natural Subregion, but also includes portions of the Upper Foothills Natural Subregion (in the extreme southeast, at the slopes of Halverson Ridge). Vegetation in most of the Park is a combination of typical foothills vegetation and vegetation influenced by surrounding boreal forest environments.

The Park is noted for its provision of habitat for provincially significant wildlife species, including woodland caribou and trumpeter swan, both listed as Endangered Species in Alberta. Caribou inhabiting the Park and adjacent areas are non-migratory animals that depend heavily on terrestrial lichen forage in winter. Trumpeter swans are known to nest on numerous lakes, wetlands, and rivers in the Chinchaga area. While the majority of their breeding range is further south (in the Saddle Hills area), at least 20 pairs are known to nest in the Chinchaga Wildland Park area.

At present, there is very little resource related information available for the Park itself. The overall goal of this project was to collect baseline biophysical data that could be used to support the management objectives of Chinchaga Wildland Park. In order to meet this goal, a number of specific tasks were undertaken, including:

- Description and mapping of ecological units (to the ecosite phase level);
- Inventory (at reconnaissance-level) of birds and mammals in the Park, along with associated significant habitats; and
- Identification and description of Environmentally Significant Areas (ESA) within the Park.

These tasks were completed through a combination of literature review, air photo interpretation, and field investigation. Field work was completed over a two-week period in mid-August, 2001, and entailed vegetation and soil characterization, wildlife habitat assessment, reconnaissance wildlife species surveys, and ESA identification. Final maps displaying the results were completed in Arc/Info platform Geographic Information System.

In the Lower Foothills portion of the Park, bog and fen (essentially wetland) ecosites comprise nearly 60% of the area, while upland forested ecosites comprise only 40% of the area. Wetland ecosites such as these play a significant hydrological role in ecosystem development, particularly those that accumulate peat (decomposed organic material). In the Upper Foothills portion of the Park, the opposite trend is noted, with wetland ecosites comprising only 6% of the area, while upland forests comprise 94%. Vegetation in the Halverson Ridge area of the Park is dominated by lodgepole pine coniferous and pine-spruce-aspen mixedwood forests typical of foothill environments.

A number of Environmentally Significant Areas (ESAs) were identified in the Park, based on their provision of habitat for threatened / sensitive species and valued ecosystem components. ESAs were classified into the following broad biotic and abiotic groups for purposes of mapping:

- The Chinchaga River
- Caribou Winter Habitat Complexes
- Steep and Gullied Old Growth Forests
- Upland Old Growth Forests
- Meltwater Channels
- Patterned Fens
- Riparian Habitats
- Unique Vegetation Communities and
- Trumpeter Swan Nesting Wetlands

In many areas, combinations of two or more of these features are present in individual ESAs. These ESAs have been selected because they contribute to the conservation of Valued Ecosystem Components, such as local and regional hydrological regimes, peat accumulation, multi-layer forest structure, and coarse woody debris, in addition to providing habitat for wildlife species that require management attention. Together, these ESAs total approximately 23,000 ha, or almost 30% of the Park's area.

All ESAs should be considered as sensitive land and waterscapes, as the VECs that they contain have inherent ecological value and, thus, warrant active conservation through management. Fens and riparian habitats in particular are dependent on consistent hydrological conditions, which are negatively impacted by the effects of industrial activity and recreation (through soil compaction, vegetation trampling, and flow alteration).

The Chinchaga River itself, which forms the northern boundary of the Park, is a provincially significant ESA. It has been uniquely identified as an abiotic feature that provides biotic VECs. Its tightly meandering pattern is unique among Alberta's major rivers, and perhaps among Canada's rivers. It also provides significant fish and wildlife habitat, and houses unique vegetation communities.

Mature, or old growth, forest stands in the Park represent both upland and lowland forests. Lowland old growth forests overlap considerably with identified caribou winter ranges, and are incidentally included in these "Caribou Winter Habitat Complex" ESAs. Upland old growth areas can withstand some use, but their conservation is critical given the anticipated commercial harvesting of old growth forests outside and immediately adjacent to the Park. Equally sensitive is a unique vegetation community identified in an area south of the Chinchaga River. A rapidly drained, sandy substrate in this area has allowed the development of a very dry, open aspen grove on rolling and hummocky topography. This type of landscape was only found as an isolated occurrence in the Park, and may be unique in a broader context as well.

Sensitivity of wildlife species must also be taken into consideration. Wetlands that house nesting trumpeter swans, for example, must be buffered from human activity by at least 500 m in order to minimize chances of nest abandonment. Both conventional and low-impact seismic lines have also proven to negatively impact caribou in northern Alberta by making them more prone to predation by wolves. Seismic line maintenance is no longer being carried out within the Park, however, and many existing lines are naturally re-vegetating through successional processes.

ACKNOWLEDGEMENTS

Administrative project management was provided by Mr. Amit Saxena of ***Geowest Environmental Consultants Ltd.*** on behalf of our project team. Ms. Elaine Nepstad provided project supervision and guidance on behalf of Alberta Community Development, Parks and Protected Areas (Valleyview District).

The field work could not have been completed without the efforts of Tricia and Bob Freelend of Chinchaga River Outfitters (CRO), who provided all the necessary logistics to work in such a remote setting. Bob Freelend and Roger Simard of Chinchaga River Outfitters not only shared their experiences of the area, but also provided camp logistics, expert operation of Argos, and all-important campfire stories!

The authors and researchers involved in this project gratefully acknowledge the time and effort contributed by a number of other Geowest staff during the course of this project. Particular thanks are due to Della Clish and Erin Anderson for completion of all map products associated with this project, including numerous working copies for inconsiderate biologists to scribble on. Ms. Terry Lang also provided assistance in word processing and data base management / manipulation.

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1. INTRODUCTION

This report is submitted in fulfillment of a contract issued by Alberta Community Development, Parks and Protected Areas (Valleyview District) to Geowest Environmental Consultants Ltd. The report provides a discussion of the project goals and objectives, a synopsis of the natural resources of Chinchaga Wildland Park, and a discussion of the methods and results of the project. The report is accompanied by a number of appendices, including various digital map products.

1.1 Project Background

Chinchaga Wildland Park is one of Alberta's newest additions to the protected areas network. The greater Chinchaga area was identified in 1995 as a provincially significant area in the Foothills Natural Region (Bentz *et al.* 1995), and a recommendation was made to conserve as much of the area as possible. On December 15, 1999, the Government of Alberta announced the designation of 800 km^2 of the Chinchaga as a Wildland Park under the authority of the *Provincial Parks Act*. The "*wildland park*" designation is intended to conserve large areas of natural landscapes that conserve biological diversity and keep interference with natural processes to a minimum.

The Park is located in a very remote and isolated setting and, as a result, very little biophysical information has been collected to date specifically for the Park area. It is the intention of this project to collect primarily baseline information that can be used to guide future data collection and resource management activities in and around the Park.

1.2 Project Objectives

The overall goal of this project was to collect biophysical data that could be used to support the management objectives of Chinchaga Wildland Park. In order to meet this goal, a number of specific objectives were established as follows:

1. Delineate and describe ecological units to the ecosite phase hierarchical level for the Park;
2. Identify and describe vegetation communities;
3. Conduct reconnaissance level bird and mammal inventories of the Park;
4. Identify and describe special features in the Park and integrate them into the maps and report; special features may include landforms and plant communities, plant species, and vertebrate and invertebrate species of concern (as identified by the Alberta Natural Heritage Information Centre (AHNIC));
5. Identify and describe sensitive areas of the Park; and
6. Provide hard copy and digital maps at a 1:50 000 scale for both ecosite phases and sensitive features;

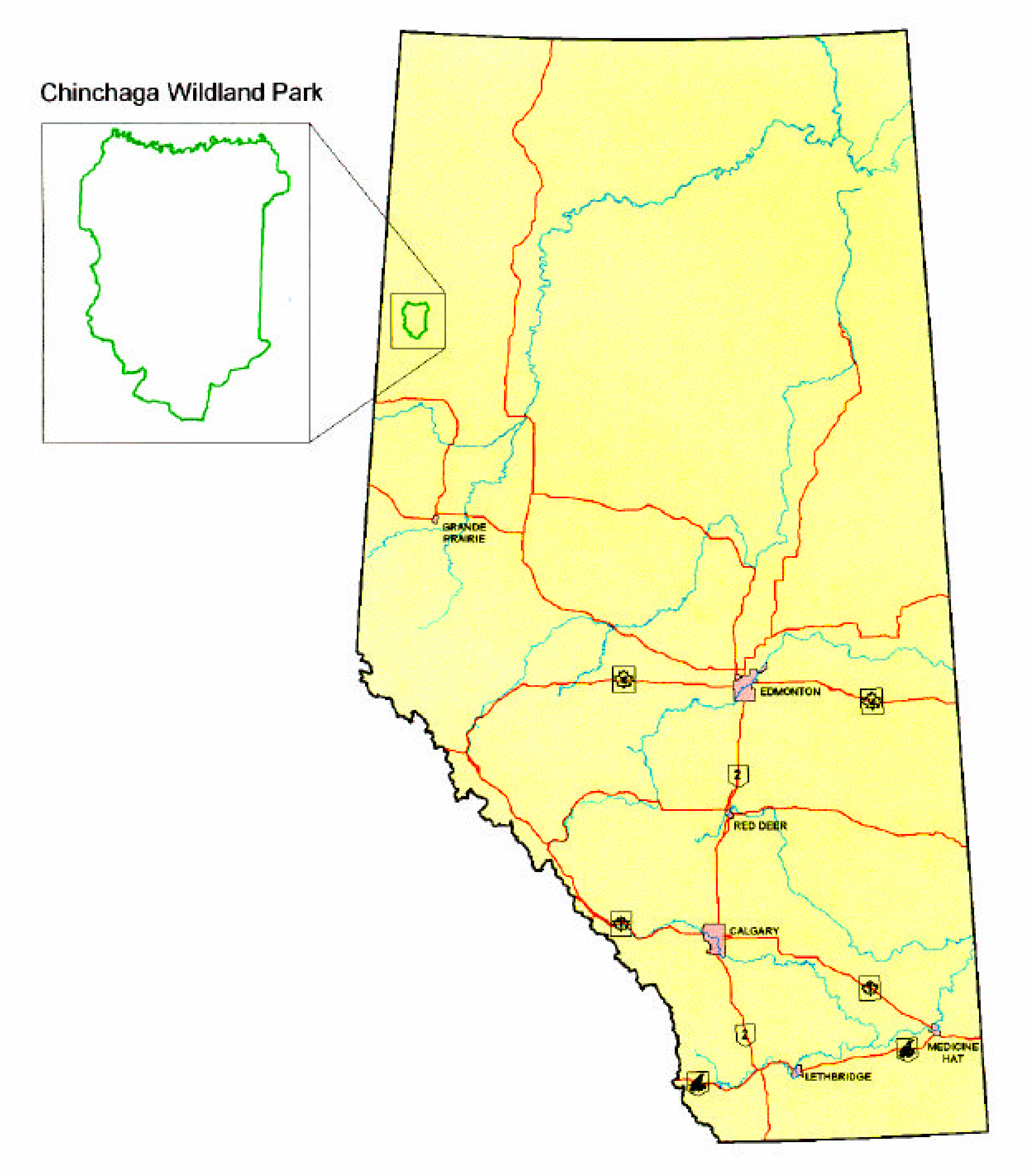
1.3 Project Area Location

Chinchaga Wildland Park is approximately 80,270 ha in size and is found in northwest Alberta ***(Figure 1)***. The Park is located approximately 100 km west of Manning and 110 km northwest of Fairview. It includes all or portions of Townships 92 – 96 and Ranges 9 – 12 west of the 6th meridian.

The Chinchaga River forms the northern boundary of the Park. The Park extends south to the Halverson Ridge height of land. The western and eastern boundaries are formed by a number of small perennial streams, including portions of Mearon Creek in the west.

Access to the Park is via the Hotchkiss Fire Tower Road. No formal road network exists within the Park, however seismic lines can be traversed by use of a 4x4 ARGO vehicle.

Figure 1.   Location of Chinchaga Wildland Park, Alberta



2. RESOURCE DESCRIPTION

This section of the report provides a general discussion of the natural resources of Chinchaga Wildland Park. The Park is discussed in terms of natural subregions, climate, bedrock and surficial geology, quaternary history, soils, hydrology, vegetation and wildlife.

2.1 Natural Regions & Subregions (and Vegetation)

Chinchaga Wildland Park is located within the Foothills Natural Region of Alberta. It occurs mainly within the Lower Foothills Natural Subregion, and to a much lesser extent, the Upper Foothills Natural Subregion ***(Figure 2)***. Each of these subregions is discussed below; much of the information is taken directly from Beckingham *et al.* (1996).

2.1.1 Lower Foothills Natural Subregion

The Lower Foothills is characterized by the codominant occurrence of aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), lodgepole pine (*Pinus contorta*), and white spruce (*Picea glauca*) on modal sites. Within the Chinchaga Wildland Park, elevations range from 650 m adjacent to the Chinchaga River to nearly 825 m south of Halverson Ridge in the south. These elevations are consistent with the overall elevation range for the Lower Foothills in Alberta (500 – 1,150 m).

The Lower Foothills represents a transition from the aspen and white spruce-dominated boreal mixedwood forests to the lodgepole pine–dominated Upper Foothills and Subalpine forests. Mixed forests of lodgepole pine, aspen, and white spruce characterize reference or modal sites within the subregion. Balsam poplar is also a common component of these forests especially on moist to wet sites. Black spruce (*Picea mariana*) and tamarack (*Larix laricina*) are common on wet sites.

Understory species in the subregion are similar to those that occur in the Boreal Forest Natural Region. Low-bush cranberry (*Viburnum edule*), prickly rose (*Rosa accicularis*), green alder (*Alnus crispa*), and Canada buffaloberry (*Sherpherdia canadensis*) are common shrubs on mesic sites. Wild sarsaparilla (*Aralia nudicaulis*), dewberry (*Rubus pubescens*), marsh reed grass (*Calamagrostis canadensis*), and hairy wild rye (*Elymus innovatus*) are common forb and grass species.

Table 1 provides a summary of climatic data for the Lower Foothills subregion.

2.1.2 Upper Foothills Natural Subregion

The Upper Foothills Natural Subregion occurs elevationally above the Lower Foothills and below the Subalpine natural subregions. The Halverson Ridge area is considered to be an outlier of the more typical Upper Foothills subregion that occurs along the Rocky Mountains. Elevations in the Upper Foothills portion of the Park range from 825 to 915 m. A summary of climatic data for the Upper Foothills subregion is found in Table 1.

Figure 2. Natural Subregions of Chinchaga Wildland Park.

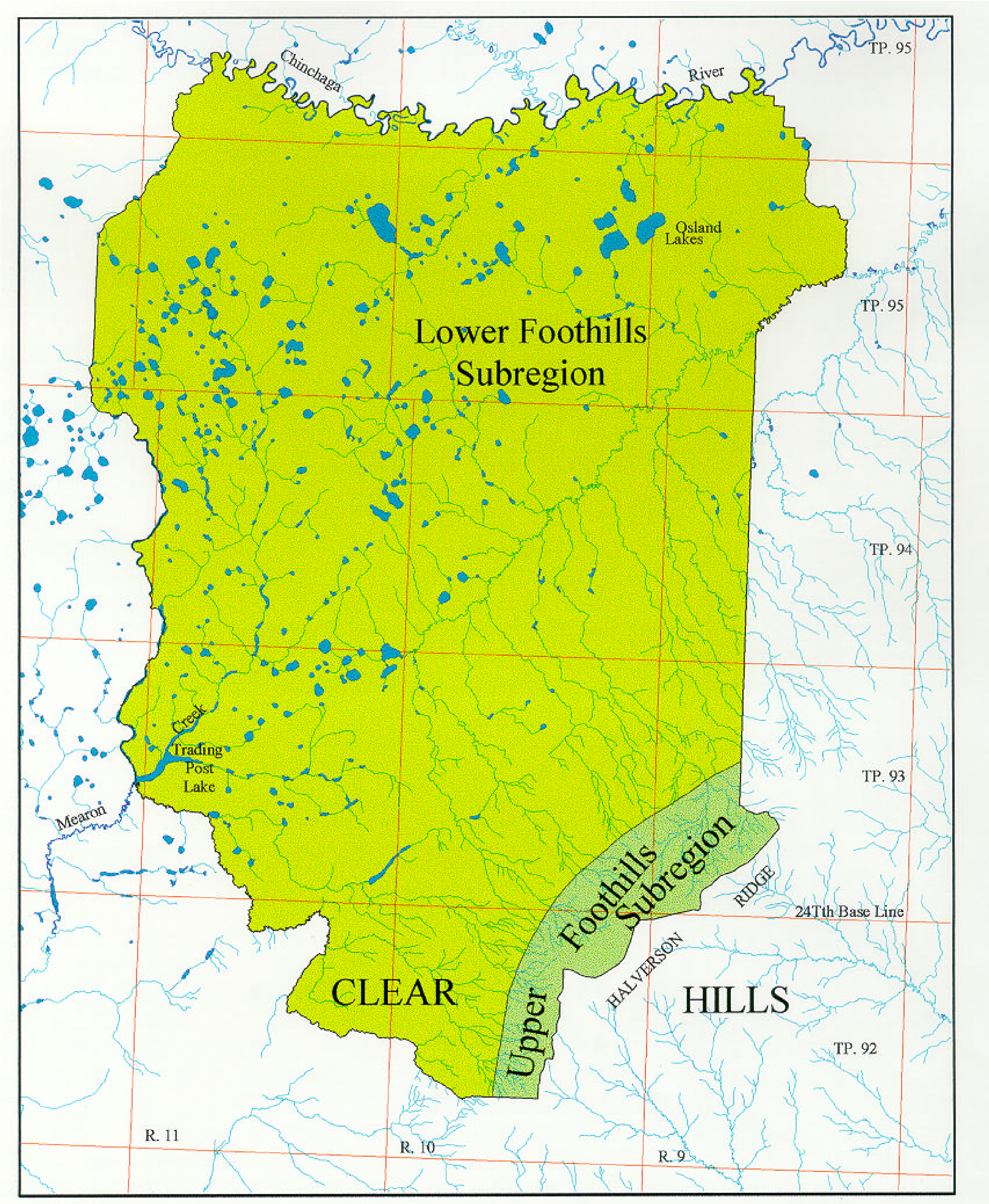


Table 1. Summary of Climatic Data by Subregion (from Beckingham *et al*. 1996)		
	Lower Foothills	**Upper Foothills**
Summer[a]		
Mean typical temperature (°C)	12.8	11.5
Minimum typical temperature (°C)	6.9	5.9
Maximum typical temperature (°C)	18.3	16.7
Total precipitation (mm)	295	340
Growing degree days	1008	752
Number of days < 0 °C	8	13
Winter[b]		
Mean typical temperature (°C)	-7.8	-6.0
Minimum typical temperature (°C)	-14.3	-12.5
Maximum typical temperature (°C)	-2.1	0.5
Total precipitation (mm)	60	60
Annual		
Total precipitation (mm)	464	538
Mean temperature (°C)	3.0	3.0

[a] Summer is defined as May, June, July and August

[b] Winter is defined as November, December, January, and February

Closed-canopied coniferous forests dominate the landscape with lodgepole pine being the most prevalent species. White spruce is common throughout the subregion and forms mixed stands with lodgepole pine or occurs in pure stands. Black spruce is common in wetlands and mixed with lodgepole pine on upland sites.

The Upper Foothills is distinguished from the Lower Foothills by the lack of aspen on modal sites. Aspen is generally restricted to warm southerly slopes or coarse-textured soils of the Upper Foothills. Similarly, the Upper Foothills is distinguished from the Subalpine by differences in potential climax tree species on modal sites; white and black spruce compose the canopy of the climax community on modal sites of the Upper Foothills, while Englemann spruce (*Picea engelmannii*) and Subalpine fir (*Abies lasiocarpa*) are the climax species in the Subalpine.

Understory species on modal sites consist largely of ericaceous shrubs such as Labrador tea (*Ledum groenlandicum*), tall bilberry (*Vaccinium membranaceum*), and bog cranberry (*V. vitis-idaea*). Green alder is a common shrub throughout the area. Forb and grass layers are not as diverse as in the Lower Foothills subregion.

2.2 Climate

Table 1 above provides climatic summaries for both the Upper and Lower Foothills subregions. Tables 2, 3, and 4 provide summaries of selected climatic parameters for stations within the project area. This data summarizes much of the climatic data collected by Environment Canada between 1951 – 1980 as well as data from climate stations established by Alberta Environment between 1979 – 1983.

Table 2. Selected Climatic Parameters for Selected Climatic Stations in the Chinchaga Wildland Park Area (from Brierley *et al*. 1985)

Climate Station	Elevation (m)	Mean Daily Temperature (ºC) [1]		Frost Free Period	Growing Degree Days [2]	Precipitation (mm) [1]	
		January	July			Total	May to September
Clear Hills Upland							
Keg Lookout (LO)	914	M	13.8	84	M	M	369
Naylor Hills LO	732	M	14.9	102	1061	M	311
Hawk Hills LO	610	M	15.0	103	1095	M	358
Battle River LO	732	M	15.0	100	1101	M	300
Chinchaga LO	762	M	14.2	92	977	M	298
Notikewin LO	762	M	14.3	99	982	M	326
Hotchkiss LO	945	M	13.7	86	889	M	388
Fort Vermilion Lowlands							
Keg River	427	-22.6	15.7	70	1160	443	282
Keg River Ranger Station	405	M	14.9	54	1117	M	256
High Level Ranger Station	338	-24.6	15.7	71	1130	387	249
Kemp	465	M	16.0	51	1062	M	250
Petromark	466	M	16.0	82	1179	M	229
Peace River Lowlands							
Notikewin East	465	-22.6	15.8	86	1158	404	245
Manning Ranger Station	460	M	16.3	81	1236	M	256

1. M = Missing (data not collected at these stations)

2. Growing Degree-Days are the equivalent of 1 degree of temperature maintained for 24 hours above the specified base temperature at which plant growth can be initiated and maintained (the base temperature for this area is approximately 5^o). For example, a day of 10^o weather (i.e., 5^o warmer than the base) is equivalent to 5 growing degree-days. 2 days of 20^o weather (i.e., 15^o warmer than the base for 2 days) is equivalent to 30 growing degree-days. Growing degree-days are used to relate plant growth and maturation to environmental air temperatures.

Table 3. Average Daily Maximum and Minimum Temperatures for Clear Hills Upland and the Fort Vermilion and Peace River Lowlands for the May to September Period

(from Brierley *et al*. 1985)

	May	June	July	August	September
Clear Hills Upland					
Daily Maximum	13.6	17.4	19.3	17.8	12.3
Daily Minimum	2.9	7.2	9.4	8.1	3.2
Range	9.7	10.2	9.9	9.7	9.1
Fort Vermilion and Peace River Lowlands					
Daily Maximum	17.2	21.0	22.9	21.3	15.7
Daily Minimum	1.5	6.0	8.4	6.7	1.7
Range	15.7	15.0	14.5	14.6	14.0

Table 4. Spring and Fall Probabilities for the Clear Hills Upland and the Fort Vermilion and Peace River Lowlands (from Brierley *et al*. 1985)

	Frost Probabilities					
	Spring			Fall		
	10 %	50 %	90 %	10 %	50 %	90 %
Clear Hills Upland	2nd week of June	1st week of June	3rd week of May	3rd week of August	1st week of September	4th week of September
Fort Vermilion and Peace River Lowlands	1st week of July	2nd week of June	4th week of May	1st week of August	3rd week of August	1st week of September

From a review of the above tables, it is quite evident that both temperatures and precipitation values for the upland areas are different from those found at lower elevations. These differences coincide with differences identified between the Upper and Lower Foothills subregions.

2.3 Bedrock and Surficial Geology

Bedrock geology and Quaternary history (i.e., that which pertains to the last two to three million years of development) ultimately play a significant role in the development and distribution of surficial materials across the landscape. The combination of these three features along with climate ultimately results in distinctive vegetation characteristics for the area.

2.3.1 Bedrock Geology

Chinchaga Wildland Park is found within the Interior Plains physiographic region of Canada (Bostock 1976). These Interior Plains are characterized by flat-lying sedimentary bedrock. The most extensive rocks in the area are of Cretaceous age, meaning that they date back to between 136 million and 65 million years ago. These rocks consist mostly of shales and siltstones, laid down in shallow seas, that interfinger westward with deltaic (i.e., deposited at the outflow of rivers and streams) and fluvial (i.e., deposited by the action of flowing waters such as rivers and streams) siltstone and sandstones that include some coal. An important component of these units is bentonite, a clay formed from volcanic ash decomposition, which consists mainly of highly expansive montmorillonite (clay minerals). The presence of this clay imparts distinctive properties to these rocks (Klassen 1989).

From north to south, Upper Cretaceous bedrock of the Dunvegan, Kaskapau, Puskwaskau and Wapiti formations underlie Chinchaga Wildland Park (Green 1970, Green and Mellon 1962, Carrigy and Green 1965) ***(Figure 3)***. Stratigraphically, the Wapiti Formation overlies the Kaskapau Formation that overlies the Puskwaskau Formation and the Dunvegan Formation. These formations are both oil and mineral bearing strata.

The Dunvegan Formation is of deltaic and marine origin and extends 10 – 15 km south of the Chinchaga River. It consists of grey, fine-grained, feldspathic (sodium and potassium rich) sandstone with hard calcareous beds (i.e., they contain accumulations of calcium and magnesium carbonate). Laminated siltstone and grey silty shales are also interbedded within this formation. The marine Kaskapau Formation is comprised of dark grey silty shale with thin concretionary (compressed) ironstone beds, which tend to grow together into hard, compact rock masses. Interbedded in the lower parts of this concretionary formation are fine-grained quartzose sandstone and thin beds of ferruginous (iron-rich) oolitic (spheroidal or ellipsoidal structures) mudstone. The Puskwaskau Formation is marine in nature and consists of dark grey fossiliferous shale, silty in part. The Wapiti Formation (found along Halverson Ridge) consists of feldspathic, clayey sandstone with interbedded grey bentonitic mudstone and bentonite; scattered coal beds.

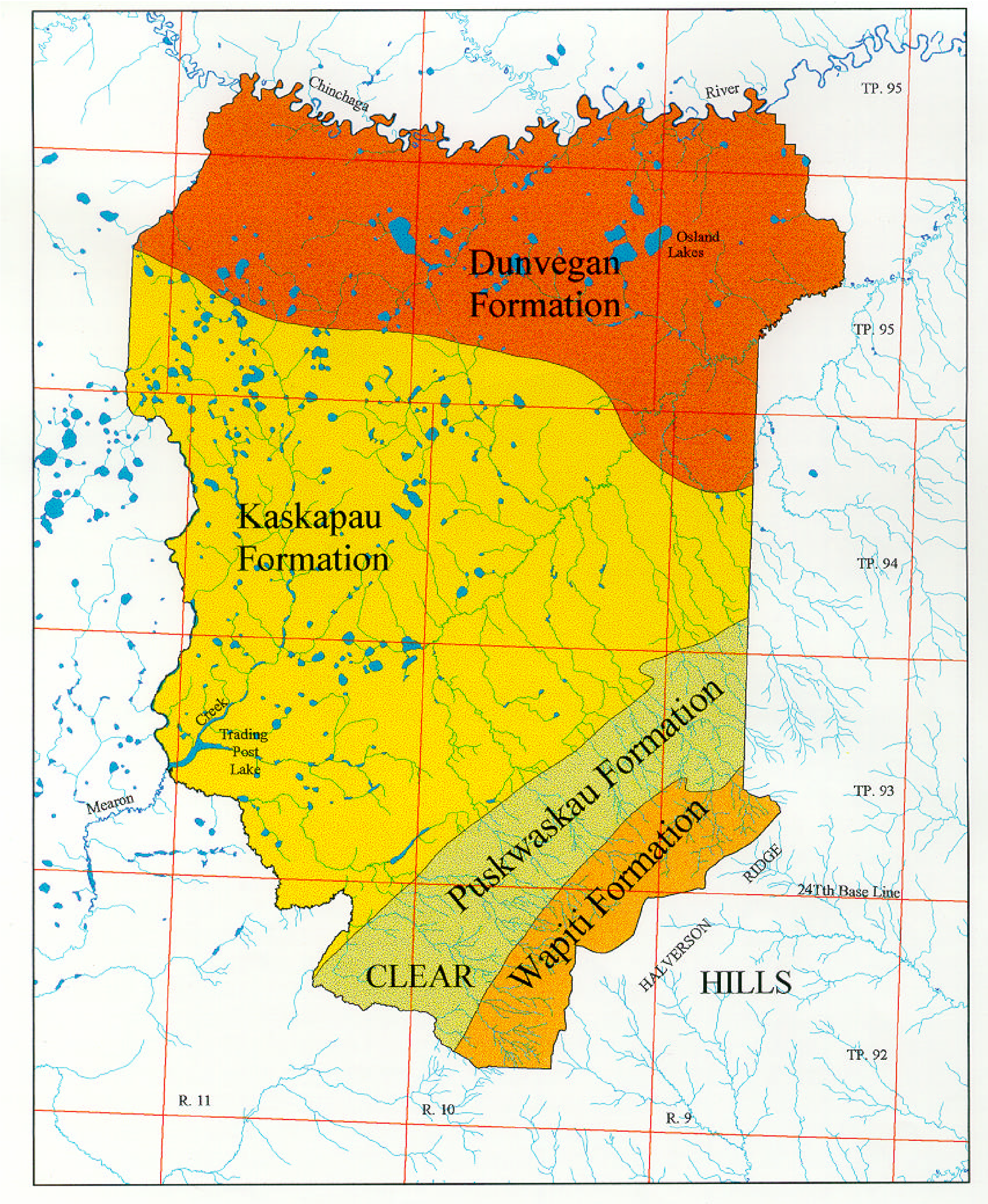
Thick unconsolidated surficial materials overlie the bedrock in Chinchaga Wildland Park; although no bedrock outcrops were observed during the field inventory, it is speculated that bedrock of the Wapiti or the underlying Puskwaskau formations may be exposed in some of the eroded gullies along Halverson Ridge.

2.3.2 Quaternary History

The Quaternary history of the Chinchaga area has not been studied in detail, however, the following discussion has been taken directly from Brierley *et al*. (1985) for an area occurring immediately adjacent to the Park.

Ice covered much of the Chinchaga Wildland Park area until about 11,000 to 10,000 years before present (Mathews 1980, Prest 1976). The presence of ground moraine and the absence of end or recessional moraines suggest that much of the retreat of the ice sheets was accomplished by stagnation. As ice sheets stagnated, meltwaters ponded between the ice sheets to the north and east and the Clear Hills Upland to the south and west. This ponding resulted in the formation of the later stages of Lake Clayhurst, Indian Creek and Keg River. Taylor (1960) has speculated that Glacial Lake Peace and Glacial Lake Tyrrell converged in this area during the later stages of Glacial Lake Peace. This resulted in the sequential deposition of clay-rich lacustrine sediments of variable thicknesses over much of the area. Ice rafting may account for the variable stone content found within these sediments (Lindsay *et al*. 1959). These lakes were relatively short-lived as indicated by the lack of shoreline features.

Figure 3. Bedrock Geology of Chinchaga Wildland Park



Termination of the Indian Creek stage of Glacial Lake Peace occurred because of the outflow of waters in a westerly direction around the north end of the Naylor Hills into the present day Chinchaga drainage system (Mathews 1980). This, combined with the continued runoff of meltwaters from ice covering the Clear Hills Upland, resulted in the formation of entrenched glacial meltwater channels and the deposition of glaciofluvial materials.

2.3.3 Surficial Geology

The surficial geology of the Chinchaga Wildland Park is rather simple and is representative of the glacial history of northern Alberta. The following comments are provided based upon the field inventory and from experience of the authors in adjacent areas.

For the most part, thick moderately fine to fine-textured glaciolacustrine sediments are found throughout the Chinchaga Wildland Park area. Moderately fine to medium-textured morainal materials are found atop Halverson Ridge.

The glaciolacustrine materials generally vary from clays and heavy clays to silty clays and silt loams. Adjacent to the Chinchaga River, the textures are considerably coarser and vary from very fine loamy sand to sand where overbank deposits are common. These glaciolacustrine materials vary from well to poorly drained depending upon topographic position. In areas where these materials are finer textured, gray varved sediments are typical.

Morainal materials are found on the lower slopes and areas atop Halverson Ridge. These materials tend to be moderately well to well drained and are characterized by textures ranging from silt loams to clay loams with up to 10 % subangular coarse fragments.

Poorly to very poorly drained wetlands are found throughout the Chinchaga Wildland Park. These areas consist of thick organic accumulations (mostly plant material) that vary from mesic (i.e., intermediate stage of decomposition) to fibric (i.e., late stage of decomposition). These accumulations are generally underlain by fine-textured glaciolacustrine sediments that were deposited in the margins of glacial lakes, and are maintained by seepage from upslope positions.

2.4 Soils

Soil development within the Chinchaga Wildland Park is strongly influenced by bedrock and surficial materials, and groundwater seepage from upslope positions adjacent to Halverson Ridge. Soils vary from Orthic, Solonetzic, Brunisolic and Gleyed Gray Luvisols to Orthic Humic and Rego Gleysols to Orthic Typic and Orthic Terric Fibrisols and Mesisols.

Soils of the Gray Luvisolic great group have developed on well to poorly drained glaciolacustrine and morainal materials throughout the area. On well and moderately well drained sites, Orthic, Brunisolic and Solonetzic subgroups have developed. On imperfectly drained sites where seasonally high water tables result in pronounced mottling of clay materials, Gleyed subgroups have developed. Luvisolic soils are characterized by strongly developed Bt horizons that are indicative of clay enrichment.

Gleysolic soils are common in poorly drained depressional topography or in areas of excessive groundwater seepage. These soils are characterized by strongly gleyed horizons (Bg) that are indicative of prolonged periods of intermittent or continuous saturation with water and reducing conditions during their genesis.

Organic soils have developed in depressional and lowland areas and are composed largely of organic materials of variable decomposition. The Clear Hills-Chinchaga area possesses the largest area (in both proportionate and absolute terms) of organic Fibrisols (Shields and Lindsay 1988) and peatlands (cf. Vitt *et al.* 1992) of all seven foothills areas in Alberta. Most organic soils are saturated with water for prolonged periods. Both Fibric and Mesic great groups are found.

2.5 Hydrology

Chinchaga Wildland Park is part of the larger Peace River watershed. Tributaries to the Chinchaga River, including Thordarson Creek, drain the northern and eastern portions, while the southern and western portions are drained by Mearon Creek and its tributaries ***(Figure 4)***. While the Chinchaga system drains to the northwest towards High Level, Mearon Creek drains to the southwest into the Doig River system that ultimately empties into the Peace River near Fort St. John, British Columbia. The waters of Thordarson and Mearon creeks and the Chinchaga River are clear and brown from humic acids typical of streams draining peatlands.

There are over 100 small lakes found in the Park, however most of these tend to be along the western side and in the northern portion where topography is very subdued. These water bodies account for approximately 4% of the total Park area. The Osland Lakes complex is in the northeast corner of the Park, while Trading Post Lake is located along the western boundary adjacent Mearon Creek. Numerous smaller ephemeral lakes are located within the Lower Foothills subregion, where they are associated with wetland areas.

2.6 Fish and Wildlife

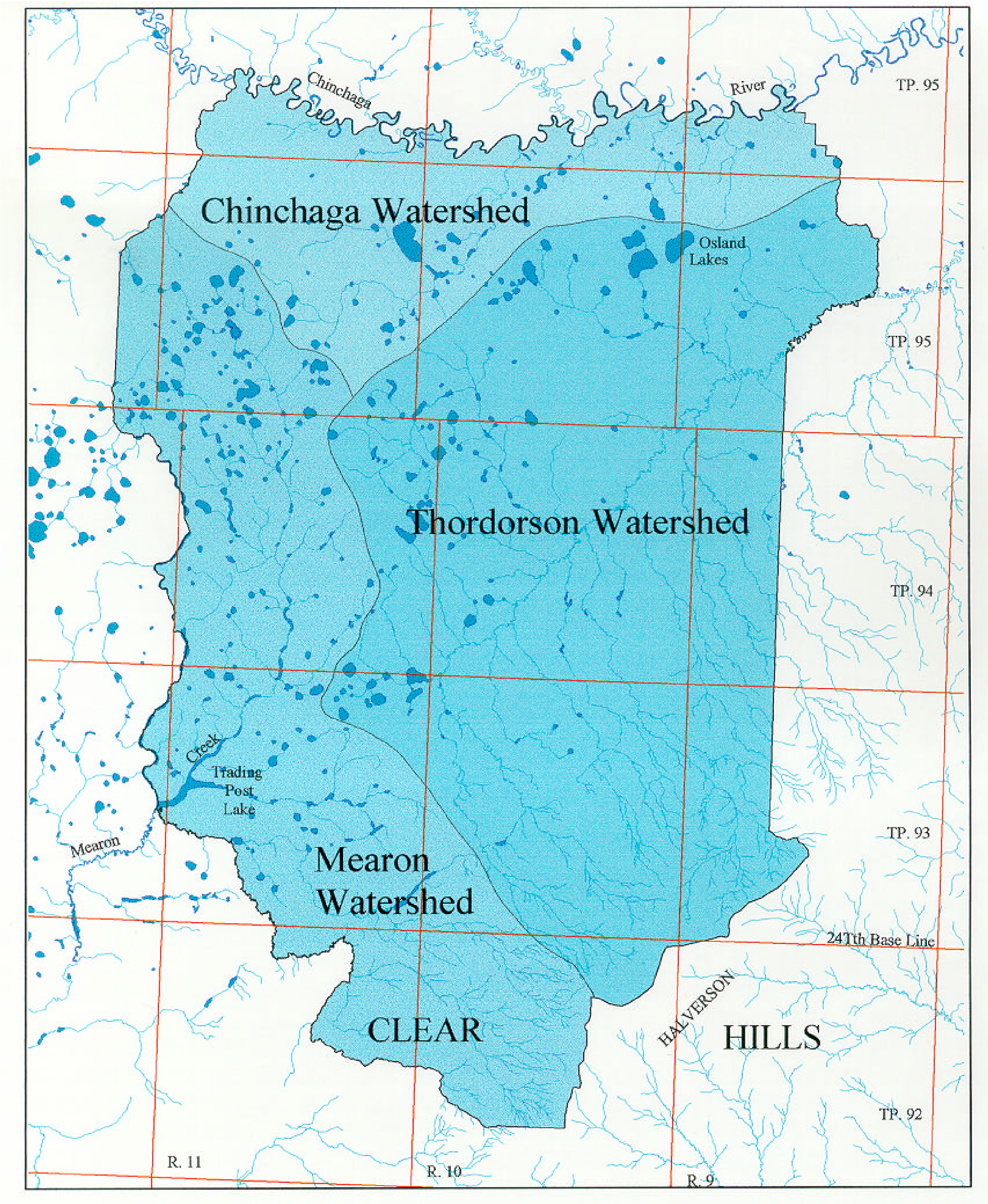
Overall wildlife diversity in the Foothills Natural Region, although reported by Strong (1992) to be lower than in the adjacent Boreal Forest Natural Region, is still fairly high. The Foothills Natural Region is transitional between the Boreal Forest and Rocky Mountain natural regions and, while Chinchaga Wildland Park is located within an outlier of the Foothills Natural Region, some portions of it do exhibit characteristics of higher elevation foothill environments.

Habitats found within Chinchaga Wildland Park include conifer-dominated upland forests (primarily in the Upper Foothills), deciduous-dominated and mixedwood upland forests (primarily in the Lower Foothills), black spruce and tamarack bogs, open-water lakes and wetlands, and riparian shrublands. These diverse landscapes and vegetation communities within the Park provide habitat for provincially significant species such as woodland caribou (*Rangifer tarandus*), grizzly bear (*Ursus arctos*), and trumpeter swan (*Cygnus buccinator*). The grizzly bear and woodland caribou are considered by COSEWIC (2001) to be "vulnerable" because they are particularly sensitive to human activities or natural habitat alterations. The trumpeter swan was only recently downgraded to "not at risk" by COSEWIC (2001), although its numbers are still low. Provincially, all three are species of management concern - Alberta Environment (2001) lists the trumpeter swan and woodland caribou as species "At Risk" (equivalent previous rank of "red-listed", as per AEP (1996)), while the grizzly bear is listed as "May Be At Risk" (equivalent previous rank of "blue-listed", as per AEP (1996)) due to habitat loss and degradation.

In addition, species typical of boreal forested and wetland habitats can be found within the Park, including beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), marten (*Martes americana*), fisher (*Martes pennanti*), moose (*Alces alces*), gray wolf (*Canis lupus*), lynx (*Lynx canadensis*), northern goshawk (*Accipiter gentilis)*, pileated woodpecker (*Dryocopus pileatus*), and numerous other small mammals, furbearers, raptors, songbirds, and waterfowl. ***Appendix 1*** presents an annotated list of terrestrial vertebrates expected to occur within the Park, and notes those species that were confirmed during field work for this project.

Aquatic habitat for fisheries are relatively limited within the Park. The Chinchaga River itself, which forms the northern boundary of the Park, and its major tributaries are known to contain longnose sucker (*Catostomus catostomus*), lake chub (*Couesius plumbeus*), trout perch (*Percopsis omiscomaycus*), northern pike (*Esox lucius*), walleye (*Stizostedion vitreum*), white sucker (*Catostomus commersoni*), five-spine stickleback (*Culaea inconstans*), pearl dace (*Margariscus margarita*), and arctic grayling (*Thymallus arcticus*) (Schroeder 1992).

Figure 4. Watersheds within Chinchaga Wildland Park



3. METHODS

3.1 Review and Analysis of Background Data

While the Chinchaga Wildland Park area is relatively data-poor, there are a number of general documents that provide a provincial and, in some cases, regional context for the assessment of resources in the Park. Examples of the relevant background documents that were reviewed prior to the field inventory program included (but were not limited to):

- *Field Guide to Ecosites of West-Central Alberta* (Beckingham *et al*. 1996);
- *Alberta's Chinchaga Wilderness* (Albertans for a Wild Chinchaga, no date);
- *Vascular Plants of the Manning - Chinchaga Area* (Macdonald and Luchanski 1994);
- *Alberta Natural Heritage Information Centre Tracking and Watch List – Vascular Plants, Mosses, Liverworts and Hornworts* (Gould 2001);
- *Integrated Resource Inventory, Keg River Area* (Brierley *et al*. 1985);
- *Environmentally Significant Areas Inventory of the Foothills Natural Region, Alberta* (Bentz *et al*. 1995); and
- *Natural Regions, Subregions and Natural History Themes of Alberta. A Classification for Protected Areas Management* (Achuff 1994)

In addition to these general information sources, considerable literature review was also conducted for resource-specific data pertaining to plant species, plant communities, wildlife species and habitats, and abiotic resources (soils, surficial materials, bedrock, *et cetera*). These sources are cited throughout the report in appropriate locations and are collated in the references section of the report

3.2 Preliminary Mapping

Prior to undertaking the field inventory program, a set of 1:50 000 color aerial photographs were interpreted to delineate meaningful units based upon parent materials, drainage, slope and vegetation. The aerial photographs were flown on July 16, 1999 and were of variable quality. A set of 1:40 000 1992 black and white photographs was also used to assist in the mapping but, like the color photography, the quality of these photographs was variable. As a result, emphasis was placed on the 1999 1:50 000 scale aerial photography because it was the most recent photography available.

In addition to delineating meaningful map units, Geowest personnel also identified locations for potential field sampling. This allowed the field crew to structure their field program to meet the objectives of the project.

3.3 Field Inventory

The field inventory program was conducted between August 11 – 23, 2001. A landscape ecologist and a wildlife biologist completed the fieldwork, which entailed vegetation and soil characterization, wildlife habitat assessment, wildlife species inventory, and environmentally significant areas identification.

3.3.1 Ecological Data Collection

A total of 118 detailed plots were established in the Chinchaga Wildland Park area. Data was recorded on data forms provided by the Alberta government; site forms (LISD15B) and vegetation description forms (LISD14B) were completed at each site. All fieldwork adhered to the standards outlined in *Ecological Land Survey Site Description Manual* (AEP 1994). In addition, the *Field Guide to Ecosites of West-Central Alberta* (Beckingham *et al*. 1996) was used to classify individual sites to the ecosite and ecosite phase level.

At each plot, the following data was recorded:

Exposure type	Ecosite
Flood hazard	Ecosite phase
Soil drainage	Community type
Perviousness	Ecodistrict
Site macro position	Natural Subregion
Site meso position	Surface substrate (% cover)
Site microtopography	Elevation (m)
Site surface shape	Slope (%)
Ecological moisture regime	Aspect
Nutrient regime	Regeneration
Disturbance factors	Latitude
Successional status	Longitude

In addition to the above, species lists and percent cover values were provided for the main canopy, understory trees, tall shrubs, low shrubs, herbs, grasses, and epiphytic mosses and lichens (i.e., plants that grow on the outside of other plants). Total cover values were also provided for each plot along with notes regarding browsing and grazing, disease, and vigor. Any plants that could not be classified in the field were collected and vouchered for future taxonomic identification.

A quick soil pit was also dug at each site to identify parent material, texture and drainage. This data was used to assist the field staff in placing individual plots into the appropriate ecosite, ecosite phase and community type.

In addition to these formal plots, numerous incidental observations were made that would aid in the final mapping process. While detailed plot forms were not completed for these sites, notes were commonly made on the backs of aerial photographs.

Aerial photographs were pin pricked to indicate the location of each site. Plot numbers were placed on the back of each aerial photograph. A hand held Garmin 12XL GPS unit was used to collect locational data for each site. In addition, 35 mm (print) photographs were taken at each site to document the site for future mapping.

3.3.2 Wildlife and Habitat Inventory

Wildlife species occurrence information was collected through a combination of ad hoc surveys and opportunistic observations. The size and remoteness of the study area and the available project budget, were both factors that effectively precluded the application of more detailed and statistically rigorous wildlife inventories. Furthermore, the seasonal timing of the field work was too late to conduct a formal breeding bird survey.

At all locations where ecological sampling plots were established, and during travel between plots, targeted searches were made for observable evidence of wildlife use (pellet groups and scat, browsing, castings, footprints, den sites, *et cetera*) in the general vicinity of the plot. Evidence of use, as well as general habitat characteristics, were recorded at each plot, and at each location where wildlife species were encountered and identified. Trumpeter swan adults and cygnets were on-nest and flocking in preparation for fall migration by the time the field survey was initiated, so were particularly conspicuous both from helicopter and from ground vehicles during the survey period.

3.3.3 Special Features Inventory

Special features were defined for this project as areas encompassing one or more special element occurrences. Special elements were considered to be elements of particular conservation concern, and included landforms, aquatic forms such as lakes and wetlands, geological features, plant communities, plant species, and vertebrate or invertebrate species.

During the field inventory, special features were identified and targeted through the following:

1. potential special features identified during the preliminary mapping prior to field work;
2. potential special features identified during the literature search prior to field work; and
3. potential special features that were first encountered or seen during the field work.

Examples of special features that were identified during the preliminary mapping and literature review phases of the project include habitat units that provide critical caribou habitat (such as the Sb / Labrador tea / Lichen community type) and the lakes and wetlands that were known to house nesting trumpeter swans (such as Osland Lakes). Other features, such as rare plants or rare wildlife sightings were obviously recorded from direct observation in the field.

3.4 Data Synthesis and Final Mapping

Immediately following the field inventory program, field personnel reviewed the field forms to ensure consistency in data and to fill in any missed fields. Data was subsequently input into the Ecological Site Information System (ESIS) at the Resource Data Division in Edmonton. In addition, any unidentified plants were forwarded to an expert for taxonomic identification.

Preliminary line work was reviewed following the field inventory program. The purpose of this task was to add more detail to the mapping based upon the field plots and incidental notes made by the field crew. Each polygon was classed to the ecosite phase level of classification (i.e., E2, M2, *et cetera*) as per the mapping requirements. Because of the small-scale nature of the aerial photographs (1:50 000 scale), up to three ecosite phases were allowed per map unit. Data was subsequently recorded on coding sheets and entered into an Excel 97 spreadsheet to be linked with the graphic files and to develop GIS products.

Classification of polygons was based mainly on the 1: 50 000 color aerial photographs and the results of the field inventory program. 1:40 000 scale black and white photography and the 1:15 000 Phase III Forest Inventory maps were used to supplement these two main data sources. While the upland vegetation is considered to have a high degree of confidence in terms of classification accuracy, the wetlands have less reliability, as crown closure causes significant difficulty in distinguishing treed versus shrub components at the 1:50 000 scale. In addition, a comparison of the 1:15 000 Phase III Forest Inventory maps (from the late 1980s) with the 1999 1:50 000 color aerial photographs suggests that much of what was identified as pine understory in the Phase III maps has now grown to pierce the canopy, and are now either dominant or co-dominant in the overstory layer.

3.5 Production of Digital Data

To properly capture the lines from the 1:50 000 color aerial photographs, the aerial photographs were tied to the Alberta 1:20 000 digital base file(s) for the project area. This was accomplished by using the extensive network of seismic lines and well sites in the project area as well as permanent hydrology features. Line work was captured using MicroStation SE software and adhered to provincial digital standards for line capture, including a tolerance for relative error of $\pm$ 0.5 mm from the centre line of the line. Digital line work was cleaned (i.e., edited to ensure no hanging lines, double digitized lines, bow-ties, sliver polygons, *et cetera*) to ensure proper topology. Subsequent to this, the polygon attribute database (Excel 97) was linked with the graphic file to create digital coverages in ARC/INFO .e00 format.

Final digital map products are found in the appendices and include two maps at 1:50 000 scale, including:

- An ecosite phase map; and
- A map depicting environmentally significant areas

4. ECOSITE CLASSIFICATION

The purpose of ecosite classification and mapping is to delineate units (or polygons) with similar vegetative features. It is generally assumed that units with similar classification have similar levels of productivity, hence the mapping can be used to assist resource managers in planning for a variety of land uses, including forest productivity, wildlife habitat, *et cetera*. In the case of this project, classification and subsequent mapping was completed at a representative scale of 1:50 000.

4.1 Hierarchical Levels of Classification

Three levels of classification were considered in this project, including (i) ecosite, (ii) ecosite phase, and (iii) plant community type. Each of these hierarchical levels of classification are defined below (from Beckingham *et al*. 1996).

Ecosite: An ecosite is a functional unit defined by moisture and nutrient regime. It is not tied to specific landforms or plant communities, but is based on the combined interaction of biophysical factors that together dictate the availability of moisture and nutrients for plant growth. For example, "Low-bush cranberry"

Ecosite Phase: An ecosite phase is a subdivision of the ecosite based on the dominant species in the canopy. In most cases, ecosite phases are mappable units. For example, "White spruce/Low-bush cranberry".

Plant Community Type: Ecosite phases may be subdivided into plant community types, which are the lowest taxonomic unit in the classification system. The environmental characteristics of the community are defined at the ecosite level and to a lesser degree at the ecosite phase level. While plant community types of the same ecosite phase share vegetational similarities, they differ in their understory species composition and abundance. Plant community types are not mappable from small-scale panchromatic aerial photographs. For example, " E4.1, E4.2, E4.3, White spruce/Low-bush cranberry".

For the purpose of this project, mapping was completed to the ecosite phase level, however individual plant community types within these ecosite phases were identified in the field.

The field inventory program resulted in the sampling of 12 ecosites, 25 ecosite phases and 38 different community types as defined in *Field Guide to Ecosites of West-Central Alberta* (Beckingham *et al*. 1996). Of these 25 ecosite phases, 20 were sampled within the Lower Foothills and the remaining five were sampled within the Upper Foothills. Among the field plots, the E2 [Aspen/Low-bush cranberry] ecosite phase was the most sampled upland ecosite within the Lower Foothills (17% of all plots), followed by E3 [Aspen-White spruce-Pine/Low bush cranberry] (8%), C2 [Aspen/Hairy wild rye] (7%), and E4 [White spruce/Low-bush cranberry] (5%).

For lowland areas (i.e., poorly drained depressional areas), the K2 [Shrubby bog] ecosite phase was the most heavily sampled ecosite phase in the Lower Foothills (12% of all plots), followed by L2 [Shrubby poor fen] (9%), M2 [Shrubby rich fen] (9%), and equal amounts of K1 [Treed bog], L1 [Treed poor fen], and M3 [Graminoid (i.e., grasses and sedges) rich fen] (3%). Since field sampling was stratified (within logistical constraints) rather than random, this distribution of sample plots provides an accurate reflection of the distribution of ecosites across the Park.

Many polygons within the Park were classified as including more than one ecosite phase (i.e., complex polygons) because individual components were too small to be mapped separately at this scale of mapping. However, the Ecosite Phase map included in Appendix 7 displays only the dominant ecosite phase for each unit identified in Chinchaga Wildland Park. Appendix 6 includes the database which contains the complete list of all ecosite phases classified for each mapped unit. A total of 151 plant species were identified, including eight trees, 35 shrubs, 68 forbs, 10 grasses, 17 mosses and 13 lichens (Appendix 2 includes a complete list of all plants species identified within the project area).

Table 5 provides a statistical summary of ecosite phases mapped within the Park, based on areal extent. These values have been derived from an analysis of statistics created from the Ecosite Phase mapping. From these statistics, it is evident that the E3 [Aspen-White spruce-Pine / Low-bush cranberry] and K1 [Treed bog] ecosite phases are the most dominant ecosites in upland and lowland areas, respectively, of the Lower Foothills. In the Upper Foothills portion of the Park, the E2 [Aspen-White spruce-Pine / Tall bilberry / Arnica] and K1 [Treed bog] ecosite phases are most dominant on upland and lowland areas, respectively. Edatopic grids showing the ecological relationships of these ecosites for the Lower and Upper Foothills are also shown in Figures 5 and 6, respectively. These edatopic grids are moisture/nutrient regime grids that display the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions, and outlines relationships between each of the ecosites.

Table 5: Areal Extent (ha) of Mapped Ecosite Phases in Chinchaga Wildland Park, Alberta					
CODE	**ECOSITE PHASE**	**AREA MAPPED AS DOMINANT**	**AREA MAPPED AS SECONDARY**	**AREA MAPPED AS TERTIARY**	**TOTAL AREA MAPPED**
Lower Foothills Natural Subregion					
C1	Pine/Hairy wild rye	25.9	92.2	25.6	143.7
C2	Aspen/Hairy wild rye	1404.0	169.1	0	1573.0
C3	Aspen-White spruce-Pine/Hairy wild rye	62.1	32.0	19.4	113.5
D1	Pine-Black spruce/Labrador tea - mesic	780.3	389.0	115.6	1285.0
E1	Pine/Low-bush cranberry	1952.0	439.6	201.3	2593.0
E2	Aspen/Low-bush cranberry	7774.0	1223.0	179.3	9176.0
E3	Aspen-White spruce-Pine/ Low-bush cranberry	8230.0	3197.0	474.0	11901.0
E4	White spruce/Low-bush cranberry	389.5	325.6	247.3	962.4
F3	Aspen-White spruce-Pine/Bracted honeysuckle	0	0	0	0
I1	Poplar-Aspen/Horsetail	458.7	57.5	19.8	536.0
I2	Poplar-White spruce/Horsetail	0	0	0	0
I3	White spruce/Horsetail	227.4	46.6	12.7	286.7
J1	Black spruce-White spruce/Labrador tea/Horsetail	163.7	188.8	166.9	519.4
K1	Treed Bog	9010.0	994.7	288.7	10294.0
K2	Shrubby Bog	1645.0	1709.0	839.0	4193.0
L1	Treed poor fen	5475.0	2695.0	362.3	8532.0
L2	Shrubby poor fen	4999.0	3588.0	234.3	8821.0
M1	Treed rich fen	406.2	329.3	46.0	781.5
M2	Shrubby rich fen	2475.0	1288.0	212.7	3977.0
M3	Graminoid rich fen	108.9	240.6	1123.0	1472.0
W	Water	1566.0	506.3	657.7	2730.0
				Lower Foothills Subtotal	**69,890.0**
Upper Foothills Natural Subregion					
C1	Pine/Hairy wild rye	67.5	113.4	49.9	230.8
E1	Pine/Tall bilberry/Arnica	2911.1	512.1	85.9	3509.1
E2	Aspen-White spruce-Pine/Tall bilberry/Arnica	4281.6	405.0	58.7	4745.3
E3	White spruce/Tall bilberry/Arnica	217.4	461.3	156.4	835.1
E4	White spruce/Low-bush cranberry	0	0	38.6	38.6
F6	Bracted honeysuckle willow	0	0	0	0
K1	Treed bog	140.0	182.9	40.3	363.2
K2	Shrubby bog	114.2	17.1	0	131.3
L1	Treed poor fen	246.2	40.8	6.4	293.4
L2	Shrubby poor fen	0	178.9	26.5	205.4
M1	Treed rich fen	19.1	9.5	0	28.6
M2	Shrubby rich fen	2.6	5.1	0	7.7
M3	Graminoid rich fen	0	0	3.2	3.2
				Upper Foothills Subtotal	**10,391.7**
				TOTAL	**80,281.7**

Figure 5: Edatopic Grid Showing Ecological Relationships of Lower Foothills Ecosites Identified in Chinchaga Wildland Park

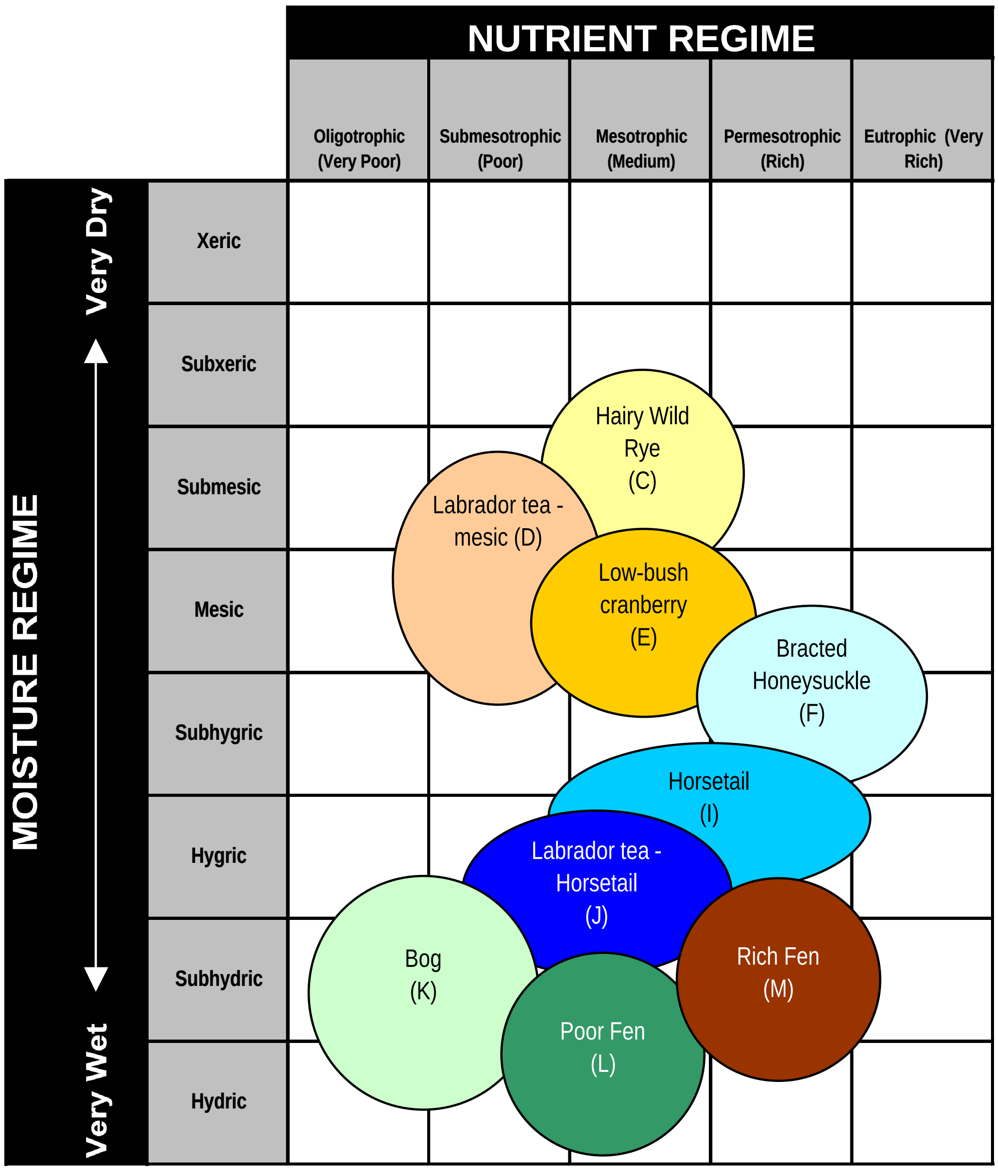
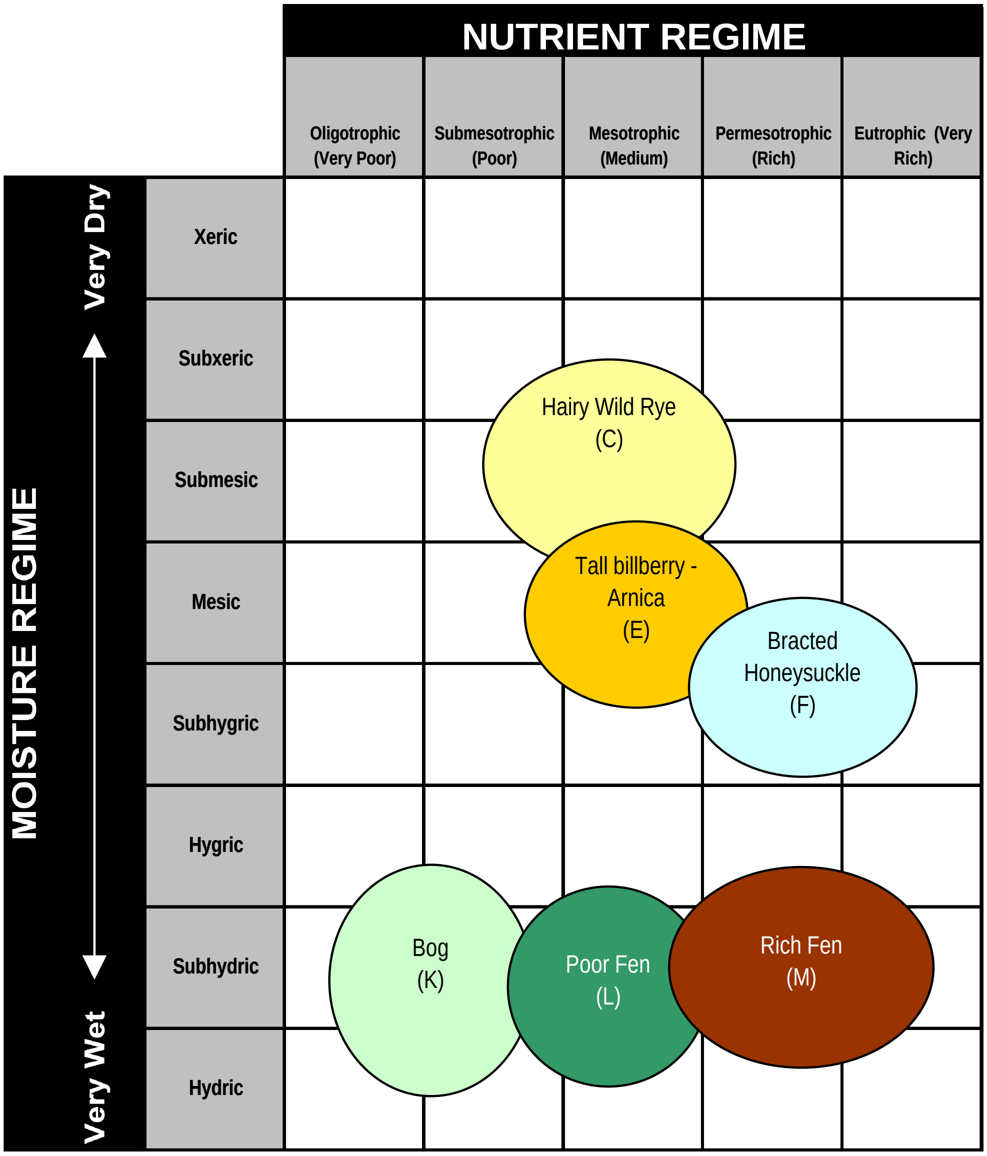


Figure 6: Edatopic Grid Showing Ecological Relationships of Upper Foothills Ecosites Identified in Chinchaga Wildland Park



4.2 Ecosite Phase Descriptions

The following section presents descriptions of each of the ecosite phases identified within Chinchaga Wildland Park. These summaries are based on the field inventory and supplemented with information, where appropriate, from the *Field Guide to Ecosites of West-Central Alberta* (Beckingham *et al*. 1996).

4.2.1 Ecosite Phases of the Lower Foothills Natural Subregion

A total of eight ecosites and 20 ecosite phases were sampled and subsequently mapped within the Lower Foothills subregion. The ecosites include:

- C Hairy wild rye
- D Labrador tea – mesic
- E Low-bush cranberry
- I Horsetail
- J Labrador tea / Horsetail
- K Bog
- L Poor fen
- M Rich fen

4.2.1.1 Hairy Wild Rye Ecosite (C)

Indicator species for the Hairy wild rye ecosite include Canada buffalo-berry, blueberry, bearberry, Labrador tea, and hairy wild rye. A total of 10 plots were established within this ecosite. Three ecosite phases were identified within the Hairy Wild Rye ecosite, as described below.

C1 Pine / Hairy Wild Rye Ecosite Phase

Only one site (45) was established within this ecosite phase; it was classed as *C1.1 Pine / Canada buffalo-berry / Hairy wild rye*. This mature stand was characterized by having 25% lodgepole pine in the tree canopy with 22 % white spruce occurring as tall (7%) and low (15%) shrubs. The stand height was approximately 22 m. The understory is relatively sparse and species poor consisting of low covers of willow (*Salix scouleriana*), Labrador tea, bog cranberry (*Vaccinium vitis-idaea*), bunchberry (*Cornus canadensis*), low-bush cranberry, prickly rose, bearberry (*Arctostaphylos uva-ursi*), and hairy wild rye. In addition, there was approximately 45% feathermoss cover, including nearly equal amounts of stair-step moss (*Hylocomium splendens*) and Schreber's moss (*Pleurozium schreberi*). The stand is found on well-drained silty glaciolacustrine materials. The stand was classed as mesic/mesotrophic, slightly drier than other similar sites identified within the Lower Foothills.

This stand varies somewhat from the description presented in *Field Guide to Ecosites of West-Central Alberta* (Beckingham *et al*. 1996) in that it lacked aspen, Canada buffalo-berry (*Sheperdia canadensis*), wild lily of the valley (*Maianthemum canadense*), fireweed (*Epilobium angustifolium*), and knight's plume moss (*Ptilium crista-castrensis*). Only 3% hairy wild rye was recorded as compared to 10 – 20 % cover within most sites.

C2 Aspen / Hairy Wild Rye Ecosite Phase

The Aspen / Hairy wild rye ecosite phase is one of the most commonly mapped units within the Chinchaga Wildland Park. A total of eight sites were established within the Aspen / Hairy wild rye ecosite phase; six within the C2.1 community type and two within the C2.3 community type. These two community types vary from one another on the basis of understory composition.

The *C2.1 Aspen / Canada buffalo-berry / Hairy wild rye* community type generally had 25 – 55 % aspen in the overstory canopy with low cover values of lodgepole pine and white spruce being common within the understory tree and tall shrub layers; balsam poplar was found at one site. The canopy of these young to mature stands varied from 18 – 24 m. This stand is distinguished from the C2.3 community type on the basis of high cover values of both prickly rose and buffalo-berry; in the case of the sites sampled, prickly rose cover values varied from 10 – 20 % while buffalo-berry varied from 15 – 60 %. These stands were all found moderately well to well-drained glaciolacustrine materials where textures varied from fine sandy loams to silt loams and clay loams. All sites were classed as submesic / mesotrophic.

The *C2.3 Aspen / Blueberry / Hairy wild rye* community type had approximately 30 % aspen in the overstory canopy with low amounts of white spruce in the understory. Tree varied from 15 – 20 m. in height. No balsam poplar, white birch, or lodgepole pine was found at the two sites. These stands were characterized by ericaceous shrubs including blueberry (*Vaccinium myrtilloides*), and bog cranberry; cover values ranged from 7 – 18 % for blueberry and 10 – 30 % bog cranberry. There is generally a high diversity of forbs, including, bunchberry, twinflower, fireweed, wild strawberry, cream-colored vetchling (*Lathyrus ochroleucus*), tall lungwort (*Mertensia paniculata*), and Lindley's aster (*Aster ciliolatus*); white clover (*Trifolium repens*) was not found at either site. Although Canada buffalo-berry and Hairy wild rye are not common within this community type, they were both found with low cover values.

This community type developed on well-drained morainal and glaciolacustrine materials where textures varied from sands and loamy sands to clay loams. These stands were classed as submesic/mesotrophic, similar to other stands of this community type found within the Lower Foothills.

C3 Aspen – White spruce – Pine / Hairy wild rye Ecosite Phase

One site was established within this ecosite phase – it was classified as the *C3.1 Aspen-White spruce-Pine/Buffalo-berry/Hairy wild rye* community type. The overstory canopy of this young climatic climax stand is dominated by lodgepole pine (18%) with lesser amounts of aspen (4%) and white spruce (2%); white spruce is common (10%) in the understory and forms the major successional species. The tree canopy was 18 m in height. Key understory indicator species for this ecosite phase and community type include prickly rose (12%), hairy wild rye (15%), stair-step moss (18%) and Schreber's moss (15%).

This stand has developed on well-drained glaciolacustrine materials; textures vary from silt loam to clay loam. These stands were classed as submesic/mesotrophic, similar to other stands of this community type found within the Lower Foothills.

4.2.1.2 Labrador tea – Mesic Ecosite (D)

This ecosite tends to have a Subxeric to subhygric nutrient-poor to medium substrate. Labrador tea and bog cranberry are indicative of the relatively acidic surface soil conditions. It occurs in upland (midslope and upper slope) or level topographic positions dominantly on morainal or glaciofluvial parent materials. There is commonly a two-tiered even-aged canopy where the faster growing lodgepole pine comprises the higher layer and the slower growing black spruce form a secondary canopy below the pine (Beckingham *et al*., 1996).

The Labrador tea – mesic ecosite type occurs to a limited extent within the Chinchaga Wildland Park area. The indicator species for this ecosite include lodgepole pine, black spruce, Labrador tea, bog cranberry and blueberry. Only one ecosite was identified during the sampling program, that being D1.

D1 Pine-Black Spruce / Labrador tea – Mesic Ecosite Phase

The Labrador tea – mesic ecosite was sampled only once in the Chinchaga Wildland Park with the *D1.1 Lodgepole pine – Black spruce / Labrador tea / feathermoss* community type being found. This stand was characterized by 38 % black spruce in the main canopy, tall shrub and low shrub layers, and 12% lodgepole pine in the main canopy. The overstory canopy ranged between 18 – 20 m in height.

Labrador tea (12% cover), bog cranberry (8%) and blueberry (15%) are the dominant shrubs; they mainly occur on raised hummocks. 80 % lichen cover characterizes the stand, consisting primarily of Yellow reindeer lichen (*Cladina mitis*), Grey reindeer lichen (*C. rangiferina*), and Pioneer lichen (*C. cornuta*). The amount of lichen in this stand is considerably greater than normally found and results in habitat of very high quality for caribou. The high number of well-developed trails within the stand confirms this. This stand has developed on well-drained silty glaciolacustrine materials. These stands were classed as mesic/submesotrophic, similar to other stands of this community type found within the Lower Foothills.

4.2.1.3 Low-bush Cranberry Ecosite (E)

The Low-bush cranberry ecosite is perhaps the most widespread ecosite within the Chinchaga Wildland Park; it has been defined as the reference ecosite for the Lower Foothills because it commonly has a mesic moisture regime and a medium (mesotrophic) nutrient regime (Beckingham *et al*. 1996). Indicator species include low-bush cranberry, dewberry (*Rubus pubescens*) and wild sarsaparilla (*Aralia nudicaulis*). Four ecosite phases were identified during the field-sampling program, including E1, E2, E3 and E4. Each of these is discussed below.

E1 Pine / Low-bush Cranberry Ecosite Phase

A total of three sites were established within the Pine / Low-bush cranberry ecosite phase. All three sites classed to the *E1.3 Pine / Feathermoss* community type. These young seral (i.e., still developing and going through successional stages) to young climatic climax stands are characterized by having 15 – 30 % lodgepole pine, with significantly lesser amounts of white spruce and aspen and in the overstory canopy. Poorly developed shrub layers are typical of these stands; willow, prickly rose and low-bush cranberry are present, but all with less than 5 % cover values. The percent cover of stair-step, Schreber's, and knight's plume moss are highly variable and vary from 5 – 50 % within all the stands sampled. These stands have developed on well-drained glaciolacustrine materials and glaciolacustrine veneers overlying morainal materials. Textures vary from loamy sand to silty clay loams. These stands were classed as mesic/submesotrophic and mesic/mesotrophic, similar to other stands of this community type found within the Lower Foothills.

E2 Aspen / Low-bush Cranberry Ecosite Phase

A total of 21 sites were established within this ecosite phase, resulting in the delineation of four community types, including E2.1, E2.3, E2.4 and E2.5.

The *E2.1 Aspen / Canada buffalo-berry* community type is widespread throughout the Chinchaga Wildland Park. The mature seral stands are characterized by having 25 – 40 % aspen in the overstory; white spruce regeneration may or may not be present depending upon seed source availability. The trees are approximately 18 – 22 m in height. Well-developed shrub layers are typical of these stands with Canada buffalo-berry being the dominant shrub species varying from 10 – 25 % cover; other shrubs include prickly rose, low-bush cranberry, and willow. Hairy wild rye is abundant on the forest floor and varies from 5 – 20 % cover. These community types have developed on well-drained glaciolacustrine materials. Textures vary from silty clays and silt loams to sandy loams. Ecological moisture regime varies from submesic to mesic while nutrient regime varies from submesotrophic (poor) to mesotrophic (medium). These values fall well within the range for both moisture and nutrient regime for sites found within the Lower Foothills.

The *E2.3 Aspen / Green alder* community type was sampled three times and is thought to be of limited distribution within the Park. These young to maturing seral stands are characterized by 40 – 60 % aspen in the overstory with 5 – 10 % aspen in the understory tree layer. The canopy tree height varies from17 – 25 m. This community type is differentiated from others on the presence of green alder in the understory; percent cover values for the three sites sampled varied from 16 – 25 %. Much of the alder occurs in patches the tall shrub layer and may be up to 10 m in height. This community type is found on moderately well to well drained glaciolacustrine and morainal materials; textures vary from loam to silt loam. These stands were classed as mesic/mesotrophic (medium nutrient regime).

The *E2.4 Aspen / Low-bush cranberry* community type was sampled only once in the project area. This mature seral stand was characterized by 35 % aspen in the overstory and 30 % low-bush cranberry in the low shrub layer. There is approximately 10 % marsh reed grass and hairy wild rye and 10 % feathermosses in the grass and moss layers, respectively. This stand has developed on well-drained, clay-rich glaciolacustrine materials. These stands were classed as mesic/mesotrophic (medium nutrient regime).

The *E2.5 Aspen / Prickly rose* community type was sampled eight times within the Chinchaga Wildland Park. The stands vary from young and maturing seral to mature edaphic climax stands. Percent aspen cover in the overstory varies from 15 – 55 % with varying amounts of balsam poplar (0 – 20 %) in the canopy. Prickly rose cover is consistently high and varies between 20 – 40 % cover. Willow is common in the tall shrub layer; on subhygric sites, willow may have cover values to 25 %. These stands have developed on moderately well- to well drained glaciolacustrine materials; textures vary from silt loams, clay loams to fine loamy sand. These stands were classed as having submesic to subhygric ecological moisture regime and nutrient regimes ranging from mesotrophic to permesotrophic (medium to rich nutrient regime).

E3 Aspen – White spruce – Pine / Low-bush Cranberry Ecosite Phase

Four community types have been identified within the Aspen-White spruce-Pine / Low-bush cranberry ecosite phase, including E3.1, E3.2, E3.4 and E3.6; the E3.3 and E3.5 community types were not sampled within the Chinchaga Wildland Park. A total of nine sites were established within these five community types.

The *E3.1 Aspen-White spruce-Pine / Canada buffalo-berry* community type is characterized by a maturing mixedwood canopy consisting of mainly aspen and lodgepole pine with white spruce being common within the understory tree layer. Percent covers in the main canopy vary from 20 – 40 %. Canada buffalo-berry is the dominant shrub species and varies in cover from 10 – 15 %; other shrub species include prickly rose and low-bush cranberry. These stands are also characterized by approximately 20 % feathermosses, including stair-step, Schreber's, and to a lesser extent, knight's plume mosses. These stands have developed on moderately well- to well drained glaciolacustrine materials; textures vary from silt loam to clay loam. These stands were classed as mesic/mesotrophic (medium nutrient regime).

The *E3.2 Aspen-White spruce-Pine / Green alder* mature seral community type is differentiated from other community types within this ecosite phase by the prevalence of green alder in the shrub layer. Percent alder cover varied from 10 – 25 %. In the two sites sampled within the Chinchaga Wildland Park, the main canopy consisted of white birch (*Betula papyrifera*), poplar, and aspen; white birch was common in both stands sampled. Also of note, was the occurrence of willow within the understory tree layer; percent cover of this species varied from 10 – 20 %. Other shrub species include prickly rose and low-bush cranberry. These stands have developed on well-drained, clay-rich glaciolacustrine materials. These stands were classed as mesic/mesotrophic (medium nutrient regime).

Within the Chinchaga Wildland Park, the *E3.4 Aspen-White spruce-Pine /Prickly rose* community type was characterized by a mature seral to young climatic climax Mixedwood overstory consisting of variable amounts of white spruce, aspen and lodgepole pine; in the younger stands, white spruce is not common, however, white birch and poplar may be found. These stands differ from other community types within this ecosite phase by having prickly rose as the dominant shrub species – percent cover values for prickly rose vary from 10 – 20 %. Other common shrub species include low-bush cranberry and willow. There is generally about 15 % feathermosses comprised mainly of stair-step moss. These stands have developed on moderately well- to well drained glaciolacustrine materials; textures vary from silt loam to silty clay loam. These stands were classed as mesic/mesotrophic (medium nutrient regime).

The *E3.6 Aspen-White spruce-Pine / Feathermoss* community type was sampled only once in the study area. While the overstory canopy is characterized by lodgepole pine, aspen and to a lesser extent, white spruce, a high cover of feathermosses on the forest floor defines this community type. In the sampled stand, feathermoss cover was as high as 70 % with stair-step moss being the dominant species; knight's plume and Schreber's mosses are also found. The shrub and forb layers are generally poor both in terms of percent cover and species diversity. This mature seral community type has developed on well-drained, clay-rich glaciolacustrine materials. These stands were classed as mesic/mesotrophic (medium nutrient regime).

E4 White Spruce / Low-bush Cranberry Ecosite Phase

The White spruce / Low-bush cranberry ecosite phase occurs within the Chinchaga Wildland Park. These stands generally are mature climatic climax stands. Two community types were identified, including E4.2, and E4.5; the E4.1, E4.3, and E4.4 community types were not found.

The *E4.2 White spruce / Low-bush cranberry* community type is characterized by mature white spruce in the main canopy; balsam poplar and aspen may or may not be present. White spruce varies in height between 25 – 35 m. (the latter occurring at site 91 south of Osland Lakes). These stands are generally characterized by poorly defined shrub layers with low cover values of prickly rose, Canada buffalo-berry and low-bush cranberry. A nearly continuous carpet of feathermosses are found (50 – 75 % cover) consisting of stair-step, Schreber's and knight's plume mosses. Blow-down is quite common in these stands. These stands have developed on moderately well- to well drained glaciolacustrine materials; textures vary from silt loams to loam. These stands were classed as mesic/mesotrophic (medium nutrient regime).

The *E4.5 White spruce / Feathermoss* community type is similar to the E4.2 community type (described above), however the percent feathermoss cover is significantly higher ranging from 75 - 90 %. The white spruce varies from 18 – 30 m in height with generally between 35 – 45 % cover in the main canopy. Aspen, birch and poplar may be present in the main canopy with low cover values. Very poorly developed shrub and forb layers also characterize these stands. In the younger stands, yellow reindeer lichen may occur with significant cover values (i.e. 15 %). In the older stands, blow-down is quite common. These stands have developed on moderately well-to-well drained glaciolacustrine materials; textures vary from silt to silty clay loam. These stands were classed as mesic/mesotrophic (medium nutrient regime).

4.2.1.4 Horsetail Ecosite (I)

The horsetail ecosite is wet and nutrient rich. These sites are commonly found on fluvial or glaciolacustrine parent materials where flooding or seepage enhances the substrate nutrient supply. With high water tables, wet soil conditions, and Gleysolic soils, organic matter tends to accumulate. Horsetails commonly form a blanket over the forest floor (Beckingham *et al*., 1996).

The Horsetail ecosite occurs throughout the Chinchaga Wildland Park and is generally associated with subhygric conditions. Common horsetail (*Equisetum arvense*) and meadow horsetail (*E. pratense*) are the indicator species that separate this ecosite from others within the Lower Foothills. A total of four sites were established within this ecosite, resulting in the mapping of ecosite phases I1 and I3.

I1 Poplar-Aspen / Horsetail Ecosite Phase

The Poplar-Aspen / Horsetail ecosite phase was sampled three times in the Chinchaga Wildland Park. Mature seral aspen and balsam poplar in the main canopy characterize these stands with percent covers varying from 35 – 40 %. White spruce is common in the understory tree and tall shrub layers. Percent cover values for horsetail commonly exceeds 20 %. One key feature of these stands is the high diversity of forb species in the understory; common species include fireweed, wild strawberry *(Fragaria virginiana*), palmate-leaved coltsfoot (*Petasites palmatus*), tall lungwort (*Mertensia paniculata*), wild vetch (*Vicia americana*) and northern bedstraw (*Galium boreale*). Grasses include hairy wild rye and marsh reed grass; grass cover values range between 10 – 20 %. These stands have developed on imperfectly to moderately well drained glaciolacustrine materials; textures are quite variable and range from silty clay loams to loamy sand. These stands were classed as subhygric/permesotrophic (rich nutrient regime).

I3 White Spruce / Horsetail Ecosite Phase

Two community types occur within the White spruce / Horsetail ecosite phase, including the White spruce / Horsetail (I3.1) and White spruce / Feathermoss (I3.2); only the White spruce / Horsetail community type was found within the Chinchaga Wildland Park.

The mature edaphic climax *I3.1 White spruce / Horsetail* community type is dominated by white spruce in the main canopy and horsetail on the forest floor. In the case of the stand sampled, percent white spruce cover was 25 % in the main canopy and 5 % in the understory tree layer. Common horsetail and meadow horsetail amounted to 35 % cover. The forb layer is also quite diverse with bunchberry, dewberry, northern bedstraw, fireweed, tall lungwort, twinflower, palmate-leaved coltsfoot, wild strawberry, and Bishop's cap (*Mitella nuda*). The forest floor is covered with up to 60 % feathermosses, including stair-step, knight's plume and Schreber's mosses. This community type is differentiated from the White spruce/Feathermoss (I3.2) type in that I3.2 does not have horsetail. This community type has developed on a fluvial terrace adjacent to Little Hay Creek; materials consist of moderately well drained loamy fluvial deposits. These stands were classed as subhygric/permesotrophic (rich nutrient regime).

4.2.1.5 Labrador Tea / Horsetail Ecosite (J)

The Labrador tea / Horsetail ecosite is wet and commonly has a medium to rich nutrient regime. These sites are commonly found in lower topographic positions on level glaciolacustrine, till, or organic parent materials (Beckingham *et al.*, 1996). Indicator species include black spruce, white spruce, Labrador tea, common horsetail, meadow horsetail and woodland horsetail (*E. sylvaticum*). Only one ecosite phase occurs within the Lower Foothills subregion, that being the Black spruce – White spruce / Labrador tea / Horsetail type. Three sites were established within this ecosite phase.

Within the Chinchaga Wildland Park, the young to mature edaphic climax *J1.1 Black spruce – White spruce / Labrador tea / Horsetail* community type is characterized by 25 – 40 % black spruce in the main canopy, 10 – 25 % Labrador tea in the low shrub layer, 10 – 40 % horsetail, and between 50 – 90 % moss cover. Tamarack (*Larix laricina*) may or may not occur in the main canopy. The main canopy is between 16 – 18 m in height. Mosses consist of knight's plume, stair-step, Schreber's mosses and rusty peat moss (*Sphagnum fuscum*). Within the Park, these forests have developed on imperfectly to poorly drained glaciolacustrine clays and silty clays. Seepage is common and results in the development of Gleysolic soils. Ecological moisture regime varies from hygric to subhydric while nutrient regime varies from submesotrophic to mesotrophic (poor to medium).

4.2.1.6 Bog Ecosite (K)

The bog ecosite commonly has organic soils consisting of slowly decomposing peat moss. They are poorly to very poorly drained and have a very poor to poor nutrient regime. This ecosite occupies level and depressional areas where water tends to be stagnant and impeded drainage or high water tables enhance the accumulation of organic matter. Stunted black spruce form a sparse canopy on the treed phase (K1) of the bog ecosite (Beckingham *et al.*, 1996). Indicator species include black spruce, Labrador tea, bog cranberry, small bog cranberry, cloudberry and peat moss. Two ecosite phases have been identified, including treed bog (K1) and shrubby bog (K2).

K1 Treed Bog Ecosite Phase

The treed bog ecosite phase was sampled four times within the Park. It is further classed as *K1.1 Black spruce / Labrador tea / Cloudberry / Peat moss*. This mature edaphic community type is characterized by a relatively open (6 – 11 % crown closure), low canopy (8 – 15 m in height) of black spruce. Labrador tea is the dominant shrub with percent cover values ranging from 35 – 60 %. Cloudberry is the dominant forb species found in this community type; percent cover values range from 10 – 15 %. Percent cover values for rusty peat moss range between 60 – 80 %. Lichen is quite common within these sites and tends to grow on hummocks; yellow reindeer lichen having cover values ranging from 15 – 50 %. Other lichens include grey reindeer lichen, pioneer lichen, and false pixie-cup (*Cladonia chlorophaea*). These stands have developed on fibric organic materials that are poorly drained. These sites are characterized by subhydric conditions and very poor nutrient regimes (oligotrophic).

K2 Shrubby Bog Ecosite Phase

The shrubby bog ecosite phase was sampled 14 times in the Park. This ecosite phase is further classed as *K2.1 Labrador tea/Cloudberry/Peat moss* community type. This young to mature edaphic community type is characterized by an open canopy with up to 50 % black spruce occurring mainly as understory trees or as tall shrubs; most stands inventoried did not have black spruce as trees. Labrador tea is the dominant shrub species with cover values ranging from 30 – 60 %. Cloudberry is the common forb with cover values ranging between 5 – 10 %. A nearly continuous cover of peat moss and lichen characterize these stands. The lichen layer is dominated by yellow reindeer lichen with lesser amounts of grey reindeer lichen, false pixie-cup, red pixie-cup, and slender cup lichen (*C. gracilis*); lichen cover generally ranges from 20 – 60 %, however, in areas where peat moss in greater than 80 %, lichen cover is generally less than 10 %. The moss layer is characterized mainly by rusty peat moss with less amounts of Warnstorf's (*S. warnstorfii*) and yellow-green (*S. angustifolium*) peat moss; percent cover values range from 35 - 90 %. These stands are found on poorly drained fibric and mesic organic accumulations. Ecological moisture regimes vary from hygric to subhydric and nutrient regime varies from oligotrophic (very poor) to submesotrophic (poor).

4.2.1.7 Poor Fen Ecosite (L)

Occurring extensively through the Lower Boreal Subregion within the Park, the poor fen ecosite is intermediate in nutrient regime between the bog (K) and the rich fen (m) ecosites and as such has species characteristic of both. Drainage is poor to very poor; however, there is some movement of water through the substratum. The organic matter consists of a combination of bog-type matter (peat moss) and fen-type organic matter (sedges, golden moss, tufted moss and brown moss). Indicator species include black spruce, tamarack, Labrador tea, dwarf birch, willow, cloudberry, sedge, peat moss, golden moss, tufted moss and brown moss (Beckingham *et al*., 1996). Two ecosite phases have been identified within the Park, including treed poor fen (L1) and shrubby poor fen (L2).

L1 Treed Poor Fen Ecosite Phase

The treed poor fen ecosite phase was sampled four times within the Park; all sites were classed as the *L1.1 Black spruce – Tamarack / Dwarf birch / Sedge / Peat moss* community type. This community type (or ecosite phase) is characterized by 10 – 20 % black spruce and 0 – 15 % tamarack; these tree species are generally less than 10 m in height. Beaked willow (*Salix bebbiana*) and low blueberry willow (*S. myrtillifolia*) are more common in these stands than dwarf birch as the percent cover of each varies from 10 – 20 % for willows and 0 – 30 % for dwarf birch. Labrador tea is equally as dominant as willow with cover values ranging from 10 – 20 %. Grasses generally amount to 12 – 25 % cover and consist of marsh reed grass, water sedge (*Carex aquatilis*) and sheathed cotton-grass (*Eriphorum vaginatum*). The moss layer ranges from 50 – 80 percent cover with rusty peat moss, tufted moss, golden moss being the most common with lesser amounts of Warnstorf's, Schreber's, stair step, and common hook moss (*Drepanocladus aduncus*). This community type has developed on poorly to very poorly drained organic materials and, on occasion, poorly drained glaciolacustrine materials with thick Ah (mineral organic accumulations) layers. Moisture regime varies from subhydric to hydric and nutrient regime varies from submesotrophic (poor) to permesotrophic (rich).

L2 Shrubby Poor Fen Ecosite Phase

Nine sites were established within the shrubby poor fen ecosite phase; all sites classed to the *L2.1 Dwarf birch – Willow / Sedge / Peat moss* community type. Dwarf birch and willow are the two dominant shrub species found within this community type. Percent cover values range from 10 – 45 % for dwarf birch and 15 – 45 for willow; willow species include Athabasca willow (*S. athabascensis*), low blueberry willow, flat-leaved willow (*S. planifolia*), and grey-leaved willow (*S. glauca*). Percent cover values for water sedge varies between 10 – 30 % and moss cover varies from 60 – 90 %. Golden moss, tufted moss and rusty peat moss are the dominant mosses associated with this community type; other mosses include Warnstorf's, stair-step moss, common hook moss and slender hair-cap (*Polytrichum strictum*). Like the shrubby poor treed fen, these communities have also developed on very poorly to poorly drained organic accumulations. Textures vary from fibric to mesic. Ecological moisture regime varies from subhydric to hydric and nutrient regime includes both submesotrophic (poor) and mesotrophic (medium).

4.2.1.8 Rich Fen Ecosite (M)

The rich fen ecosite is characterized by flowing water and alkaline, nutrient-rich conditions. The soil is composed of organic matter from decomposing sedges, golden, tufted and brown mosses. This ecosite occupies level and depressional areas where moving water is at or near the surface for a portion of the growing season. Tamarack dominates the canopy of the treed phase (M1), while dwarf birch or willow form the canopy of the shrubby phase (M2), and sedges dominate the Graminoid phase (M3) of the rich fen site (Beckingham *et al*., 1996). Indicator species include tamarack, willow, dwarf birch, sedge, golden moss, tufted moss, brown moss, buck-bean and marsh marigold. Three ecosite phases have been identified, including M1, M2 and M3.

M1 Treed Rich Fen Ecosite Phase

Two treed rich fen sites were sampled within the Park; both sites were classed as the *M1.1 Tamarack / Dwarf birch / Sedge / Golden moss* community type. Tamarack is found within both the main canopy (up to 13 m. in height) and shrub layers; within the shrub layers, percent cover values for tamarack varies between 10 – 25 %. Dwarf birch is the common shrub species with percent cover values ranging from 10 – 40 %; willow may or may not be present. Although water sedge is a characteristic species of this community type, it is generally found with low cover values, generally below 15 %. Moss cover is as high as 70 % and is dominated by golden moss, tufted moss and rusty peat moss; lesser species include stair-step moss, Schreber's moss, Warnstorf's moss and brown moss. Buck-bean was not identified at either of the two sites. This community has developed on poorly to very poorly drained organic materials and to a lesser extent, poorly drained, clay-rich glaciolacustrine materials. Ecological moisture regime varies from subhydric to hydric and nutrient regime is considered permesotrophic (rich).

M2 Shrubby Rich Fen Ecosite Phase

A total of 11 sites were established within the shrubby rich fen ecosite phase. An analysis of the data from all sites suggests the presence of two community types within this ecosite phase, including M2.1 and M2.2.

The *M2.1 Dwarf birch / Sedge / Golden moss* community type was sampled at five of the 11 sites inventoried. This community type is characterized by 15 – 30 % cover of dwarf birch. Willow may or may not be present, but when present, it is usually codominant with dwarf birch or dominant, with percent cover values ranging from 20 – 65 %; willow species include low blueberry willow, flat-leaved willow and grey-leaved willow. Percent cover of water sedge is generally between 25 – 40 %; hair-like sedge (*C. capillaris*) was also found at a number of the sites. Brown moss, golden moss and tufted moss are the three dominant moss types and were found at all sites; percent cover for these species varied from 10 – 30 %; other moss species noted included stair-step moss, Warnstorf's moss, and rusty peat moss. This community type has developed on thick, very poorly drained fibric and mesic organic materials. Ecological moisture regime varies from subhydric to hydric while nutrient regime varies from permesotrophic (rich) to eutrophic (very rich).

The *M2.2 Willow / Sedge / Golden moss* community type is characterized by a very high cover of willow; percent cover values generally range between 65 – 75 %. Willow species include mainly low blueberry willow and grey-leaved willow with lesser amounts of beaked willow. Dwarf birch, and to a much lesser extent alder, may or may not be present; when they are present, percent cover values are generally between10 – 15 %. Likewise, tamarack and black spruce may occur as tall shrubs. Water sedge is usually quite common with percent cover values between 25 – 60 %. Tufted, brown and golden moss are the most dominant mosses with lesser amounts of Schreber's moss, rusty peat moss, spreading-leaved peat moss (*S. squarrosum*), and *bryum spp*. Vegetation composition within this community type is strongly dependent upon water flow within the system. For example, in areas where open water is present, species such as common cattail (*Typha latifolia*) may be found. This community type has developed mainly on thick organic accumulations; however, it was also found on poorly drained, clay-rich glaciolacustrine materials and poorly drained, clay-rich active fluvial materials. Moisture regime varies from subhydric to hydric and nutrient regime varies from mesotrophic (medium) to eutrophic (very rich).

M3 Graminoid Rich Fen Ecosite Phase

The Graminoid rich fen ecosite phase was sampled four times within the Chinchaga Wildland Park. All sites were classed to the sedge rich fen (M3.1) community type.

The *M3.1 Sedge Rich Fen* community type commonly found adjacent permanent lakes and ponds and adjacent stream channels. It is characterized by a very high percentage of grass species. Water sedge is the most dominant grass with percent cover values ranging from 50 – 75 %. Turned sedge (*C. retrorsa*) and marsh reed grass have cover values of 10 – 20 % at all of the sites sampled. Willow may or may not be present as a low shrub within this community type; willow species include low blueberry willow, flat-leaved willow, and grey-leaved willow. Likewise, mosses may or may not be present depending upon water levels; if present, moss species include sausage moss (*Scorpidium scorpiodes*), spreading-leaved peat moss, and claw-leaved feathermoss. This community has developed on both very poorly drained organic accumulations as well as on moderately fine-textured fluvial materials.

4.2.2 Upper Foothills Natural Subregion

A total of two ecosites and three ecosite phases were sampled and subsequently mapped within the Upper Foothills subregion. The ecosites include:

- C Hairy wild rye
- E Tall bilberry / Arnica

A description of individual wetland ecosite phases is provided above; no differentiation of wetlands was possible at this scale between the Lower and Upper Foothills subregions.

4.2.2.1 Hairy Wild Rye Ecosite (C)

This ecosite tends to be submesic to mesic as a result of southerly aspects, and occasionally due to relatively coarse-textured parent materials or a combination of both. The nutrient regime varies from poor to rich with more productive sites being associated with higher covers of hairy wild rye and deciduous trees. The presence of wiry fern moss indicates that parent materials are calcareous (Beckingham *et al*., 1996). The C1 ecosite phase was the only ecosite phase sampled within the project area.

C1 Pine / Hairy Wild Rye Ecosite Phase

The *C1.2 Pine / Green alder / Hairy wild rye* community type was sampled within the Upper Foothills portion of the Chinchaga Wildland Park. The stand that was sampled is considered to be a young seral stand as there is extensive evidence of fire within the stand, including tall burnt snags (to 20 m in height). The stand was characterized by having lodgepole pine as the dominant tree species; pine occurred with 30 % cover in the tall shrub layer with 5 % as trees. White spruce regeneration is quite high and may approach 20 % cover. Green alder was the most prevalent shrub species found with a percent cover value of 35 %. The forest floor is covered with numerous feathermosses, including stair-step moss, Schreber's moss, and knight's plume moss. Wiry fern moss (*Thuidium abietinum*) was not found. Small patches of yellow reindeer lichen are scattered throughout the stand. This community type has developed on well-drained, clay loam morainal materials. Ecological moisture regime is submesic and nutrient regime is mesotrophic (medium).

4.2.2.2 Tall Bilberry / Arnica Ecosite (E)

The Tall bilberry / Arnica ecosite was found to be the dominant ecosite type within the Upper Foothills section of the Chinchaga Wildland Park. This is the reference site for the Upper Foothills subregion because it commonly has a mesic moisture regime and a medium nutrient regime. Stands on these sites may consist of pine, spruce, and fir mixtures with aspen, balsam poplar, and white birch being less common. Indicator species include white spruce, tall bilberry, green alder, low-bush cranberry, Labrador tea and heart-leaved arnica (Beckingham *et al*., 1996). Three ecosite phases have been sampled within this ecosite, including E1, E2 and E3. All tall bilberry / arnica sites sampled within the Upper Foothills were young seral; this indicates the frequency of fire within this subregion; tree heights varied between 8 – 13 m. Many of these stands are less than 30 years.

E1 Pine / Tall bilberry / Arnica Ecosite Phase

The *E1.1 Pine / Green alder / Feathermoss* community type was sampled twice within the Upper Foothills subregion. These young to mature seral fire origin stands are characterized by a main canopy of lodgepole pine with a dense cover of green alder in the shrub layer. Percent cover values for pine varies from 10 – 45 % and tree heights varied from 8 – 11 m. White spruce regeneration was found at both sites. Green alder cover values vary between 20 – 25 %. Labrador tea occurs but with low cover values. The forest floor is partially covered by feathermosses, including Schreber's, knight's plume, and stair-step mosses; feathermoss cover values generally range 55 – 65 %. These stands have developed on well-drained morainal materials; textures ranged from silt loam to clay loam. Moisture regime was mesic while nutrient regime was classed as mesotrophic (medium).

The *E1.3 Pine / Labrador tea / Feathermoss* community type was also sampled twice in the Upper Foothills subregion. Like the E1.1 community type, this community type is a young seral fire origin stand. Percent cover values fro pine varies from 30 – 55 % in the main canopy that varied from 7.5 – 10 m in height. Aspen also occurs in the main canopy, however with very low cover values. Secondary succession to white spruce is quite common as the understory layers are dominated by white spruce with cover values ranging from 20 – 50 %. Labrador tea is the characteristic shrub species; percent cover values ranged from 10 – 20 %. The forest floor is covered with Schreber's, knight's plume and stair-step moss; juniper hair-cap (*Polytrichum juniperinum*) was also found but with limited cover values. These stands have developed on well-drained, clay-rich morainal and glaciolacustrine materials, the latter occurring on lower slope positions within the Upper Foothills subregion. Ecological moisture regime is mesic and nutrient regime is considered mesotrophic (medium).

Within Chinchaga Wildland Park, the *E1.5 Pine / Feathermoss* community type occurs as young seral stands characterized by lodgepole pine of less than 14 m in height. Percent cover values for pine are 20 %. Again, white spruce is quite common, especially in the tall shrub layer where cover values reach 20 %. White birch cover values reach 15 % in the main canopy and understory tree layers. Very poorly developed shrub and forb layers characterize these stands. Feathermoss cover values are poor compared to other community types within this ecosite; Schreber's moss occurs with 15 – 20 % cover values, while knight's plume and stair-step moss have cover values less than 10 %; common hair-cap (*Polytrichum commune*) was also found at the site with approximately 6 % cover values in the moss layer. This community type has also developed on well-drained morainal blankets overlying bedrock. Ecological moisture regime is mesic and nutrient regime is considered mesotrophic (medium).

E2 Aspen – White spruce – Pine / Tall Bilberry / Arnica Ecosite Phase

Within the Chinchaga Wildland Park, the *E2.1 Aspen – White spruce – Pine / Green alder / Feathermoss* community type is considered to be an old seral community type. Tree heights ranged to 27 m. The main canopy consists mainly of aspen (35 % cover values) and lodgepole pine (10 % cover values); white spruce was not found at the sampled site. The shrub layer is considered to be well developed and is characterized by green alder, prickly rose, low-bush cranberry, Scouler's willow (*S. scouleriana*), blueberry, and bog cranberry. Green alder is the most prevalent shrub species with cover values ranging to 30 %. A well-developed forb layer consists of common pink wintergreen (*Pyrola asarifolia*), creamy peavine (*Lathyrus ochroleucus*), dewberry (*Rubus pubescens*), fireweed, palmate-leaved coltsfoot, woodland horsetail (*E. sylvaticum*), stiff club-moss (*Lycopodium annotinum*), and fringed aster (*Aster ciliolatus*). Stair-step and Schreber's mosses result in approximately 25 % feathermoss cover. These stands have developed on well drained, silt loam morainal materials. Ecological moisture regime is mesic and nutrient regime is considered mesotrophic (medium).

E3 White Spruce / Tall Bilberry / Arnica Ecosite Phase

The *E3.2 White spruce / Bilberry / Feathermoss* community type is characterized by 35 % white spruce and 35 % aspen in the shrub layer; no trees were found as the stand is considered to be only 30 years in age. The high percentage of aspen in the stand may be due to the influence of the Lower Boreal subregion. Tall bilberry is the dominant shrub species occurring with nearly 15 % cover values; other shrubs include Labrador tea, prickly rose and bog cranberry. Schreber's and knight's plume mosses are the dominant feathermosses; common hair-cap was also found but with low cover values. These stands are found on well-drained silty glaciolacustrine materials. Ecological moisture regime is mesic and nutrient regime is considered mesotrophic (medium).

4.3 Plant Community Types

Plant community types are the lowest taxonomic unit in Alberta's ecosite classification system. While plant community types of the same ecosite phase share vegetational similarities, they differ in their understory species composition and abundance. As a result, plant community types themselves are not mappable from small-scale panchromatic aerial photographs, even though they may be important to wildlife, recreation, or other resource sectors. For this reason, plant community types were identified in the field, but have not been included in subsequent map products.

In the field, each plant community type was identified by the ecosite letter, the phase number followed by a period, and another number that together constitute the plant community type (e.g., c1.1 = Pl / Canada buffalo-berry / hairy wild rye). The 38 plant community types identified during field work in the Park are listed in Table 6 below.

Table 6. Plant Community Types Sampled in Chinchaga Wildland Park

Ecosite	Ecosite Phase		Community Type(s)	Plot Number(s)
	Code	Description		
LOWER FOOTHILLS				
C – Hairy Wild Rye	C1	Pine/Hairy wild rye	C1.1	45
	C2	Aspen/Hairy wild rye	C2.1 C2.3	8, 12, 31, 33, 50, 60, 69 38, 108
	C3	Aspen-White spruce-Pine/Hairy wild rye	C3.1	52
D – Labrador tea – mesic	D1	Pine-Black spruce/Labrador tea – mesic	D1.1	113
E – Low-bush cranberry	E1	Pine/Low-bush cranberry	E1.3	7, 43, 62, 67
	E2	Aspen/Low-bush cranberry	E2.1 E2.3 E2.4 E2.5	1, 2, 27, 53, 59, 74 71, 100, 111 68 10, 34, 37, 75, 77, 78, 80, 83, 85, 116
	E3	Aspen-White spruce-Pine / Low-bush cranberry	E3.1 E3.2 E3.4 E3.6	16, 18, 23 25, 26 21, 24, 29 42
	E4	White spruce/Low-bush cranberry	E4.2 E4.5	86, 91, 117, 118 92, 93
I – Horsetail	I1	Poplar-Aspen/Horsetail	I1.1	6, 36, 90
	I3	White spruce/Horsetail	I3.1	88
J – Labrador tea/Horsetail	J1	Black spruce-White spruce / Labrador tea/Horsetail	J1.1	20, 94, 101
K – Bog	K1	Treed bog	K1.1	54, 70, 73, 84, 114
	K2	Shrubby bog	K2.1	3, 9, 14, 17, 22, 28, 30, 41, 46, 63, 76, 81, 96, 102, 112
L – Poor fen	L1	Treed poor fen	L1.1	19, 48, 55, 110
	L2	Shrubby poor fen	L2.1	4, 32, 39, 40, 47, 87, 89, 102, 109, 115
M – Rich fen	M1	Treed rich fen	M1.1	49, 66
	M2	Shrubby rich fen	M2.1 M2.2	51, 56, 57, 58, 65 5, 11, 13, 15, 72, 79
	M3	Graminoid rich fen	M3.1	44, 61, 64, 82
UPPER FOOTHILLS				
C – Hairy wild rye	C1	Pine/Hairy wild rye	C1.2	98

E – Tall bilberry/Arnica	E1	Pine/Tall bilberry/Arnica	E1.1 E1.3 E1.5	97, 107 95, 103 104
	E2	Aspen-White spruce-Pine / Tall bilberry/Arnica	E2.1	106
	E3	White spruce/Tall bilberry/Arnica	E3.2	99

4.4 Stand Age and Fire History

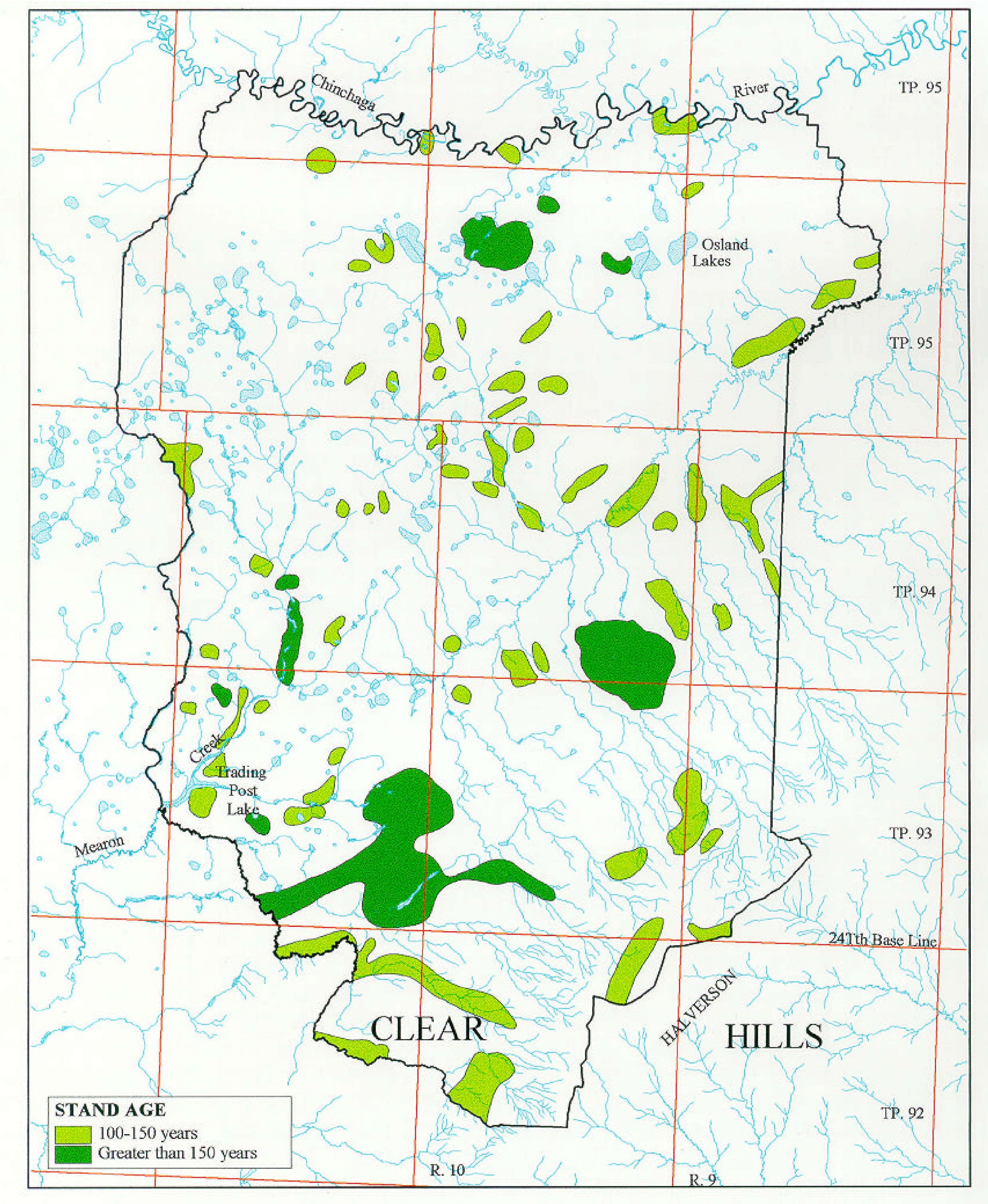
An analysis of the Phase III Forest Inventory maps suggests that fire has played a significant role in the development of forested stands within Chinchaga Wildland Park. In a report by Albertans for a Wild Chinchaga (nd), the authors state that *"fire is a characteristic phenomenon of the Chinchaga area and an essential ecological process in maintaining the integrity of this wilderness ecosystem."* Stands in the Park range from 25 to 160 years in age. Figure 7 shows the general location of forest stands in excess of 100 years old within Chinchaga Wildland Park. This map suggests that fire has had a profound effect on the development of various plant communities found within the Park today.

Within the Park, the Lower Foothills subregion is characterized by four distinct vegetation patterns. Immediately adjacent to the Upper Foothills subregion (i.e., above 800 m elevation), stands tend to be 35 – 45 years of age while much of the area to the north is characterized by either shrubby and/or treed wetlands, 60 year old seral stands of aspen or mature to over-mature white spruce and aspen stands adjacent to the Chinchaga River and a number of unnamed streams.

Within the Upper Foothills portion of the Park, stand origins range from 1845 to 1965, however much of the forests in this area are approximately 50 – 60 years in age. There are a few isolated stands within north-facing gullies of Halverson Ridge that are in excess of 155 years; these older stands tend to be white spruce dominated with lesser amounts of black spruce.

The evidence suggests that major fires occurred in the Park in 1845, 1890 and 1950. This would result in return cycles of between 45 – 55 years for this area, far different than the 492 year fire return interval suggested by Stelfox and Wynes (1999). The 1950 Chinchaga fire, which burned through a large portion of the Park, burned a total area of 11,760 km^2 and is the largest fire in Alberta's recorded history (Tymstra *et al*. 1997). Areal analysis of fire occurrence (1050 – 1998) found that 60 % of the Chinchaga Wildland Park burned in the past 49 years, yielding a fire return interval of 81.66 years, or 1.2 % per year (Albertans for a Wild Chinchaga, nd).

***Figure 7. Approximate Location of Stands in Excess of 100 Years Old in Chinchaga Wildland Park*.**



5. ENVIRONMENTALLY SIGNIFICANT AREAS

Environmentally significant areas (ESAs) are generally defined as landscape elements or places which are vital to the long-term maintenance of biological diversity, soil, water, or other natural processes, both on-site and in a regional context (Jennings and Reganold 1991). These component species, features, and processes are termed Valued Ecosystem Components (VECs), and are used to describe the structural and functional components of ecosystems. Discrete boundaries cannot be delineated around VECs at most scales of mapping (exceptions may include features such as coarse woody debris or snags, if mapped for a very small area and at a very large scale). However, boundaries can be delineated around areas that contain, or may contain, VECs. Such areas are defined in this project as ESAs, and are presented graphically in Appendix 8.

Much of the early work in Canada concerning the identification and management of ESAs was developed by Eagles (1980, 1984). Eagles' concepts have been applied to resource conservation initiatives in Alberta at regional (D.A. Westworth and Associates Ltd. 1990, Bentz *et al*. 1995, Saxena *et al*. 1996a, 1996b, Bilyk *et al*. 1997), sub-regional (Sweetgrass Consultants Ltd. 1991, Bentz and Saxena 1993, 1994), and local (Lamoureux *et al*. 1983, Brusnyk *et al*. 1991, O'Leary *et al*. 1993) scales.

Summarized from the above documents are the following criteria used to identify environmentally significant areas:

- Hazard lands and areas that are unsuitable for development in their natural state (e.g., floodplains, steep or unstable slopes);
- Areas that perform a vital environmental, ecological, or hydrological function (e.g., aquifer recharge or groundwater seepage areas);
- Areas that contain unique geological or physiographic features;
- Areas that contain significant, rare, or endangered plant and animal species;
- Areas that are unique habitats with limited representation in the region, or areas that represent small remnants of previously abundant habitats that have virtually disappeared;
- Areas that contain an unusual diversity of plant and / or animal communities due to a variety of geomorphological features and microclimatic effects;
- Areas that contain large or undisturbed habitats and provide shelter habitat for species that are intolerant of disturbances;
- Areas that contain plants, animals, or landforms that are unusual or are of local, regional, provincial, national, or international significance;
- Areas that provide a vital linking function and permit the movement of wildlife over considerable distances, or between habitats;
- Areas that are excellent representatives of one or more ecosystems or landscapes that characterize a natural region;

- Areas with intrinsic appeal due to widespread community interest or the presence of highly valued features or species such as game species, sport fish, or outstanding vistas; and

- Areas with lengthy histories of scientific research.

For purposes of this project for Chinchaga Wildland Park, ESAs were identified as combinations of elements fitting the above descriptions, as well as elements of special conservation concern as identified by the Alberta Natural Heritage Information Center (ANHIC). The identification and classification of special features in Alberta is now guided by a fine-filter, bottom-up approach. This process is described in *Special Features in Alberta: Proposed Framework for Site Identification and Initial Evaluation of Potential Special Feature Sites* (AEP 1998). The following general rules and information sources were applied in order to identify and map ESAs within the Park:

- For special element landforms, the classification system described in *Classification of Alberta Landforms* (ANHIC 1998) was used to identify sites, primarily through air photo interpretation and field visitation; and

- For special element plant communities, plant species, and wildlife species, the ANHIC tracking lists were consulted to cross-reference species or communities identified in the Park with those on the tracking lists.

Based on the above definitions and descriptions, environmentally significant areas (ESAs) in Chinchaga Wildland Park were identified as those areas with one or more of the following elements or element types:

- **Priority Rare Elements** – areas that include one or more elements with five or fewer known provincial occurrences, or 100 or fewer known global occurrences;

- **Outstanding Elements** – areas that include one or more elements that are recognized as outstanding examples in a provincial, national, or international context (may include noteworthy landforms or vegetation types or sites with seasonal concentrations of vertebrate animals);

- **Elements At Risk** – areas that include one or more elements considered at risk due to being restricted to a small portion of their former range or extent (based on a combination of ANHIC tracking and watch lists, federal endangered species lists, and provincial red and blue-listed species lists);

- **Assemblages of Elements –** areas that contain four or more elements considered of special conservation concern by ANHIC.

5.1 Terrain and Landscape Features

Physical characteristics or features of the landscape are often referred to as terrain features. For this project, terrain features were recognized as integral components of the landscape contributing to landscape diversity and aesthetic or scenic values within Chinchaga Wildland Park. Terrain features often have associated hydrologic or hydrogeologic functions as well. Terrain, or landscape, features comprising important components of ESAs in the Park include glacial landforms, peatlands, and fluvial and hydrological features such as rivers, creeks, wetlands and lakes.

5.1.1 Geology and Landforms

Bedrock geology, surficial materials and landforms play a very significant role in the development of vegetation communities. In particular, two landscape features within Chinchaga Wildland Park have been classed as being regionally significant; these include the deeply incised gullied topography along the north-facing slope of Halverson Ridge and the series of relic meltwater channels along the lower slopes of the Upper Foothills Natural Subregion.

A total of nine gully complexes have been delineated as environmentally significant areas along the north-facing slope of Halverson Ridge. Although access constraints precluded field confirmation of these features, interpretation of aerial photography indicates that these gullies represent the only areas within the Park where bedrock may be exposed. It is speculated that, in these areas, both the Wapiti and Kaskapau formations are exposed due to erosion by water and subsequent down cutting through soft surficial materials. Furthermore, it appears that some of the slopes within these gullies have failed due to a combination of excessive moisture conditions, oversteepened slopes and failure-prone bedrock. Because of the unique topographic conditions associated with these gullies (i.e., aspect, slope, excessive soil moisture, failed surficial sediments, *et cetera*), environmental conditions may give rise to unique plant assemblages.

A series of three distinct meltwater channels appear at the base of the Upper Foothills subregion; these channel scars can be used to reconstruct the glacial history of the area. These nearly continuous linear features (polygons 930, 952 and 1020 on the ecosite map) are oriented in a northeast-southwest direction. It is speculated that as the Laurentide ice front retreated off of Halverson Ridge, meltwaters flowed from the ice sheet south where they were narrowly confined by the freshly exposed upland topography (of Halverson Ridge) – these meltwaters subsequently eroded these distinct meltwater channels. They have currently in-filled with sedge and sphagnum peats.

5.1.2 Lakes and Rivers

The Park is dotted by numerous lakes and open-water wetlands, many of which are used by significant wildlife species such as trumpeter swan. Generally, the morphology of these lakes (e.g., their size, shape, depth and volume) influence their ecological characteristics. While morphological measurements were not conducted on lakes in the Park, most were observed to have the following characteristics – they are small, relatively shallow, regular shaped (mostly ovoid), with low inflows and forested margins. Many lakes occur as complexes of variably sized lakes, such as the Osland Lakes, while others occur as isolated depressional catchments.

The hydrological regime of major creeks and rivers within the Park is characterized by a highly variable water level. Snow-melt runoff, wetland discharge, and precipitation flows are all factors that influence water levels, and the major river in the area – the Chinchaga River – is known for its peak water flows that are up to 2 m higher than during its low flow period. With its headwaters in the Milligan Hills of northeastern British Columbia, the Chinchaga River is one of the primary drainages for northwestern Alberta, flowing into the Hay River (which eventually drains into Great Slave Lake in the Northwest Territories). As such, it is a dominant physiographic feature not only of the Park, but also of northwest Alberta.

Although only forming the northern boundary of the Park, the Chinchaga River provides a significant landscape feature that should be considered an environmentally significant area. It represents one of the best examples of a “tortuous meandering” or “contorted meandering” river channel in Alberta, and perhaps in Canada (it is the authors opinion that the only other comparable example in Canada of a meandering river channel may be a small segment of the Dog River, northwest of Thunder Bay, Ontario).

A meander is defined as "a sharp, sinuous loop or curve in a stream" (Parker 1994); it is characterized by oxbow lakes, meander cutoffs, point bars, and meander curves. Meanders are rarely fixed in position, providing a clear picture of the movement of rivers through time. Continued erosion and deposition cause them to migrate back and forth across the valley floor, leaving scars and arcuate point bars that mark their former positions (Plummer and McGeary 1991). The simultaneous erosion on the outside of a curve and deposition on the inside can deepen a gentle curve into a hairpin-like curve. The channel in a meander bend is deep close to the outside or undercut bank, which yields by caving and allows the bend to grow in radius. Here the channel has its greatest depth, forming a pool. As flow passes from one bend to the next, the threads of swiftest current cross the channel diagonally in a zone known as the crossing. This element of the channel, which is shallow and has many shifting bars, constitutes a riffle. Thus pools and riffles occur in alternation, corresponding with each meander bend. The meander bend not only grows laterally, but also shifts slowly down-valley in a migratory movement known as down-valley sweep. Combined effect of meander growth and sweep gives to the point-bar deposits nested arcuate patterns consisting of bars (embankments of bed materials) and swales (troughs between bars) (Strahler and Strahler 1973).

Of note in the Chinchaga River is the fact that the meander belt is so strongly developed and extends the entire length of the park along its northern boundary, a distance of over 24 km. Meanders are generally associated with lower reaches of a river, where sediment tends to become somewhat finer; however Chinchaga Wildland Park occurs within the upper fifth of the Chinchaga River course. According to Muller and Oberlander (1984), typical meander wavelength is normally from 7 to 15 times the channel width; in the case of the Chinchaga River, however, the wavelength is 15 – 45 times the channel width, suggesting a much stronger sinuosity than is normally found in most meandering channels.

5.1.3 Wetlands and Peatlands

Wetland ecosystems have been classified in a number of ways. The bases for these wetland classifications are varied and include floristic composition, topographic location, geomorphologic basin configuration, and other environmental parameters. In Alberta, the Alberta Water Resources Commission (1993) has developed draft policies for wetland management, in which five wetland forms are recognized: (i) shallow open water; (ii) marsh; (iii) swamp; (iv) fen; and (v) bog. The first three of these wetland forms (shallow open water, marsh, and swamp) are non-peat accumulating wetlands, while the last two (fen and bog) are peat-accumulating forms.

Both peat-accumulating and non-peat accumulating wetland forms are significant features of the Park. By definition, wetlands are areas where the water table is located near, at, or above the land surface long enough to promote wetland aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity which are adapted to a wet environment (NWWG 1988). All wetlands serve a variety of ecological functions, including (D.A. Westworth and Associates Ltd. 1993):

- **Life support functions** – habitat for all types of plants and microscopic, invertebrate, and vertebrate animals;

- **Hydrological functions** – flood buffering and water storage, groundwater discharge and recharge, surface water flow augmentation, influences on the climatic regime; and

- **Water quality functions** – modification of chemical, sedimentary and biological water constituents, changes in dissolved oxygen, pH and mineral composition.

Peat-accumulating wetlands are particularly fragile environments within the Park, and are also the dominant ecosites occurring in the Park. Peat consists of partly decayed organic (plant) matter, inorganic minerals, and water in varying proportions. Peat forms when the rate of plant accumulation exceeds the rate of decay. Vegetation falling in standing water or where a rising water table quickly forms a protective cover has a good chance of forming high-quality peat, but vegetation falling in oxygenated water, such as flowing water containing aerobic bacteria, or on moist surfaces in the presence of air will decay more rapidly.

Essentially, the stabilization of seasonal water levels and restriction of water flow through a wetland allows for the establishment and development of a bryophyte layer. The establishment of a bryophyte layer results in the accumulation of nutrients in a non-available form, reducing vascular plant production. Stabilized water levels, anaerobic conditions, and decreased nutrient availability lead to a substantial decrease in decomposition rates and development of peat-accumulating ecosystems. Halsey and Vitt (1999) classified peat-accumulating wetlands as having greater than 40 cm of accumulated organics, and non peat-accumulating wetlands as having less than 40 cm of accumulated organics.

All five wetland forms identified above (shallow open water, marshes, swamps, fens and bogs) are found in Chinchaga Wildland Park to varying degrees, and are described below.

Shallow Open Waters are non-peat forming wetlands that are characterized by aquatic processes confined to less than 2m depth at mid-summer. These wetlands have submergent to floating vegetation and form a transition to truly aquatic ecosystems. In Chinchaga Wildland Park, most open-water environments may be classified as this wetland form, rather than as lakes (although there are some larger waterbodies, such as Osland Lakes and West Lake, that are classed as lakes).

Marshes are open, non-peat forming wetlands that are dominated by sedges. Marshes are characterized by seasonal water level fluctuations, relatively high amounts of water flow, and are influenced by both ground and surface waters. As a result, concentrations of nitrogen and phosphorus are high, leading to abundant vascular plant production; however, peat accumulation is limited by high decomposition rates. In Chinchaga Wildland Park, marsh areas are often associated with the margins surrounding lakes and shallow open waters. The lack of tree or shrub cover, resulting from frequent flooding, distinguish this wetland form from others.

Swamps are forested or shrubby non peat-accumulating wetlands. They are similar to marshes in many ways (poorly developed bryophyte layers, strong seasonal water level fluctuations, landscape association with lakes and other open water environments), however the rate of flooding is sufficiently lower than in marshes to allow for the development of shrub or tree layers. In the Park, combinations of tamarack, black spruce, water birch, and willows characterize the shrub / tree communities on these sites.

Fens are geogenous peat-accumulating ecosystems that are affected by mineral soil waters (ground and/or surface) that may be relatively rich in mineral content. Halsey and Vitt (1999) identified three fen types in Alberta, subdivided on the basis of hydrology: soligenous fens (influenced by flowing surface water), topogenous fens (influenced by stagnant standing water), and limnogenous fens (influenced by associated lakes and ponds).

Soligenous fens commonly have discrete patterns of open pools (flarks) alternating with elongate, shrubby ridges (strings) oriented perpendicular to the direction of surface flow, creating a “patterned” appearance. In Alberta, numerous patterned fens have been identified in many areas of the contiguous Foothills Natural Region (Bentz *et al*. 1995), and in the Chinchaga outlier of the Foothills Natural Region (Grande Alberta Paper 1998). However, field work conducted for this project indicated that most fens within Chinchaga Wildland Park are topogenous, non-patterned fens. The fens located within the Park exhibit a variety of forms, including open graminoid-dominated forms, shrubby birch and willow-dominated forms, and sparsely forested tamarack, spruce, birch and willow-dominated forms. In the associated ecosite map and descriptions presented in this report, fens have been classified and mapped as either Poor Fens (ecosite L), occurring as treed poor fens (ecosite phase L.1) and shrubby poor fens (ecosite phase L.2) or as Rich Fens (ecosite M) occurring as treed rich fens (ecosite phase M.1), shrubby rich fens (ecosite phase M.2), and graminoid rich fens (ecosite phase M.3).

Bogs are ombrogenous peat-accumulating wetlands that receive their water only from precipitation and have low water flow. The water table is generally 40-60 cm below the peat surface. For these reasons, bogs are acidic ecosystems with pH values below 4.5; they are poor in base cations and have no alkalinity. Bogs within the Park are dominated by oligotrophic species of *Sphagnum*, feather mosses (*Pleurozium schreberi*, *Hylocomium splendens*), and lichens (*Cladonia* spp. and *Cladina* spp.). As a result of the low thermal conductivity of dry *Sphagnum*, bogs have lower surface water temperatures than other surrounding organic and non-organic soils. In Chinchaga Wildland Park, which occurs very close to the southern limit of discontinuous permafrost (see Section 5.1.1), permafrost is limited to these bog environments. In the associated ecosite map and descriptions presented in this report, the Bog Ecosite (ecosite K) has been classified and mapped as either treed bog (ecosite phase K.1) or shrubby bog (ecosite phase K.2). The shrubby bog ecosite (K.2) is the predominant wetland ecosystem unit found in the Park.

Peat-accumulating wetland forms such as fens and bogs are significant because they are extremely sensitive to disruption of hydrological conditions. In their natural state, bogs serve as water absorption and storage reservoirs that help to reduce flood hazards and the amount of free-flowing silt-laden water. The presence of peat improves water quality by filtering loads of nutrients, pollutants and sediments. In Chinchaga Wildland Park, this filtering process is vital to the survival of wildlife species (such as trumpeter swan and beaver) that live in and on the larger water bodies that receive peatland discharge. Once peatlands are destroyed, they do not return to their original condition. Peat-forming plants accumulate at a relatively slow rate. Belanger *et al*. (1988) estimated an approximate rate of peat accumulation of 100 cm per 1,000 years.

5.2 Vegetation Features

The vegetation in Chinchaga Wildland Park is, for the most part, typical of the Lower and Upper Foothills natural subregions, but is extensively influenced by boreal characteristics. Old growth forests, while more common outside the Park, are present in small stands, while riparian and floodplain vegetation are significant features adjacent to the Park's numerous streams, rivers, and wetlands. These features, along with rare, threatened or endangered species or communities, are environmentally significant areas of the Park.

5.2.1 Old Growth Forests

Remnants of mature, undisturbed forested lands have been identified as natural elements of significance in the Foothills Natural Region of Alberta (Bentz *et al*. 1995), and should be considered equally significant within Chinchaga Wildland Park. Such forests are often generically referred to as "old-growth" forests – a term that is applied zealously to a range of environmental conditions. In reality, no single definition of "old-growth" is likely to be applicable across the board to all forest types. Franklin *et al*. (1981) defined old growth forests as *"functionally intact natural ecosystems that have developed over a long period of time, free of catastrophic disturbances such as fire."* If this definition were used to describe Alberta's old growth forests, few stands would meet the criteria, as most northern coniferous forests are fire-maintained systems that rarely reach climax or late successional stages.

Heinselman (1981) analyzed the existing information on fire cycles in various ecoregions of North America, estimating the length of cycles at 75 years in the boreal forest, 10 years in the aspen parkland (pre-settlement), 25 years in dry montane subalpine forests, 50 years in lower subalpine forests, and over 100 years at higher elevations. Murphy (1985) also estimated a fire cycle of 38 years for the boreal mixedwood forests of northern Alberta. Clearly, a combination of age and other criteria need to be developed to identify, manage, and conserve old growth forests in the boreal forests of Alberta, and 100 years has been proposed as the age at which old growth characteristics are, for the most part, well developed in the boreal forest.

Timoney (1998, n.d.) and other authors have summarized a suite of structural attributes, features, and characteristics of old growth forests as including:

- Trees showing dieback, major side branches, multiple tops, physical and fire scars, conks, and leaning trees;
- Standing dead trees (snags);
- Coarse woody material in the form of large, downed trees and logs in various stages of decay;
- Trees of multiple ages and sizes whose age structure is autogenic;
- An uneven canopy featuring gaps in various stages of gap-dynamic succession;
- High plant species diversity;
- High cover and diversity of fungi;
- Detrital food webs; and
- Fungal-invertebrate and fungal-invertebrate-vertebrate relationships

Stahle and Chaney (1994) point out that large trees are not necessarily a requisite of old growth forests. A forest may display any number of these physiognomic attributes to varying degrees. Together, these structural elements that characterize old growth forests give rise to functional attributes that make them critical to the maintenance of landscape-level integrity.

Old growth forests typically support a higher richness of birds, mammals, vascular and non-vascular plants, fungi, bacteria, arthropods, and fish than young or mature forests (numerous authors cited in Timoney n.d.). As ecosystems or landscapes, old growth forests are seldom abundant relative to young and mature forests, because they take many years to develop. Timoney (n.d.) states that, relative to the province as a whole, old growth is relatively scarce in the Chinchaga area. Forests older than 150 years compose 12.7 % of all forests older than 100 years in Alberta, relative to only 1.3 % in the greater Chinchaga area, which also encompassed the present wildland park (Timoney 1998, n.d.)

Because of their high structural and functional diversity, old growth forests provide niche habitats for species such as cavity-nesting birds and mammals, slow developing bryophyte-dependent species. Ohmann *et al*. (1994) identified more than 100 vertebrate species in the Pacific Northwest that require standing dead trees (snags) at some time during their life cycle. Many species of conservation and management concern in Alberta require or prefer the habitats provided old growth forests, including songbirds such as bay-breasted warbler (*Dendroica castanea*), Cape May warbler (*D. tigrina*), black-throated green warbler (*D. virens*), ungulates such as woodland caribou, large carnivores such as grizzly bears, and smaller mammals such as northern long-eared bat (*Myotis septentrionalis*), and northern flying squirrel (*Glaucomys sabrinus*).

In Chinchaga Wildland Park, significant old growth forest stands (>100 years of age) are scattered throughout the Park, mostly occurring as small, isolated pockets associated with riparian or floodplain environments (see Figure 7). Among these stands, only a handful are >150 years old. Most of the contiguous tracts of old growth forests in the vicinity of the Chinchaga are located east and south of the Park, in the Halverson Ridge area (see Appendix 8). The large Chinchaga fire of 1950 that burned 11,760 km^2 adjacent to the Park, also left a patchwork of remnant old growth stands adjacent to the Park that today are the oldest stands in the vicinity. However, these stands are also targeted for timber harvesting as soon as dispositions are allocated. Consequently, the significance of old growth forests within Chinchaga Wildland Park is exacerbated by the fact that, in Alberta, there are presently no policies in place to explicitly conserve old growth ecosystems. As a matter of fact, under the present policy of sustained yield forest management, removal of old growth timber is given priority, while the preservation of old-growth is incidental to the process of netting out areas such as buffers around lakes and streams, non-merchantable timber, and inoperable areas.

5.2.2 Riparian Areas

Riparian ecosystems are well-defined landscape features that share many of the same values as wetlands but are distinct enough to warrant consideration on their own merit. Like the term “wetland”, there is no universally accepted definition of a “riparian zone”, but the following definition suits our purposes (Johnson and McCormick 1979):

> *Riparian ecosystems are ecosystems with a high water table because of proximity to an aquatic system or subsurface water. Riparian ecosystems usually occur as an ecotone between aquatic and upland ecosystems, but have distinct vegetation and soil characteristics…. Riparian ecosystems are uniquely characterized by the combination of high species diversity, high species density, and high productivity. Continuous interactions occur between riparian, aquatic, and terrestrial ecosystems through exchanges of energy, nutrients, and species.*

In the Foothills Natural Region, Bentz *et al*. (1995) identified significant riparian ecosystems in association with broad alluvial valleys of major rivers. Within Chinchaga Wildland Park, however, the majority of riparian zones are found in association with the dendritic, or branching, drainage network of smaller streams, creeks, and rivers, while also including larger rivers such as the Chinchaga.

The small, heavily shaded streams that are present throughout Chinchaga Wildland Park have strong linkages with streamside vegetation, and the influence of riparian vegetation is maximal in these small streams. Vegetation bordering the channels of streams like Mearon Creek and numerous similar unnamed streams within the Park, provides shade that limits plant growth, and contributes major quantities of organic matter such as twigs and leaves. This plant material makes up the bulk of the detritus that provides up to 90% of the organic matter necessary to support headwater stream communities (Jahn 1979).

Apart from the broader watershed-level functions of nutrient cycling and energy transfer, riparian ecosystems also play a critical role in maintaining fish and wildlife productivity. Organisms of all trophic levels benefit from the interactions between biological, physical, and chemical components of the system, creating complex food webs that support productive and diverse wildlife populations. While some species are dependent on riparian zones for all of their life requirements, others simply make extensive use of these areas even though they are not dependent on them. One of the most significant facultative uses of riparian habitats is the provision of migratory or dispersion corridors for ungulates. Due to their primarily linear character, streamside riparian environments often serve as conduits with low snow and low bush conditions in deep snow winters (Harris 1984).

5.2.3 Rare Plants and Plant Communities

The Alberta Natural Heritage Information Centre (ANHIC) collects, evaluates, and makes available information on the elements of natural biodiversity of Alberta, including plants, animals, natural plant communities, and landscapes. ANHIC has developed tracking lists of elements that are considered of high priority because they are rare or special in some way. These lists are under constant review, and are updated periodically.

During field work conducted for this project, only one rare plant element was encountered – beaked sedge (*Carex rostrata*), which is ranked as S2/G5 by ANHIC. These rankings refer to sub-national (i.e., provincial) and global status of the species. A provincial status rank of S2 indicates 6 - 20 or fewer occurrences, or many individuals occurring in fewer locations, while the global rank of G5 typically indicates that the species is demonstrably secure globally (>100 occurrences), even though it may be quite rare in parts of its range, particularly at the periphery.

In the Park, *Carex rostrata* has a strong affiliation with the M.3.1 community type, which is a graminoid rich fen ecosite phase. While one occurrence was identified from a shrubby poor fen ecosite phase (L.2), the remaining four out of five encounters of this species were within the M.3 ecosite phase. Where they occur within the Park, these graminoid rich fens have been identified as ESAs due to their hydrological functions, as well as their potential to house rare species such as *Carex rostrata*.

A query of the ANHIC database also revealed the previous identification of thread rush (*Juncus filiformis*) from the Park (see Appendix 3 for a record of this database query). In Alberta, this species has the same status (S2S3/G5) as beaked sedge. Thread rush was not identified in the field during surveys conducted for this project, however rare plants were not targeted.

The presence of four other plant species in the Park can also be considered somewhat significant. Bog birch (*Betula glandulosa*) is common in lowland areas of the Park, however MacDonald and Luchanski (1994) report the occurrence of bog birch in this area as a major mapping extension of the species' range in Alberta. Three other species encountered in the Park – spreading sweet cicely (*Osmorhiza depauperata*), dwarf bilberry (*Vaccinium caespitosum*), and heart-leaved arnica (*Arnica cordifolia*) – are reported by MacDonald and Luchanski (1994) to be at the periphery, or limit, of their range in the Chinchaga area.

One unique plant community was also identified in the Park. A small area of undulating to rolling glaciofluvial materials is found immediately south of the Chinchaga River. This deposit consists of medium sands that are rapidly drained, resulting in the development of xeric, stunted, and very open aspen-dominated stands. Within this site, open grassy areas consist of bearberry, low blueberry, Kentucky blue grass (*Poa pratensis*), hairy wild rye, wheat grass (*Agropyron trachycaulum*), yellow reindeer lichen (*Cladina mitis*), red pixie-cup (*Cladonia borealis*), and coral (*Stereocaulon paschale*). This site was "unclassified", as it is not adequately described in either the *Field Guide to Ecosites of West-Central Alberta* (Beckingham *et al*. 1996) or the *Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996). It is similar to the B1.1 (Bearberry/Lichen) ecosite phase described by Beckingham *et al*. (1996), but the site is aspen-dominated, rather than pine-dominated. It was only identified in one location in the Park, and was therefore classified as a locally significant ESA; a photograph of this site is included in Appendix 5.

5.3 Focal Wildlife Species and Habitats

Science-based conservation and protected areas management often relies on carefully selected focal species for planning (Miller *et al*. 1999). Focal species are organisms used in planning and managing land use because their requirements for survival represent factors important to maintaining ecologically healthy conditions, or because their requirements for survival are contained within the protected area. Several different kinds of focal species can be identified, including the following:

- **Umbrella** – species that generally cover large and ecologically diverse areas in their daily or seasonal movements; protection of enough of their habitat to assure a viable population of these organisms would, it turn, provide protection of habitat and resources for many other species more restricted in range;

- **Keystone** – species that enrich ecosystem functioning in a unique and significant manner through their activities, and the effect is often disproportionate to their numerical abundance. The extirpation of keystone species often triggers other extirpations and significant changes or loss of habitats;

- **Flagship** – charismatic species that build popular support for the Park or the area being managed, including rare and endangered species, and most species of megafauna;

- **Specialists** – species that are dependent on habitat types or habitat features that are in themselves extremely rare, limited, or in decline;

- **Habitat Quality Indicators** – species that require natural habitat of high ecological integrity, and that provide an early warning system because they are sensitive to ecological changes;

- **Wilderness Quality Indicators** – species that are sensitive or vulnerable to human disturbance and, thus, require remote wilderness habitats;

- **Prey** – key prey species for focal predators in the above categories.

Based on these criteria, areas that provide key habitats for a suite of focal species within Chinchaga Wildland Park have also been identified as ESAs. The focal wildlife species selected for Chinchaga Wildland Park are:

- Woodland caribou;

- Grizzly bear;

- Beaver;

- Northern goshawk; and

- Trumpeter swan

Some ESAs have been identified solely (or at least, primarily) as key habitats for these focal species (such as caribou feeding habitats and trumpeter swan nesting lakes), while for other species such as beaver, their key habitats are included within larger ESAs such as wetlands and riparian areas. Key habitat requirements (and their relationship to ESAs) for these focal species within the Park are described below.

5.3.1 Woodland Caribou

Woodland caribou range across northern and west-central Alberta. They are currently considered a species "***at risk***" of declining due to non-viable population levels, and are designated as "threatened" under the *Alberta Wildlife Act* (Alberta Environment 2001). Nationally, the status of woodland caribou varies considerably across the species' range, with Alberta populations listed as "threatened" (Gray 1999, COSEWIC 2001).

Two ecotypes of woodland caribou are generally recognized in Alberta, the differentiation based on characteristic adaptations and habitat use. Woodland caribou that live year round in lowland forested habitat are referred to as 'boreal ecotype', while caribou that winter in forested foothills and migrate to alpine mountain habitat during summer are referred to as 'mountain ecotype' (Edmonds 1991, Thomas 1995). Habitat use by these two ecotypes is considerably different. The boreal ecotype of woodland caribou inhabit northern Alberta, including Chinchaga Wildland Park and adjacent areas. Since ecotypes are differentiated based on behavioral patterns, neither the provincial nor the federal status ranks address ecotypes; they refer only to the species, which includes both ecotypes.

Boreal ecotype caribou make extensive movements throughout the year, but most do not make predictable migrations and therefore habitat use does not differ on a seasonal basis, as opposed to the habitat use patterns of mountain ecotype caribou (Hornbeck and Moyles 1995, Stuart-Smith *et al*. 1997). Terrestrial lichens are the most important food source for caribou throughout the year, but particularly during winter. Due to their extremely slow growth and limited dispersal mechanisms, these lichens are found primarily in old forests, contributing to the affinity of woodland caribou to relatively old forests (Dzus 2001). Boreal ecotype caribou are typically found in peatland complexes dominated by black spruce and larch (Bradshaw *et al*. 1995, Hornbeck and Moyles 1995, Anderson 1999), and Stuart-Smith *et al*. (1997) even reported caribou movements in northeastern Alberta to be constrained by the boundaries of peatland complexes.

This pattern of lowland habitat use, in combination with varying use of lichen-rich jack pine and lodgepole pine stands, are common to caribou in non-mountainous areas (Schneider *et al*. 2000, Dzus 2001). Recent work in northern Alberta has shown that even in areas where small peatlands are interspersed in an upland matrix, caribou tend to select treed bogs and fens (Morton and Wynes 1997, Anderson 1999). Bradshaw *et al*. (1995) also documented avoidance of upland stands of aspen, white spruce, birch and balsam fir by caribou.

Within Chinchaga Wildland Park, habitat complexes containing appropriate combinations of lowland bogs (i.e., peatlands) and upland forests have been identified as ESAs. In the context of the ecosite mapping for the Park, relatively large areas mapped as treed and shrubby bog ecosite phases (mapped as K.1 and K.2) were identified as significant winter habitat for caribou. These bog communities are acidic, dominated by *Sphagnum* spp. mosses, and have fewer nutrients than other peatlands (i.e., fens) because of decreased water flow due to higher elevation above the surrounding landscapes. These "raised bogs" are ombrotrophic, as they are raised above the influence of the surrounding landscape and receive their water and mineral supplies solely from precipitation. (Vitt 1994). Consequently, they occur as drier sites, and provide excellent substrate for lichens of the genus *Cladina*, particularly *C. mitis*, *C. stellaris*, and *C. rangiferina*, all of which are significant forage species for caribou.

Upland, forested pine / lichen communities are also used by woodland caribou during years of heavy snowfall. Either very deep or crusted snow conditions in open peatlands limit the effectiveness of cratering by caribou to access terrestrial lichens. Under such conditions, forested units such as the Pine-Black Spruce / Labrador Tea – Mesic ecosite phase (mapped as D.1) within the Park provide abundant terrestrial lichens with shallower snow conditions due to snow interception by the tree canopy. When they occur in complexes with peatland sites (or adjacent to them), these units are also significant for their provision of security habitat for caribou during movement between bogs, essentially serving a linking or dispersal function.

Because caribou in northern Alberta are largely restricted to peatland complexes, it is imperative to maintain the contiguity and connectivity of these complexes (Stuart-Smith *et al*. 1997). The large home ranges and lack of distinct calving and wintering areas suggests that setting aside small areas for protection from development is not, by itself, likely to be effective in preventing declines in caribou populations. Therefore, habitat units that have been identified as Caribou Habitat ESAs within Chinchaga Wildland Park should also be extrapolated and managed accordingly in areas outside and adjacent to the Park.

5.3.2 Grizzly Bear

Nagy and Gunson (1990) have estimated approximately 575 grizzly bears on provincial land in Alberta, with an additional 215 animals in federal protected areas (Jasper, Banff, and Waterton national parks). Grizzly bear distribution in Alberta, as defined by Nagy and Gunson (1990), Pattie and Hoffman (1992) and Smith (1993), corresponds closely to the boundaries of the Foothills Natural Region, and includes smaller populations in outlier areas such as the Swan Hills and the Clear Hills Complex (where Halverson Ridge is situated).

The Chinchaga area has been identified by Bentz *et al*. (1995) as providing significant grizzly bear habitat; this provision of grizzly bear habitat was one of the defining criteria to designate the area as provincially significant. Grizzly bears are classed nationally as a Species of Special Concern due to characteristics that make it particularly sensitive to human activities or natural events (COSEWIC 2001). Provincially, the grizzly bear is currently ranked as “May Be At Risk” in Alberta (Alberta Environment 2000), which is equivalent to the previous status as “blue-listed” (AEP 1996). Alberta Environment (2000) cites a stable population of grizzly bears in Alberta since 1980, with the greatest threat to them being loss and degradation of wilderness habitat through resource extraction and recreational development.

Grizzly bears require a diversity of habitats in close proximity within the boundaries of large home ranges, including areas for travel, seclusion, feeding, and denning. As a result, grizzly bears are seasonally nomadic, moving across the landscape as they track the phenological development of their preferred forage items over the course of the growing season. Generally, riparian forests and wetland complexes provide the best early spring range for vegetation, as these sites green up earlier than others in the spring and bears can readily obtain nutritious emergent vegetation. Fall fruit production is a critical forage that provides grizzly bears with an abundant source of sugar prior to hibernating. Although diets certainly vary among individual populations of grizzly bears, research has shown that a few items comprise a significant proportion of their diet in all areas. These critical food items include:

- Horsetails (*Equisetum* spp.), which is the only plant genera used in all regions within North American grizzly bear range, and is selected during all seasons. In combination with sedges and grasses, horsetails are likely the true staple food item for grizzly bears during the spring and summer seasons;

- Cow parsnip (*Heracleum lanatum*), non-native clovers (*Trifolium* spp.) and dandelions *(Taraxacum* spp.) are important early and mid-season food items. The latter two species, in particular, tend to pioneer early successional habitats and are, thus, compatible with grizzlies’ preference for early seral forest stages;

- The roots of *Hedysarum* spp. and other robust legumes such as yellow glacier lily (*Erythronium grandiflorum*) and springbeauty (*Claytonia* spp.) are dug in mountainous and upper foothills environments;

- The fruit of two shrub taxa constitute a vital mid and late-season food item in much of the grizzly bears' foothills range in Alberta. When available, the fruit (berries) of *Vaccinium* spp. and *Shepherdia canadensis* are the primary sources of energy and fat deposition. Dwarf blueberry (*V. caespitosum*), black huckleberry (*V. membranaceum*), velvet-leaved blueberry (*V. myrtilloides*), and oval-leaved blueberry (*V. ovalifolium*) are particularly important species to local bear populations.

During the course of an active season, grizzly bears occupy a wide range of habitats from low elevation valleys to upper alpine ridges. Therefore, it is understandable that, in the Chinchaga area, grizzly bears have been recorded at all elevations, ranging from low elevation muskeg areas to upper foothills forested stands (D. Moyles, personal communication).

While grizzly bears range throughout the Chinchaga Wildland Park to meet foraging needs, denning habitat is likely much more limited in this area. A variety of existing landscape structures can be utilized as dens, including natural caves and hollows under tree root masses, dens are more commonly excavated under fallen trees and other downed material. Dens are excavated in slopes with aspects that vary from region to region, however most are oriented to ensure a good early catchment of insulative snow cover over the den entrance. The angle of slope in which dens are excavated ranged in most regions from 22^o to 45^o (Nagy *et al*. 1983). Characteristically, several researchers have described dens at high elevations in remote areas with slopes >30o, soils that are deep, and aspects where snow accumulates. Sloped sites are often selected because they facilitate easier digging and they are generally stabilized by trees, boulders, or root systems of herbaceous vegetation.

Given these characteristic denning habitat requirements, most habitat suitable for denning by grizzly bears in Chinchaga Wildland Park is likely limited to the deeply incised north-facing slopes of Halverson Ridge and higher elevation forests atop the ridge. Grizzly bear habitats themselves have not been identified as ESAs, however their recognition is incidental with other ESAs such as "gullied old growth forests", which provide both denning and foraging habitat for bears along Halverson Ridge; "riparian habitats", which provide early season foraging habitats; and "upland old growth forests", which provide both feeding and security habitat.

5.3.3 Beaver

Beaver occur in streams, rivers, ponds, and lakes throughout most of North America, except for peninsular Florida, the arctic tundra, southwestern deserts, and prairie grasslands (Jenkins and Busher 1979). In Alberta, they occur throughout the province, with the exception of most of the Grassland Natural Region. Prime beaver range coincides with the Central Parkland Natural Subregion, but they are locally abundant in the Boreal Forest and Foothills natural regions under suitable conditions. Throughout their continental range, including that in Alberta, beaver are commercially important furbearers with stable or increasing populations. They are not considered to be at risk anywhere in their range.

However, beaver are a keystone species, which affect ecosystem structure and dynamics far beyond their immediate requirements for food and space (Naiman and Melillo 1984). By changing the flow of water in the landscape, beaver impoundments convert terrestrial to aquatic ecosystems, alter plant communities, and effect pathways and rates of nutrient cycling. Beaver ponds increase landscape heterogeneity by creating a spatial mosaic of aquatic and semi-aquatic patches in an otherwise forested matrix. Because they are created and maintained by living organisms, beaver ponds are themselves dynamic, changing as they are colonized, flooded, and abandoned by beaver.

Beaver impoundment is very common in marsh-sedge wetlands and shrubby wetlands wherever deciduous forest margins occur in Chinchaga Wildland Park. Extensive evidence of present, recent, and old beaver activity was noted in the Park during field work. The structural heterogeneity in these beaver ponds is significantly higher than in surrounding terrestrial habitats and, thus, provides an increased number of microhabitats for a variety of species including mink (*Mustela vison*), muskrat, waterfowl, and raptors. Trumpeter swan (*Cygnus buccinator*) and northern goshawk (*Accipiter gentilis*) are two examples of other significant wildlife species within the Park that depend on beaver impacted wetlands, canals, and forests – trumpeter swan for nesting habitat, and northern goshawk for foraging. These types of biota-controlled wetlands are significant features of the landscape in Chinchaga Wildland Park. At the scale of mapping undertaken for this project (1:50,000), beaver impoundments and other activity could not be explicitly mapped as Environmentally Significant Areas. However, beaver activity is so ubiquitous in the Park that their inclusion is often incidental to the delineation of other ESAs such as trumpeter swan nest areas and significant hydrological features.

5.3.4 Northern Goshawk

Northern goshawks (*Accipiter gentilis*) are a prominent species throughout Canada and the northern half of the United States (Squires and Reynolds 1997). Duncan and Kirk (1994) cite and estimated 10,000 – 50,000 pairs of goshawks in Canada with stable population trends. Northern goshawks are listed as a species not at risk by COSEWIC (2001). In Alberta, northern goshawks are classified by Alberta Environment (2001) as a "***sensitive***" species, defined as *"a species that is not at risk of extinction or extirpation, but may require special management attention or protection to prevent it from becoming extinct."*

Northern goshawks are most common in densely wooded parts of northern and western Alberta, where they inhabit mixedwood forests in the Foothills and Boreal Forest natural regions. Semenchuk (1992) shows the Chinchaga outlier of the Foothills Natural Region as the approximate northern extent of its range in Alberta, and two individual birds were recorded within Chinchaga Wildland Park during field work for this project. Its reliance on mature forested habitats results in northern goshawk maintaining a close affinity to mature and old growth forest stands.

Northern goshawks are not considered to be seasonal migrants, although they may make elevational and latitudinal movements in response to low prey densities. Documented prey species consist primarily of hares, grouse, and squirrels. Approximately every 10 years, large southward migrations of northern goshawks are recorded coincident with cyclic hare populations. Foraging, or hunting, habitat for northern goshawks are concentrated in mature mixedwood forests with open understories. Forest stands that contain mature, dense canopies tend to restrict the growing conditions of the understory, thereby providing: (i) increased visibility for hunting; (ii) excellent flight corridors, maximum maneuverability, and access to prey species; and (iii) reduced availability of escape cover for prey. Schaffer *et al*. (1996) identified optimal foraging habitat for northern goshawks as containing a deciduous component of 10 – 90 %, tree canopy closure of 30 – 85 %, and mean canopy heights of 8 – 16 m.

Although both deciduous and coniferous trees are used for nesting, deciduous trees are most often selected by goshawks throughout their continental range (Younk and Bechard 1994, Shaffer *et al*. 1996, Squires and Ruggiero 1996). Generally, they nest in large diameter trees (>20 cm dbh) on gentle to moderate slopes with cool aspects. Interestingly, free water consisting of anything from forest ponds to small streams, large rivers, or large lakes, is often found adjacent to goshawk nest sites (Hargis *et al*. 1994, Bull and Hohnmann 1994), but is not considered a habitat requirement. Such water sources are incorporated into home ranges up to 3.5 km from nesting sites (Squires and Reynolds 1997).

Of primary consideration in any attempt to manage a landscape for northern goshawk is the requirement for a matrix of interspersed foraging and nesting habitats. Forested stands used to provide nesting habitat should ideally be mature to old stands about 12 ha in size (Shaffer *et al*. 1996). Most such forested stands in Chinchaga Wildland

Park have been identified as Old Growth ESAs as part of this project. Those old growth stands with a significant deciduous component provide appropriate nesting sites for goshawks. Foraging, or hunting, habitat is most accessible in areas where these sites are interspersed with natural canopy gaps and clearings such as wetlands, bogs, and windthrow.

Northern goshawks are raptors of mature to old mixedwood forest habitats. In addition, they require an interspersion of mature nest trees and open, ecotonal, or edge habitats for foraging. This requirement necessitates a landscape-level approach to identifying and conserving old growth forest stands of mixed canopies.

5.3.5 Trumpeter Swan

Trumpeter swans are the world's largest and rarest swan. Trumpeter swans once ranged in a wide band from Alaska to southern Quebec, and from Oregon to Mississippi. However, by the early 1900s, a combination of habitat destruction and hunting nearly extirpated the species from Canada and the lower 48 states. In the second half of the century, trumpeter swan populations have increased and, in 1996, the species was re-designated to the not-at-risk category by COSEWIC (Alvo 1996). In 1991, the trumpeter swan was assigned to Alberta's Red List of species at risk due to low population size and critical shortage of winter habitat. The species was reassigned to the Blue List in 1996 (AEP 1996), and are presently classed as being "At Risk" by Alberta Environment (2001). The trumpeter swan is currently also designated as a "threatened animal" under the *Alberta Wildlife Act*.

The present range of trumpeter swans in Alberta includes lakes, wetlands and marshes in aspen parkland, boreal mixedwood, and lower foothills areas of west-central and northwest Alberta, however observations have also been recorded from Elk Island (reintroduced population), Wood Buffalo, and Waterton national parks, the Bow River west of Calgary, and the Edson / Whitecourt area (James 2000). Most of Alberta's trumpeter swans breed in an area south of the Peace River that extends 80 km west and north, and 50 km southeast and southwest from the city of Grande Prairie. However, another primary area with large concentrations of nesting trumpeter swans is an area west and northwest of the town of Manning (north of the Peace River). This area includes Chinchaga Wildland Park, and many wetlands and lakes within the Park are used for nesting by trumpeter swans. As a matter of fact, Beyersbergen and Shandruk (1993) reported an increase in the Chinchaga / Whitemud River population from 5 in 1985 to 58 in 1990 and to 72 individuals birds in 1992.

Mitchell (1994) lists the basic breeding habitat requirements for trumpeter swan as consisting of the following features:

- Adequate room to take off (approximately 100 m);
- Accessible forage species;
- Shallow and stable water levels;
- Emergent vegetation;
- Structure for nest sites; and
- Low levels of human disturbance.

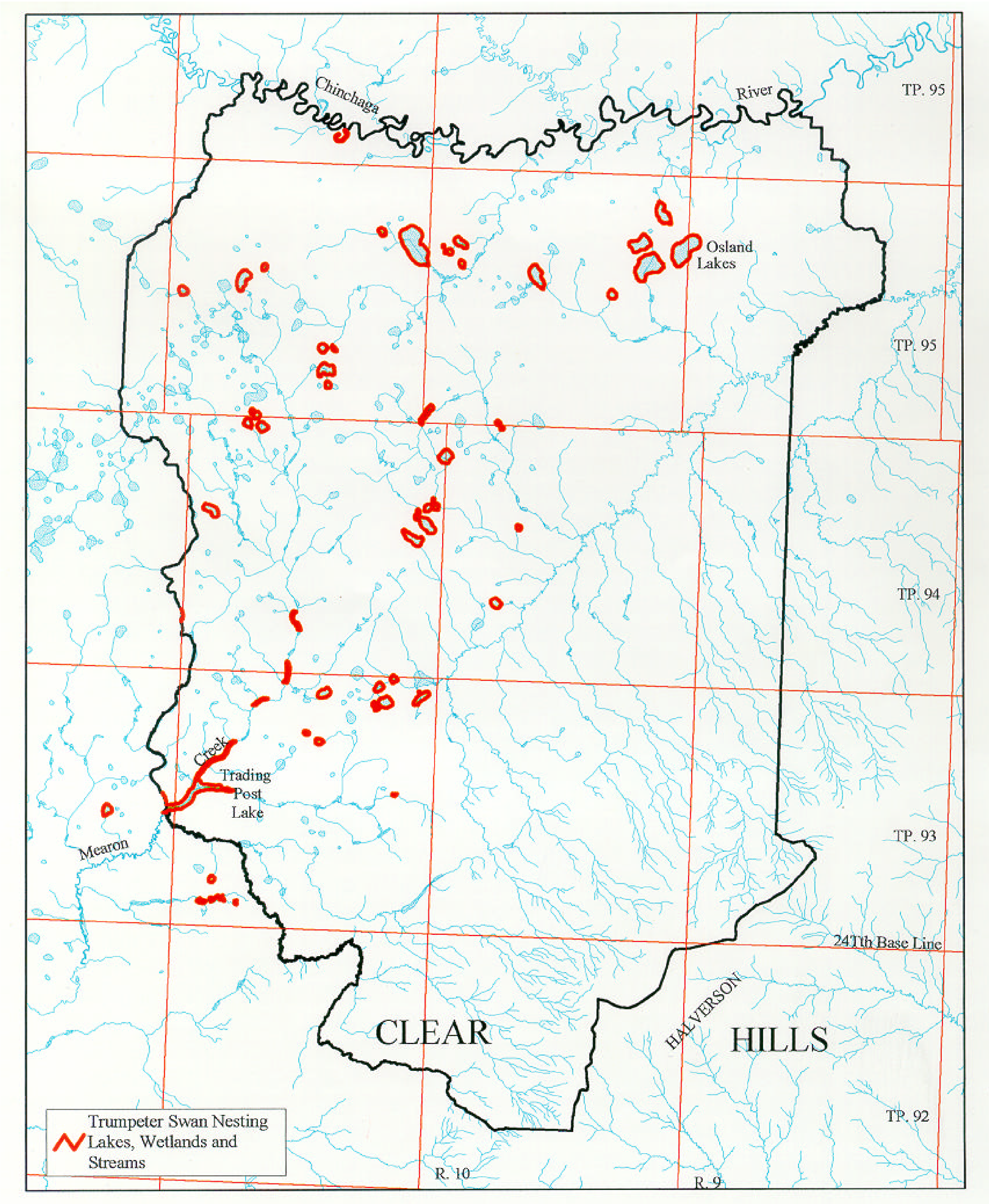
On the basis of these features, a number of basic habitat types are utilized by trumpeter swans in Chinchaga Wildland Park, including:

- Long, narrow lakes;
- Perched basins and associated terraces;
- Outflow streams in valley bottoms with connections to beaver impoundments or perched basins; and
- Oxbow wetlands associated with major river channels.

Nests are rarely located in upland areas, but are usually located near the shoreline on small islands, or on muskrat (*Ondatra zibethicus*) houses or beaver lodges. Within the Park, trumpeter swans have been recorded nesting on Osland, West, and Trading Post lakes, numerous unnamed lakes and wetlands, Mearon Creek, and the Chinchaga River (Alberta Environment, unpubl. data; Bentz *et al*. 1995; see ***Figure 8***). Individuals and pairs were also observed on numerous other wetlands during field work for this project, however it is not known whether these additional locations contained nesting birds, or simply birds flocking prior to autumnal migrations.

The highly territorial nature of trumpeter swans generally limit nesting densities to one breeding pair per wetland. However, multiple nesting does occur on lakes that are sufficiently large and spatially arranged to provide visual blocks to separate the pairs. This site fidelity results in very little movement from lake to lake, as breeding pairs utilize mostly one wetland and a buffer zone around it. Wetlands that are known to house trumpeter swan nests have been identified in this project as Environmentally Significant Areas.

Figure 8: Known Locations of Trumpeter Swan Nesting Wetlands in Chinchaga Wildland Park



6. GENERAL OBSERVATIONS OF STUDY AREA

Vegetation in Chinchaga Wildland Park is composed primarily of peatland bog complexes and mixedwood forests. While it is located in an outlier of the Foothills Natural Region, the vegetation in this area is heavily influenced by, and in places is more characteristic of, the Boreal Forest Natural Region. In the Lower Foothills portion of the Park, bog and fen ecosites comprise approximately 58.5% of the area, while upland forests comprise approximately 41.5% of the area. Among the bog and fen ecosite phases mapped, the K1 (Treed bog) is by far the dominant unit in the Lower Foothills, encompassing 10,294 ha of the Lower Foothills portion of the Park. Deciduous and deciduous-dominated mixedwood forests are the most common upland unit mapped in the Lower Foothills. Specifically, the E3 (Aspen-White spruce-Pine / Low-bush cranberry) and E2 (Aspen / Low-bush cranberry) ecosite phases encompass 11,901 ha and 9,176 ha, respectively.

In the Upper Foothills portion of the Park, the opposite trend is evident. Bog and fen ecosites comprise only 669.6 ha of the Upper Foothills, or 6.5% of the area. Upland forested sites are much more dominant in the Upper Foothills Subregion, with coniferous and conifer-dominated mixedwood forests encompassing 9,722.1 ha, or 93.5% of the area. The E2 (Aspen-White spruce-Pine / Tall bilberry / Arnica) and E1 (Pine / Tall bilberry / Arnica) ecosite phases encompass 4,745.3 and 3,509 ha, respectively.

Amongst these plant communities identified and mapped, one unique community that remained unclassified was also found in the Park. A small area of very rapidly drained, sandy substrate immediately south of the Chinchaga River has favored the development of an open and stunted aspen grove in rolling and hummocky topography. This site was only identified at this location, and is not presently described by either of the ecosite guides applicable to this area. As such, it remains “unclassified” at this point, and is identified as an Environmentally Significant Area.

The Park is noted for its provision of habitat for provincially significant species, including woodland caribou and trumpeter swan. Caribou inhabiting Chinchaga Wildland Park and adjacent areas in northwestern Alberta are non-migratory ‘boreal ecotype’ caribou. They depend heavily on terrestrial lichen forage, and concentrate their winter activity in lowland communities comprised of a mosaic of treed muskeg and moderately open scrub coniferous forest on poorly drained sites, interspersed with localized pine / spruce stands. Extensive upland forested sites are avoided by caribou in northern Alberta, thus emphasizing the significance of treed bog, shrubby bog, and pine / spruce / lichen ecosite phases (K1, K2, and D1, respectively) in the Park.

Trumpeter swans nest on numerous lakes and wetlands in Chinchaga Wildland Park. In the Park, they have been documented using a variety of habitats, including large lakes, small shallow wetlands, beaver impoundments, slow streams, and cut-off oxbows and meanders. Because trumpeter swans use individual waterbodies (or complexes) to meet all or most of their life requisites, these identified wetlands are very important.

A dominant wildlife feature of the Park is the extensive beaver activity. A combination of old, recent, and extant evidence of beaver activity is found almost ubiquitously wherever flowing water environments exist in the Park. These beaver impoundments provide habitat for other significant species such as trumpeter swan, while also significantly increasing structural and biotic diversity around wetland margins.

A number of Environmentally Significant Areas (ESAs) have been identified within the Park, based on their provision of key wildlife habitats and valued ecosystem components. ESAs were classified into the following broad categories:

1. Steep and gullied old growth forests;
2. Upland old growth forests;
3. Riparian corridors;
4. Patterned fen complexes;
5. Unique plant communities;
6. Meltwater channels;
7. Trumpeter swan nesting lakes and lake complexes; and
8. Woodland caribou winter habitat.

The extent of these ESAs in the Park is shown in Table 7.

Table 7: Extent and Distribution of ESAs in Chinchaga Wildland Park

ESA Class	Significance	Area (ha)	% of Park Area
Chinchaga River	Provincial	1,495	1.80
Caribou Winter Habitat Complex	Provincial	9,784	12.1
Steep and Gullied Old Growth Forest	Regional	1,215	1.50
Meltwater Channel	Local	560	0.70
Patterned Fen	Regional	32	0.04
Riparian Habitat	Regional	3,476	4.30
Trumpeter Swan Nesting Wetland	Provincial	753	0.94
Unique Vegetation Community	Local	143	0.18
Upland Old Growth Forest	Regional	5,578	6.90
TOTAL		**23,035**	**28.7**

In many areas, combinations of two or more of these features are present in individual ESAs. The attached map (Appendix 8) shows the locations of these ESAs in the Park. These ESAs have been selected because they contribute to the conservation of a number of Valued Ecosystem Components, such as local and regional hydrological regimes, peat accumulation, multi-layer forest structure, and coarse woody debris, in addition to providing habitat for focal wildlife species that require management attention (e.g., northern goshawk, trumpeter swan, grizzly bear, and woodland caribou) and others that are keystone species in these ecosystems (e.g., beaver).

Although the Park is isolated and remote, there is a considerable amount of low-impact disturbance in the area. In particular, seismic lines are prevalent features both within and adjacent the Park. They vary in frequency and intensity of use; those that are not used regularly have regenerated well. Tall shrubs such as green alder are common regenerated species in these linear corridors (see ***Figure 9***). The presence of these long, linear corridors that traverse most of the Park has the potential to negatively affect some wildlife species, particularly woodland caribou. Studies in northern Alberta have shown that wolves select such corridors for travel, and likely for hunting as well. It has been shown that caribou inhabiting areas dissected by seismic lines are more prone to predation than are caribou inhabiting undisturbed landscapes.

Figure 9: Seismic lines in the Park have naturally re-vegetated to varying stages, depending on the level and consistency of vehicular travel they sustain.

6.1 Data Gaps and Future Research Needs

One of the primary limitations of this project was the scale at which the mapping was completed. The interpretation of individual ecosite phase polygons occurred at 1:50 000 scale, a scale that works well for upland, forested units, but one that is not conducive to delineating wetland ecosite phases. Additionally, from time spent in the field it was evident that trees in the wetlands, if present, are on the cusp between shrub and tree layers (i.e., they are between six and nine meters in height), thus making it more unrealistic to differentiate between shrubby and treed ecosite phases with 1:50 000 scale photography. While interpretations were necessarily made on the classification of these wetland ecosite phases using the judgment and experience of ecosystem mappers, the confidence limits of such interpretations are not as high as might be needed for future resource planning. Detailed mapping and delineation of wetland ecosite phases can only be attained through interpretation of large-scale photography flown at scales of between 1:15 000 to 1:5 000, for example, coupled with minimal field-checking of interpretations.

Specific wildlife inventory information is still lacking for the Park. Currently, wildlife information is collected either coincidentally by researchers working outside the Park boundaries (e.g., caribou sightings by researchers flying over the Park but working in areas north and east of the Park itself), or by regional-level projects that encompass habitats within the Park (e.g., provincial trumpeter swan surveys that include habitats within the Park). The ***actual*** level and patterns of use of appropriate habitats even by large fauna such as woodland caribou and grizzly bear are not known. This paucity of data is even more pronounced for less conspicuous species and species groups such as furbearers, small mammals, songbirds, waterfowl, and herpetiles. Certainly, statistically sound wildlife inventories in the Park, conducted solely for this purpose, would be beneficial to future resource planning and conservation.

Among the plant communities identified and mapped in this project, the unclassified Aspen / Blueberry-Bearberry community warrants additional attention. This site was an isolated occurrence, and has been identified as a locally significant ESA in this report, however it may be upgraded to regionally significant if it is unique in the region, rather than just in the Park. Additional investigation will be required to make this determination.

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