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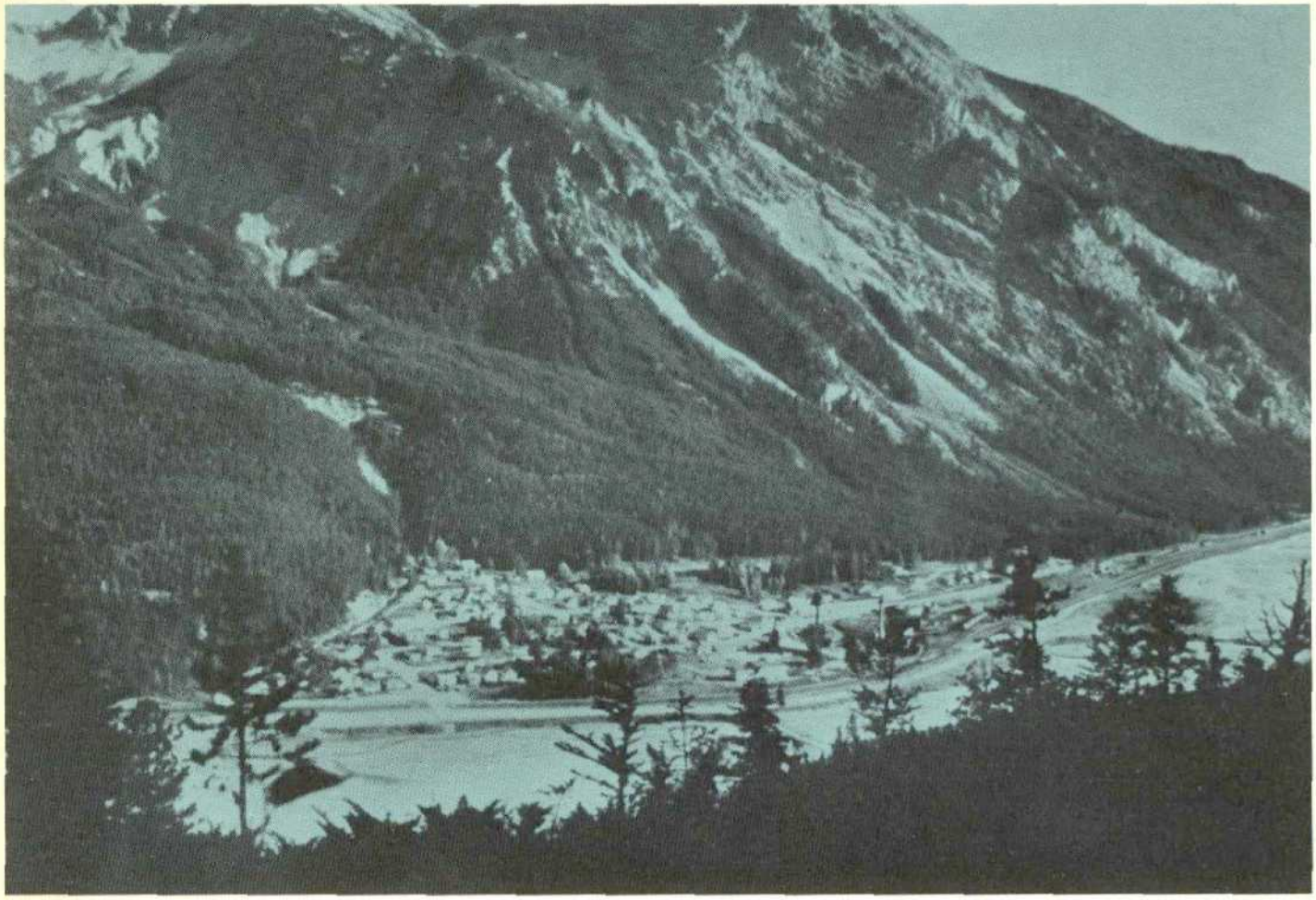
Biophysical (ecological) inventory of Yoho National Park, British Columbia, Canada



Canada

Biophysical (ecological) inventory of Yoho National Park, British Columbia, Canada

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LRRI Contribution No. 82-20
Alberta Institute of Pedology No. M-82-2

Research Branch
Agriculture Canada
1982

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Produced by Research Program Service

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PREFACE

The biophysical (ecological) inventory of Yoho National Park was undertaken at the request of Parks Canada to provide a map of landforms, soils and vegetation to facilitate their land management decisions. The development of integrated biophysical map unit concepts emphasizes the soil-vegetation relationships and displays these natural resources using one set of polygons.

Maps included with and constituting an integral part of this report provide a mechanism for extrapolating from site specific research data to an areal expression of the landscape and from an area of known response to a similar area where experience is limited. For example, if a new campground is to be located in a biophysical map unit of the same kind as one in which an existing campground is located, then over a similar period of time and with similar use, the landscape could be expected to respond to the new campground in much the same way as it did to the existing campground. The response of an existing campsite would likely suggest some of the weaknesses of that ecosystem to withstand the imposed use and thereby indicate some ameliorating measures which could be taken. This is one way the user, without specialized training, can benefit from the information contained herein.

This report provides a brief introduction to the natural history of Yoho National Park and then discusses the methodology used to prepare the maps. The map unit descriptions comprise the bulk of the report and provide a detailed description of the map units outlined in the legend. This report and map is a derivative document based on previous reports by the authors, and more detailed information may be gained by consulting these publications.

The smallest delineation on the map is approximately one-half centimeter square which at a scale of 1:50,000 corresponds to about 12 ha (30 acres). Delineations this small were made only to separate highly contrasting ecological areas; in most cases areas smaller than 1 centimeter square on the map or 25 ha (60 acres) on the ground were not delineated. Thus, field inspections should preceed management decisions involving an area of less than 25 ha, or a tract where a contrasting ecological area of up to 25 ha would affect the decision. Because of the variability of ecological factors over very short distances, this report does not substitute for on-site inspections by qualified specialists. It should, however, reduce the number of areas to be considered or allow management decisions for more or less extensive areas.

ACKNOWLEDGEMENTS

The Biophysical (Ecological) Inventory of Yoho National Park (Canada) was compiled under the auspices of Agriculture Canada, Land Resource Research Institute, Soil Survey, Edmonton, in cooperation with the other member agencies of the Alberta Institute of Pedology. Financial assistance was provided by the Department of Indian and Northern Affairs, Parks Canada, under contract No. WR 42-75. The University of Alberta provided laboratory and office space.

The authors wish to express their appreciation to Parks Canada staff whose assistance and forbearance is gratefully recognized, in particular: P.A. Benson, C. Zinkan and D.L. Day, Resource Studies Managers from Western Region Office: Park Superintendent J.R. Pilon; K. Seel and G. Rutherford for assistance with drafting of the maps and R. Robertson for useful discussions.

To J. Tajek and I. Fisher go thanks for map checking and editing, and to C. Lirette and M.A. Hooper for typing and to P.L. Achuff, W.D. Holland, J.A. Shields and W.W. Pettapiece thanks for a critical review of the manuscript.

The cooperation and support of the members of the Alberta Institute of Pedology is recognized.

SUMMARY

The biophysical (ecological) inventory of Yoho National Park covers an area of just over 1300 square kilometers situated around 50° 50'N and 116° 30' W in southeastern British Columbia. This rugged mountainous area west of the Continental Divide has peaks up to 3540 m asl with most valley bottoms above 1000 m asl.

Climate of the area is characterized by very changeable weather, being influenced by both dry Polar Continental and moist Polar Maritime air masses. A mean annual temperature of 2.8° C and total yearly precipitation of about 560 mm (40% as snow) is reported in the valley bottoms with considerably cooler and moister conditions prevailing near the tree line.

The contorted, sedimentary geologic strata in Yoho have been strongly modified by glacial and post-glacial erosion. The resulting medium textured, calcareous till along with fluvial and colluvial deposits provide the parent materials for most soils in the Park.

The biophysical map unit concepts were developed by first dividing the landscape into Montane, Lower Subalpine, Upper Subalpine and Alpine vegetation zones. Within these zones glaciofluvial, fluvial, glaciolacustrine, morainal, and colluvial landforms were recognized. Parameters, besides vegetation zone and landform, used to define the concept of specific map units include: texture and coarse fragments, drainage class, soil taxonomy as it reflects ecological groupings, and changes in vegetation type (which often reflect moisture regime). Integration of these soil and landscape characteristics resulted in ecological landscape areas which were commonly repetitive.

The map legend consisted of 64 map unit concepts which were used to identify map delineations, some as small as about 12 ha in situations where changes in the landscape were highly contrasting and abrupt. The report provides map unit descriptions for each of the map units developed for this inventory.

Good correlation occurs between soils and vegetation where the landforms are sufficiently stable to allow the soil horizons to develop and where vegetation disturbance has been sufficiently small to allow near climax vegetation. In the Montane zone white spruce and Douglas fir communities are associated with Eluviated Eutric and Orthic Eutric Brunisols, whereas the spruce-subalpine fir forests of the Lower Subalpine zone are associated with Eluviated Eutric Brunisol and Orthic Humo-Ferric Podzol soils. In the Upper Subalpine zone spruce-subalpine fir forests with open canopies are associated with Orthic Humo-Ferric Podzols with thin Ah horizons. Alpine zone heath tundra vegetation is associated with Sombric Humo-Ferric Podzol soils with thicker Ah horizons.

RESUME

L'étude biophysique (écologique) du parc national de Yoho au sud-est de la Colombie-Britannique couvre un territoire d'un peu plus de 1 300 kilomètres carrés situé à une latitude et une longitude de 50°50' N et 116°30' O. Cette région accidentée, qui sétend à l'ouest de la ligne continentale de partage des eaux, dresse ses sommets jusqu'à 3 540 m d'altitude et le fond de la plupart de ses vallées se situe à plus de 1 000 m.

Le climat de la région est caractérisé par un climat trè changeant, influencé à la fois par les masses d'air continentales polaires sèches et maritimes humides. Dans les vallées, la température moyenne annuelle est de 2,8°C et la précipitation totale d'environ 560 mm (dont 40% sous forme de neige); les conditions météorologiques près de la limite forestière sont considérablement plus fraîches et humides.

Les strates géologique sédimentaires toutmentees du parc Yoho ont été fortemenet modifiées par l'érosion glaciaire et post-glaciaire, produisant un till calcaire de texture moyenne ainsi que des dépôts fluviaux et colluviaux, qui constituent les matériaux d'origine de la plupart des sols du parc.

Les unités cartographiques biophysiques ont été établies d'abord en divisant la paysage et 4 zones de végétation montagneuse, subalpine inférieure, subalpine supérieure et alpine. Puis ces zones principales ont été subdivisées en zones fluvio-glaciaires, fluviales, glacio-acustres, morainiques et colluviales selon le type de modelé.

En plus de la végétation et du relief, les paramètres utilisés dans la définition des unités cartographiques particulières comprennent la texture de la présence de fragments grossiers, la classe de drainage, la taxinomie des sols reliée aux groupements écologiques et les changements dans le type de végétation (souvent reflet du régime hydrique). L'intégration de ces caractères des sols et du paysage a produit des zones de paysage écologiques assez répétitives.

La légende de cette carte comporte 64 concepts utilisés pour identifier les délimitations des zones dont les plus petites mesurent à peine 12 hectares, dans les situations de paysage fortement contrasté et abrupt. Le rapport définit chacune des unités cartographiques élaborées durant cet inventaire.

Une bonne corrélation s'observe entre des sols et la végétation là où le sol est suffisamment stable pour permettre la formation d'horizons et où les perturbations de la végétation n'ont pas empêché la formation d'un état quasiclimacique. Dans

la zone montagneuse, les communautés a épinette blanche et a sapin de Douglas son associées à des brunisols eutriques élavés et des brunisols eutriques orthiques, tandis que les forêts à épinetter et à sapins de la zone subalpine inférieure croissent sur des brunisols eutriques éluviés et des podzols humoferriques orthiques. Dans la zone subalpine supérieure, les forêts claires d'épinette et de sapin sont associées à des podzols orthiques humo-ferrique à horizon Ah Mince. La toundra à Ericacées de la zone alpine est associée à des podzols sombriques humo-ferriques à horizon Ah plus épais.

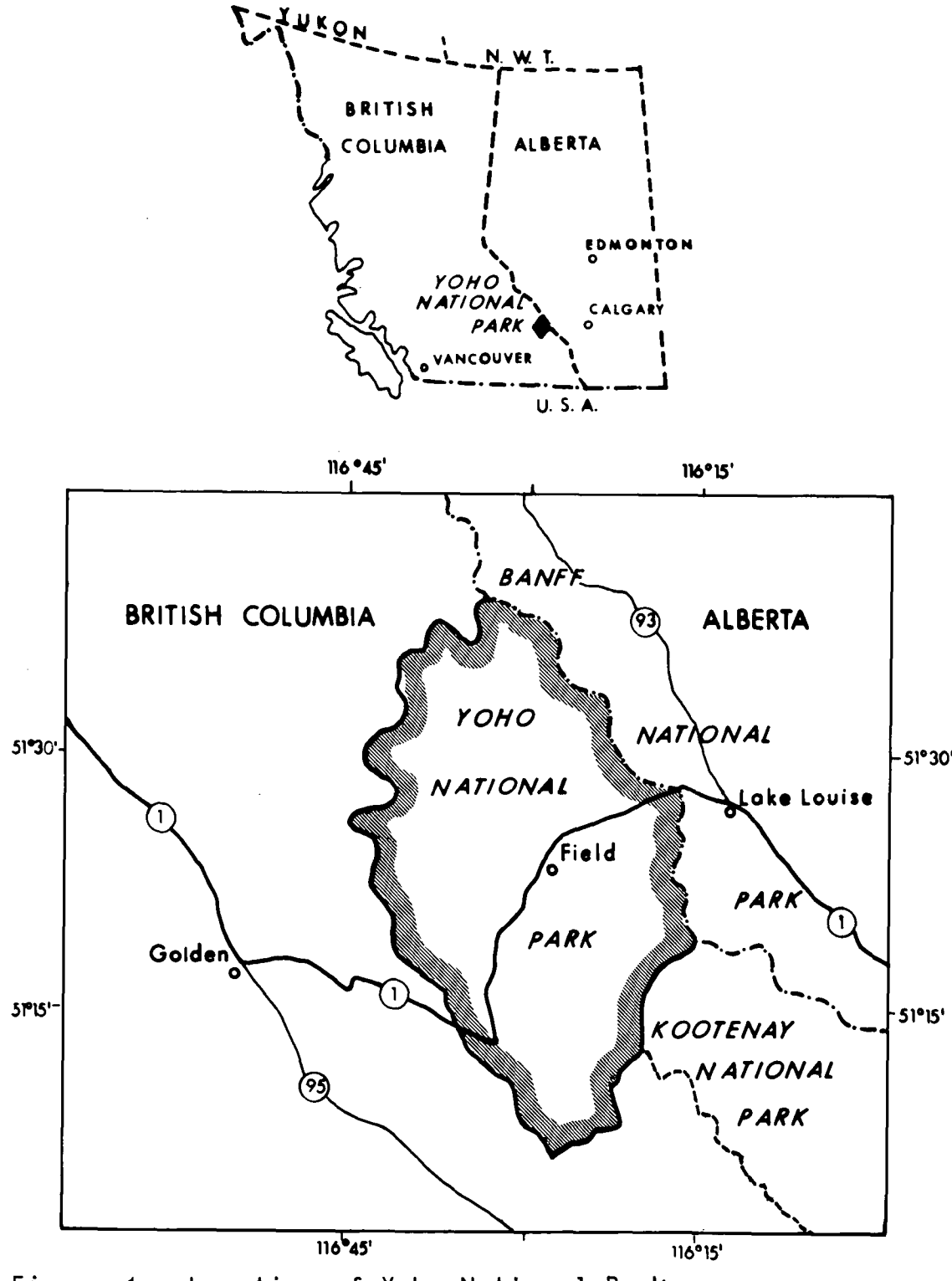

Figure 1 - Location of Yoho National Park.

INTRODUCTION

LOCATION AND EXTENT

Yoho National Park is located in southeastern British Columbia (Fig. 1). The Park is shaped roughly like a diamond with its northernmost point at approximately 51° 48′ N, its most easterly point at approximately 116° 15′ W, its southernmost point at approximately 50° 57′ N, and its most westerly point at approximately 116° 49′ W. The northeastern Park boundary is situated on the Continental Divide coincident with the British Columbia-Alberta border and Banff National Park, and to the southeast is bounded by Kootenay National Park along a portion of its border.

The area of Yoho National Park is about 1313 square kilometers. It is about 35 km wide at its widest east-west dimension and about 56 km at its longest north-south dimension.

PHYSIOGRAPHY AND GEOLOGY

Yoho National Park is situated in the Continental Ranges of the Southern Rocky Mountains which is within the Eastern System of the Cordilleran Physiographic Region (Bostock 1968). The rugged terrain of Yoho National Park was sculptured from stratified sedimentary rocks by alpine glaciers and subsequently modified by ongoing erosion and weathering (Fig. 2). The folded and contorted sedimentary and metasedimentary rocks which comprise most of the exposed bedrock are generally calcareous except for the massive non-calcareous quartzites in the Lake O'Hara area (Douglas et al. 1968, Cook 1975). Glaciation has left a mantle of drift covering the valleys, excluding the steep rock walls, to an elevation of about 2200 m asl and often higher (Drew 1975, Fox 1974).

Water erosion and mass wasting have also been important in shaping the modern landforms of Yoho National Park. Fluvial fans and terraces and colluviating landforms evident throughout the Park are indications of the importance of this erosion and weathering.

CLIMATE

Climate in Yoho National Park is determined by its position immediately west of the Continental Divide where conditions are moderated by the Maritime air masses from the Pacific coast.

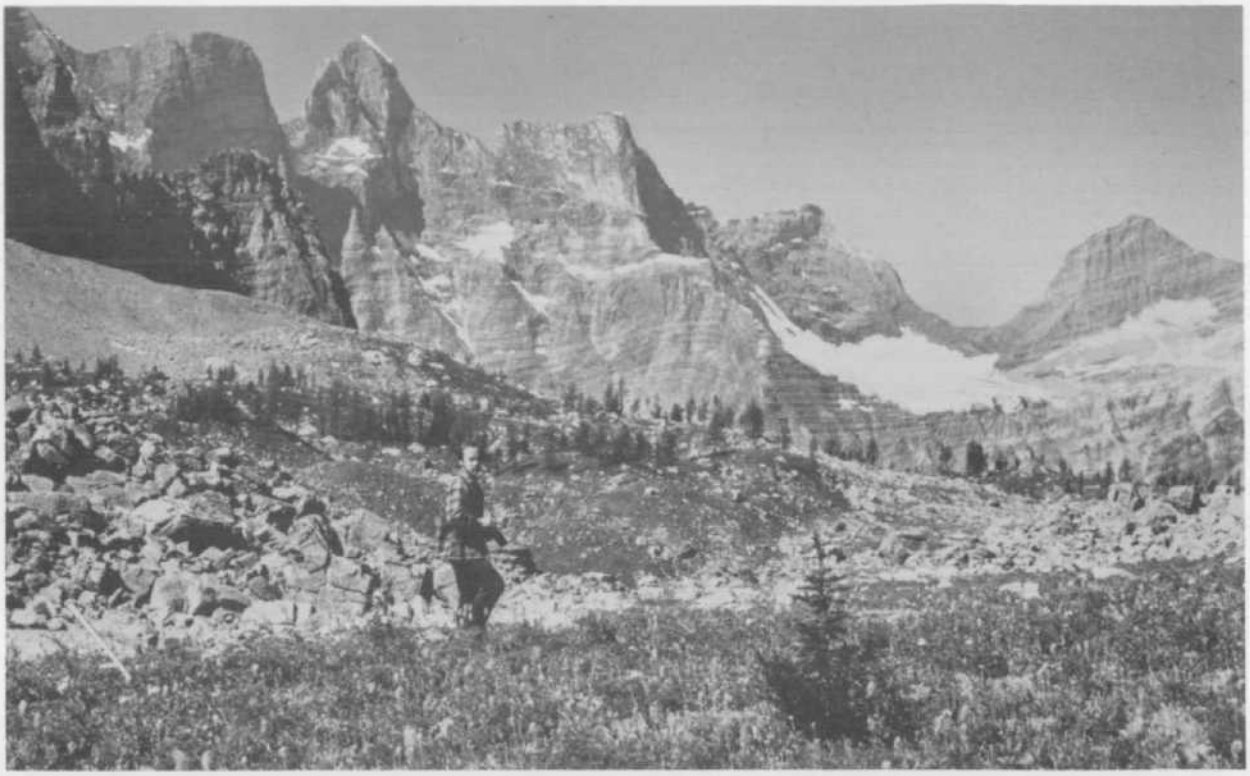

Figure 2. Rugged Terrain of Yoho National Park sculptured from sedimentary rocks by glaciers and modified by erosion (Goodsir Mountains).

Changeability of the weather is a very important climatic characteristic and is largely determined by frequency and type of air masses affecting the area. In this portion of the Canadian Rockies weather is determined mainly by two air masses:

1. Polar Continental air masses which originate in the Yukon and Alaska. These air masses are cold and dry in the winter and warm and dry in the summer. Southward movement of these air masses is parallel to the trend of the major valleys, and thus largely unrestricted.

2. Polar Maritime air masses which originate over the Pacific Ocean. As these moist, warm air masses move eastward across the mountain ranges, they become progressively cooler and drier, losing their moisture through precipitation on the west facing slopes (Chapman 1952, Heuser 1956, Janz and Storr 1977).

The local climate of Yoho National Park is characterized by a mean annual temperature of 2.8° C with five winter months having mean temperatures below 0° C and four months having mean temperatures higher than 5° C. In July the mean temperature is usually higher than 15° C. Total annual precipitation is about 500 mm of which 40% falls as snow. According to criteria suggested by the Soil Research Institute and Plant Research

Institute staff (1972), the climate is referred to as humid to subhumid cold cryoboreal.

VEGETATION

General Vegetation Pattern

About 50% of the park is covered by coniferous forest. Bare rock, mostly above timberline occupies another 30%. Glaciers, ice and snow cover another 10%, and the remaining 10% is covered by non-forest vegetation. There are no extensive areas of grassland or scrub. Non-grassy meadows are numerous and varied but at the same time small and limited in their total effect on the landscape (Kuchar 1978).

Lodgepole pine forests and spruce forests are the most widespread vegetation types. Douglas fir, whitebark pine and subalpine fir and/or subalpine larch forests are less common. Western red cedar forests occur locally in the western portion of the Park (Kuchar 1978).

Vegetation Zonation

In Yoho National Park the Montane-Subalpine transition occurs at about 1600 m asl, which is close to the major soil transition from dominantly Brunisolic soils to those with a transitional Brunisolic-Podzolic character. Roughleaf ricegrass, Douglas fir and trembling aspen, which provide convenient clues to identify the Montane zone, rarely occur above 1600 m asl.

Natural timberline in Yoho occurs at about 2100 m asl, but there is some controversy in the literature (Love 1979) as to what constitutes Alpine versus Subalpine. In Yoho it was possible to make the separation quite distinctly using floristic criteria. Plants such as golden fleabane, alpine sandwort, black alpine sedge and western anemone are common in the Alpine zone whereas stickseeds, cow parsnip and meadow rue are indications of the Subalpine zone (Kuchar 1978).

For the purposes of this report Montane, Lower Subalpine, Upper Subalpine, and Alpine zones were recognized. Most biophysical map units fell exclusively into one or the other of these zones but a category of Montane-Subalpine was defined to identify those map units which were identified within both the Montane and the Subalpine. The Subalpine zone, as recognized by the preceding criteria, was subdivided into a Lower Subalpine zone having greater than 30% canopy cover and an Upper Subalpine zone having less than 30% canopy cover.

SOILS

Soils in Yoho National Park are generally derived from medium textured calcareous materials. The relatively thin profile development of most soils reflects the humid and subhumid climate and unstable geomorphic conditions resulting from steep slopes. A ubiquitous layer of wind transported material has been deposited throughout the Park and wherever stable landforms occur the upper solum is developed in this relatively stone-free material. Horizons appear to develop more quickly and strongly in this loose, low bulk density material than in the adjacent dense till. The generally thin solum and often thin unconsolidated material over bedrock provide a medium for plant growth which is fairly susceptible to destruction through erosion or other disturbances.

The soil forming factors of climate, living organisms, topography, nature of the parent material, and time (Jenny 1941, Brady 1974) contribute to the different kinds of soils in Yoho National Park. To provide an overview, soils of Yoho National Park can be grouped into five broad categories distinguished on morphological evidence of their genetic development. These groups associated with and identified according to the following convention are:

1. Soils of the Montane zone

2. Soils of the Montane-Subalpine zone

3. Soils of the Subalpine zone

4. Soils of the Upper Subalpine zone

5. Soils of the Alpine zone

The Brunisolic soils in the Montane zone grade with increasing elevation to Podzolic soils in the Lower and Upper Subalpine and further to Sombric Humo-Ferric Podzols in the Alpine zone. Because of unstable geomorphic conditions associated with steep slopes and floodplains, soils of the Montane-Subalpine zone are classified as being dominantly in the Regosolic and Gleysolic Orders.

MAN AND THE PARK

The completion of the Canadian Pacific Railway in 1885 and the creation of, first a park reserve of ten square miles (26 square kilometers) in 1886, and finally a National Park in 1911, were important events in the history of the area now known as Yoho National Park (Getty 1972). These events and associated activities have resulted in modification of the landscape and ecosystems resulting from mining, road and townsite construction, lumbering, and fires (Fig. 3). The attractriveness of the magnificent scenery and extensive areas of wilderness to

backpackers and hikers results in continued pressure on the ecosystems within Yoho National Park. This biophysical inventory was undertaken to identify and locate the natural resources of the Park and in this way to assist parks personnel in making appropriate decisions.

Figure 3. Construction of railways, highways, townsites and other developments influence the ecosystems and aesthetics of the area. The Upper Spiral Tunnel on the Canadian Pacific Railway, Yoho National Park.

METHODOLOGY

Independent inventories of the vegetation and soils-landforms of this Park were previously conducted by Kuchar (1978) and Coen et al. (1977) respectively. A brief description of the mapping philosophies of these two inventories will provide background useful in appreciating the information in this combined biophysical report.

VEGETATION CLASSIFICATION AND MAPPING

Philosophy

In an extensive vegetation survey the aim is to maximize the general information within the time constraints. It was impossible to gather exhaustive data from many sites, and inappropriate to gather very detailed data at a few sites while ignoring the remainder, or to extrapolate from the few intensive sites. Consequently it was necessary to obtain basic and widescale information: what is there, roughly its abundance and general environmental conditions. A little data from many stands will usually be much more informative than a great deal of data from a small number of stands, and will bring one much nearer to a correct interpretation and description of the vegetation. Kuchar (1978, p. 62) states:

> "Bearing in mind from the outset that this was part of an inventory program, I came, I saw, I classified. In contrast some plant ecologists (e.g. Daubenmire 1952) do not classify what they see but prefer to extrapolate potential climax vegetation types. Although this has value in characterizing habitat potential, and can help to reconstruct successional stages, it is useless for the very practical purpose of telling us what is there now. It doesn't help a bit, for example, to call an area Douglas fir-red cedar climax when in actual fact it is young lodgepole pine."

Classification of Yoho Vegetation

Vegetation Type was selected as the basic unit of classification in Yoho National Park. Vegetation Type is a level in the classification hierarchy that stresses growth form in the dominant layer together with site conditions, especially soil moisture. The Alliance of European phytosociology has approximately the same rank as Vegetation Type. Each Vegetation Type has one or more Plant Communities, distinguished on the basis of dominant species in the most strongly developed layer or layers. In some cases a difference in dominants within just one layer will suffice to

distinguish communities; in other cases all layers may have to be different before the community would be called different. Vegetation classification is an imprecise science without hard and fast rules. They would only create more inconsistencies, awkward splits or unions of plant communities. In practice, the Vegetation Types of Yoho were first identified and then split (where necessary) into smaller units rather than identifying all the Plant Communities and then grouping into Vegetation Types.

Mapping of Yoho Vegetation

In his lucid guide to mapping vegetation, Kuchler (1967) suggested these steps:

1. Outline on airphotos all units of vegetation differing from one another in physiognomy.

2. Tentatively establish the structure of the observed vegetation types, especially their height and density; also determine environmental features like slope and exposure.

3. In the field, analyze stands of each vegetation type, using airphotos to locate them and to establish or confirm their boundaries.

4. Extend the information from the inspected units to the entire area, and on this basis draw the vegetation map directly from the photos.

The method used to map Yoho vegetation differed in one significant respect; very few units were outlined on the airphotos before the field inspections were made. This decision resulted from previous experience indicating that more lines might well be drawn around topographic discontinuities than around genuinely different vegetation units. Some of the major Vegetation Types were exceedingly difficult or impossible to discern on black-and-white small scale airphotos such as were available, therefore they could be identified only through field inspection and thence approximate delineation on airphotos. When all vegetation map units had been satisfactorily delineated, they were transferred by J.C. Sproule and Associates Ltd. on to a base map prepared by splicing and enlarging National Topographic Series maps. Table 1 provides a definition of the vegetation map units on the maps (Kuchar 1978) from which the derived biophysical maps were synthesized.

Table 1 - Vegetation map units (1:25,000 scale)

MAJOR VEGETATION GROUPS & SUBGROUPS	MAP SYMBOL	VEGETATION TYPE
1. UPLAND FOREST		
a. Moist Montane	SDC	white spruce-Douglas fir-western red cedar (-western hemlock)
	SFDy	white spruce-subalpine fir-Douglas fir-western yew
b. Intermediate Montane	SD, SD	white spruce-Douglas fir
	DS	Douglas fir-white spruce
	BDS	paper birch-Douglas fir-white spruce
	TS	aspen-balsam poplar-white spruce
c. Dry Montane	BT	paper birch-aspen
	TD	aspen-Douglas fir
	PT	lodgepole pine-poplar
	PD	lodgepole pine-Douglas fir
	DP	Douglas fir-lodgepole pine
	D, D	Douglas fir
	DN	Douglas fir-limber pine
d. Montane-Subalpine	P	lodgepole pine
	PS	lodgepole pine-spruce
	SP	spruce-lodgepole pine
e. Low-mid Subalpine: mostly closed canopy	SF-SF	Engelmann spruce-subalpine fir
	PSF	lodgepole pine-spruce-fir
f. High Subalpine: mostly open canopy, numerous glades	WhP	whitebark pine
	F, F	Subalpine fir
	aL	Subalpine larch
2. FLUVIAL FOREST		
	SDP	white spruce-Douglas fir-lodgepole pine on old alluvial fans
	SC	white spruce-western red cedar
	Se	white spruce on ± permanently waterlogged soil
	PSj	lodgepole pine-white spruce on floodplain
	Sd	white & hybrid spruce (-lodgepole pine) on coarse dry alluvium
	S	white & hybrid spruce on moist to fairly dry alluvium
	ST	white spruce-poplar on moist alluvium
	T	aspen-balsam poplar on moist alluvium
3. UPLAND SCRUB & MEADOW		
a. Montane-Subalpine	A	avalanche scrub & meadow
	rec(A)	recently burned avalanche scrub
	rec(D)	recently burned montane forest
	rec(SF)	recently burned low-mid subalpine forest
	rec(F)	recently burned high subalpine forest
	log	recently logged subalpine spruce-fir forest
b. Alpine	HF	heath tundra with sparse alpine fir
	HaL	heath tundra with sparse alpine larch
	Hm	alpine (-high subalpine) forb meadows & snowbeds
	H	heath tundra
	rec(H)	recently burned heath tundra
	Hx	stony tundra
4. FLUVIAL SCRUB & MEADOW	w	wetland scrub, sedge meadows & bog communities
	Aw	tall willow scrub
	rec(w)	recently burned wetland meadows
	rec(Se)	recently burned alluvial white spruce
	G	yellow dryad on fresh alluvial gravel & sand
5. OTHER TYPES	vc	vegetated cliffs
	vt	thinly colonized talus & moraine
	X	rock lichen tundra
	Λ	barren rock & snowfield
	o	open water, some with submergent vegetation
	z	seriously man-disturbed vegetation

* from Kuchar (1978)

SOIL CLASSIFICATION AND MAPPING

Philosophy

The Canadian System of Soil Classification (Canada Soil Survey Committee 1978) was used to classify the soils in Yoho National Park because it provides a standard hierarchical taxonomic system for identifying soils (Coen et al.1977). While often providing useful criteria upon which to base map unit separations, the classification was not used solely to determine the attributes or location of those separations. The soil map unit separation criteria, as much as possible, reflected the perceived needs of various Parks users. As with any undertaking, the amount of information obtained is governed by the amount of effort (or funding) available. Thus, not all the questions for which Parks user groups would like answers were reflected in the criteria chosen to separate soil map units.

The precision with which a landscape segment can be located both on the map and in the field is governed largely by the scale of the map. The scale of 1:50,000 was chosen as a compromise between the desired smallest delineation and the cost of increased detail. At the scale used, any contrasting soil or landscape segment smaller than 8 to 12 ha could not be shown on the map. As a consequence, land use decisions related to areas smaller than can be delineated on the map should be made only after on-site examinations are carried out.

Classification of Yoho Soils

The soil map unit concepts used in Yoho are described and defined in terms of Subgroups in the Canadian System of Soil Classification (Canada Soil Survey Committee 1978). Conceptually, the map units were defined in terms of slope, texture, calcareousness, coarse fragment and drainage phases of Subgroups. Many separations were precise enough to conform to the limits of the soil series category. However, establishing, defining and naming series is very time consuming and should be undertaken only in the context of extensive areas. Establishment of soil series concepts was not considered essential to the full use of the soil survey information from Yoho National Park and therefore was not undertaken. Soil mapping concepts were established by subdividing broad taxonomic groupings rather than grouping soils identified at low taxonomic levels.

Mapping of Yoho Soils

An understanding of the relationships between changes in soil, vegetation and landform is mandatory when mapping soils in mountainous wildlands. The most useful tool to extrapolate site information over an extended area is the aerial photograph. Since the ground can seldom be seen through the vegetation cover, and even then it is impossible to "see" the profile morphology. Consequently it is necessary to correlate the non-soil information of vegetation and landforms to soil information such as horizon sequence, reaction, parent material, and texture.

Aerial photographs taken in August 1973 at a scale of 1:25,000 were used as the basic field tool for delineating soilscape areas. Initially a brief reconnaissance was used to establish a tentative legend to identify soilscape map units. Using the tentative legend, areas were then delineated and identified on the aerial photographs. Field checking, using soil pits and any other available exposure, allowed refining of the aerial photographic interpretations and the legend. As the differentiating characteristics for individual map units were finalized, the legend was altered to fit those concepts.

The landscape was first divided on the basis of landforms (Table 2). Thus, for example, moraines were separated from glaciofluvial deposits, floodplains, fluvial fans, glaciolacustrine deposits and colluvial deposits. The landforms were then subdivided on the basis of materials; calcareous versus non-calcareous and medium versus coarse texture. The resulting terrain units were then further subdivided into soilscape groups[1] on the basis of soil development and climate as indicated by vegetation. These soilscape group concepts were identified on the maps by local geographic names (Coen et al.1977).

The soilscape map units,[2] as delineated on the aerial photographs, were continuously updated as the map unit concepts evolved. When the map unit concepts were finalized, the map unit boundaries as delineated on the aerial photographs were representative of those final map unit concepts. Representative pedons (soil profiles) were described and sampled to characterize the map units. Thus,

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[1]Soilscape group - A defined and named aggretate of soil bodies grouped together on the basis of similar parent materials, drainage, soil and profile development (Coen et al. 1977, glossary).

[2]Map unit, soilscape - A defined and named aggregate of soil bodies occurring together in an individual and natural characteristic pattern over the land surface. A subdivision of soilscape groups based on variations in texture, coarse fragments, and depth to bedrock (lithic vs. non-lithic). Taken from Glossary in Coen et al.(1977).

Table 2 - Major characteristics of soilscape map units (from Coen et al. 1977)

TERRAIN UNIT LANDFORM	MATERIALS	SOILSCAPE GROUP	SOILSCAPE MAP UNIT	SOIL SUBGROUP CLASSIFICATION	TEXTURE	COARSE FRAGMENTS	DRAINAGE	VEGETATION ZONE	COMMENTS
Glaciofluvial terrace	Calcareous stratified LS-SiL	Haygarth	HR1	Eluviated Eutric Brunisols	LS	less than 10%	D1-D2	Subalpine	Outwash sand; intergrade to Humo-Ferric Podzols. Coarse fragments generally less than 5%; mainly gravels.
			HR2	Eluviated Eutric Brunisols	SiL / SL	10 to 20%	D2	Subalpine & Montane	Ice contact stratified drift; valley train deposit.
	Calcareous stratified G & VGLS	Takakkaw	TA1	Eluviated Eutric Brunisols & Humo-Ferric Podzols	SiL / GSL	0 to 20% / more than 20%	D1-D2	Subalpine	Occasionally hummocky glaciofluvial included; less gravel near surface.
Floodplain	Calcareous stratified FSL-SiL over GSL	Kicking Horse	KI1	Orthic Regosols & Cumulic Regosols	FSL-SiL / GSL	0 to 20% / more than 20%	D3	Montane	Often droughty because of low water table if no rain; generally less than 75 cm to gravelly or very gravelly strata.
			KI2	Gleyed Orthic Regosols & Gleyed Cumulic Regosols	FSL-SiL / GSL	0 to 20% / more than 20%	D4	Montane	Generally less than 75 cm to gravelly or very gravelly strata
		Otterhead	OT1	Eluviated Eutric Brunisols	FSL-SiL / VGSL-VGLS	0 to 20% / more than 20%	D2	Montane	Generally less than 25 cm to gravels, some D3.
	Calcareous stratified SL & SiL alluvium	Beaverfoot	BC1	Rego Gleysols (peaty)	FSL-SiL	less than 5%	D6	Montane	Possibly some D5, frequently flooded.
			BC2	Orthic & Rego Gleysols	SiL	less than 5%	D6	Montane	Possibly some D5, frequently flooded.
			BC3	Rego Gleysols	SL-FSL / GSL	0 to 20% / more than 20%	D5-D6	Montane	Some areas artificially drained.
Fan*	Calcareous stratified coarse textured gravelly and very gravelly alluvium	Watchtower	WR1*	Orthic Regosols and Cumulic Regosols	GSL-GLS	20 to 50%	D2	Montane & Subalpine	Effervescent to the surface
			WR2*	Cumulic Regosols & Orthic Regosols	GL-GSL	more than 40%	D1-D2	Subalpine & Montane	Steeply sloping; cobbles & boulders common; dark colored, non-turfy Ah; often mechanical mixture of raw organic matter and mineral matter.
			WR3*	Orthic Regosols & Cumulic Regosols	SiL / GSL	less than 20% / 20 to 50%	D2	Montane	Often few coarse fragments near surface; gravelly below.
			WR4*	Gleyed Orthic Regosols & Gleyed Cumulic Regosols	SiL	less than 20%	D3	Montane	Deep medium textured; calcareous to surface; few coarse fragments.
			WR5*	Gleyed Orthic Regosols	GFSL-GSiL	20 to 50%	D4	Subalpine & Montane	Gleyed equivalent of WR3; generally less than 5% coarse fragments
		Clawson	CO1*	Orthic Eutric Brunisols	GSiL / VGSL	20 to 50% / approx. 50%	D2	Montane	Represents the few stable fans in Yoho.
		Hoodoo	HO1*	Rego Gleysols & Orthic Gleysols	SiL-FSL	less than 10%	D5	Montane	Few coarse fragments, especially near surface.
	Non-calcareous stratified coarse textured gravelly and cobbly alluvium	Opabin	OP1*	Cumulic Regosols	VGSL-SiL	20 to 50%	D3	Subalpine	Coarse fragments are mainly quartzite (Gog formation); Lake O'Hara area.
		Mollison	MO1*	Orthic Humo-Ferric Podzols	GSL-GLS	20 to 50%	D2-D3	Montane	Coarse fragments are mainly granitic gravels and cobbles; Ice River Valley.
		Wiwaxy	WI1*	Orthic Humo-Ferric Podzols	L / VGLS	approx.5% / more than 50%	D3	Upper Subalpine "Meadow"	Subalpine meadow below tree line; frost hollow.
Lacustrine veneer	Calcareous well sorted silts	Dennis	DS1	Eluviated Eutric Brunisols	SiL-SiCL	less than 10%	D2	Montane & Subalpine	Small glaciolacustrine pockets often approx. 75 cm thick over till.
Moraine	Calcareous non-stratified medium textured stony till	Ottertail	OL1	Eluviated Eutric Brinisols	SiL	10 to 20%	D2	Montane	"Washed till", lime at 40 to 75 cm; warmer and drier climate than OG1.
			OL2	Gleyed Melanic Brunisols & Gleyed Eutric Brunisols	SiL	less than 5% / 20 to 50%	D4	Montane & Subalpine	Some members of this map unit have gravels at or near the surface.
		Ogden	OG1	Orthic Humo-Ferric Podzols & Eluviated Eutric Brunisols	SiL	less than 20%	D2	Subalpine	Mainly at higher elevations in the side valleys.
			OG2	Orthic Humo-Ferric Podzols	SiL	less than 5% / approx. 20%	D2	Subalpine	Silty surficial deposit over silt loam till.
		Tocher	TO1	Cumulic Regosols	L-SiL	less than 50%	D2	Subalpine & Montane	Eroding steep slopes;calcareous to mineral surface.
	Calcareous non-stratified medium and coarse textured stony till	Vanguard	VA1	Rego Humic Gleysols (peaty)	SiL-SL	5 to 20%	D5-D6	Subalpine	Poorly drained associate of OG1, CM1, and OH1.
		Odaray	OD1	Orthic Humo-Ferric Podzols	SiL-SL	20 to 50%	D2	Upper Subalpine	Subalpine larch, subalpine fir, heather; thin "turfy" Ah; 2000 to 2150 m a.s.l.
		Schaffer	SK1	Sombric Humo-Ferric Podzols	SiL-GSL	less than 50%	D2-D3	Alpine & "Krummholz"	"Turfy" Ah; generally above 2150 m a.s.l.; complex & variable soil & vegetation patterns.
	Calcareous coarse textured stony till	Cathedral	CM1	Eluviated Dystric Brunisols & Orthic Humo-Ferric Podzols	SL-GSL	10 to 25%	D2-D3	Subalpine	Mainly the Cataract Brook and the Porcupine Creek valleys; occasional seepage inclusions.
	Non-calcareous coarse textured till	O'Hara	OH1	Orthic Humo-Ferric Podzols & Eluviated Dystric Brunisols	GLS-SL	15 to 30%	D2	Subalpine	Some imperfectly drained soils as inclusions; boulders common; surface 20 to 25 cm is FSL-SiL.
Colluvial Slopes	Generally calcareous coarse and some medium textured cobbly bouldery and gravelly colluvium	Burgess	BG1	Boulder field plus some Orthic Regosols	SL-L	boulders 2 to 20 m diam.	D1-D2	Subalpine	Rock slide areas; soil covers 10 to 20% of the area; the rest is covered with large boulders.
			BG2	Cumulic Regosols and cobble land	V.Cobbly VGSiL	more than 50%	D1-D2	Subalpine & Montane	Steep vegetated slopes; often below cliffs.
			BG3	Orthic Regosols & some Orthic Eutric Brunisols	GSiL-GL	20 to 50%	D1-D2	Subalpine & Montane	Unstable colluvial slopes with fewer coarse fragments than BG2.
			BG4	Cumulic Regosols & Orthic Regosols	GSiL-GSL	more than 20%	D2-D3	Subalpine & Montane	Non-turfy, dark colored Ah; snow avalanched areas; coarse fragments variable.
			BG5	Orthic Regosols & Cumulic Regosols	SiL	less than 20%	D2	Subalpine	Derived from medium textured shales and schists.
		Float	FL1	Orthic Eutric Brunisols & Orthic Humo-Ferric Podzols	GSiL-GL	10 to 30%	D2	Subalpine	Sometimes developed on non-calcareous residual material near ridge tops.
		Niles	NI1	Lithic Orthic Eutric Brunisols & Lithic Orthic Regosols	SiL-L / R	less than 50%	D1-D2	Subalpine & Montane	Shallow slopewash and unconsolidated residual material (less than 50 cm to bedrock).
		Silverslope	SI1	Orthic Humo-Ferric Podzols & Orthic Ferro-Humic Podzols	SiL-SL	less than 50%	D2	Upper Subalpine	"Turfy" Ah, generally 2000 to 2150 m a.s.l., often modified residual parent material.
			SI2	Lithic Humo-Ferric Podzols & Lithic Eutric Brunisols	SiL-SL / R	less than 50%	D2	Upper Subalpine	Same as SI1 except shallow (less than 50 cm) to bedrock.
		Otto	OO1	Sombric Humo-Ferric Podzols	SiL-SL	less than 50%	D2	Alpine & "Krummholz"	"Turfy" Ah, generally more than 2150 m a.s.l., often modified residual parent material.
			OO2	Lithic Sombric Humo-Ferric Podzols	L-SL / R	less than 50%	D2	Alpine & "Krummholz"	Same as OO1 except shallow (less than 50 cm)on rock benches and ridge tops, & often on undifferentiated parent materials.
		Narao	NA1	Terric Mesisols	sedge derived		D6	Subalpine	Organic soil areas around Narao Lake.
			NA2	Terric Mesic Fibrisols	moss derived		D6	Montane	Organic soil areas in the Beaverfoot River area.

* These soilscape map unit descriptions describe soils in approximately the mid-fan position. Almost every fan can vary from cobbly sand through thin sandy loam over gravel to fine sandy loam or silt loam, and drainage classes from rapidly to poorly or very poorly drained.

SPECIAL LAND UNITS

A Used as a suffix to indicate modification of soilscape by repeated snow slides or avalanches ($\frac{xxxA}{Y}$ if greater than 25% and $\frac{xxx}{Y}$ +A if less than 25% of the map area is affected).

Bp Borrow Pit.

Er Eroded areas where soil creep and erosion is so active as to prevent vegetation growth.

m Recent moraine, unvegetated.

SC Cobble land associated with stream channels.

T Talus and coalescing talus cones.

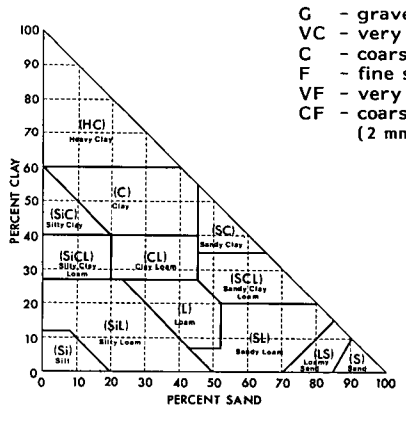
R Rock, bedrock and fractured bedrock stable enough to that talus cones are not evident.

W Water body.

SOIL TEXTURAL CLASSES

Percentages of clay and sand in the main textural classes of soils; the remainder of each class is silt. Some of the abbreviations used in the table are given in parentheses in the triangle. Other abbreviations include:

G - gravelly
VC - very coarse sand
C - coarse sand
F - fine sand
VF - very fine sand
CF - coarse fragments (2 mm to 25 cm)



DRAINAGE CLASSES

D1 - Rapidly drained
D2 - Well drained
D3 - Moderately well drained
D4 - Imperfectly drained
D5 - Poorly drained
D6 - Very Poorly Drained

each map unit concept is a composite of the information obtained from the aerial photographs, the field analyses and the chemical and physical analyses conducted in the laboratory.

When all the polygons corresponding to soilscape map unit concepts had been satisfactorily delineated they were transferred by J.C. Sproule and Associates Ltd. onto the same base map as was used for vegetation maps. Table 2 (from Coen et al. 1977) provides a definition of the soilscape map units used on the soils maps from which the derived biophysical maps were synthesized.

BIOPHYSICAL CLASSIFICATION AND MAPPING

Philosophy

Because the biophysical map is a synthesis of the two independent inventories (Kuchar 1978, Coen et al. 1977) the foregoing discussion provides an understanding of the data base from which this compilation began. Data analysis from several independently prepared resource sector maps all on differing base maps and at differing scales as experienced during the planning activities undertaken in Waterton Lakes National Park proved to be a complex and difficult task. In order to simplify the use of resource inventory data for planning, an integrated (Biophysical) approach to resource inventory was adopted for the soils, landform, and vegetation sectors of the Yoho National Park resource inventories. This aggregate of information is shown by a set of map unit delineations on a single map and the biophysical map unit concepts generally recur in different parts of the project area.

Overview of Biophysical Relationships

A consistent relationship between soil profile development (soil genesis) and vegetation occurs on landscapes where the vegetation is at or near climax. The kind of soil profile development we see today is an integration of the soil forming factors to which it has been exposed over time. Thus the profile development will best relate to the vegetation established on the site for the majority of the time since deglaciation, which appears, in many cases, to be the climax vegetation.

In the Montane zone, white spruce and Douglas fir forests are consistently associated with Eluviated Eutric and Orthic Eutric Brunisols (Fig. 4). At higher elevations in the Lower Subalpine zone, spruce-fir forests are consistently associated with Eluviated Eutric Brunisol and Orthic Humo-Ferric Podzol soils (Fig. 5). At still higher elevations

in the Upper Subalpine zone open canopied (less than 30% cover) spruce-fir forests are associated with Orthic Humo-Ferric Podzol soils (Fig. 6). These latter sites usually have heathers as an understory component and a thin (less than 10 cm) Ah horizon on the soil surface. In the Alpine zone heath-tundra communities are generally associated with Sombric Humo-Ferric Podzols with thicker Ah horizons (Fig. 7). All of the above associations are contingent upon geomorphically stable landforms. If the landforms are unstable because of steep slopes, Regosolic soils are developed and may be associated with a broad spectrum of vegetation appropriate to the zone in which it is located. If the landforms are unstable because of flooding, Regosolic and Gleysolic soils are again associated with a wide range of vegetation appropriate to the moisture regimes and vegetation zones in which they are found. Specific relationships are elaborated upon in the map unit descriptions which comprise the main portion of this report.

Mapping of Biophysical Concepts

To develop the biophysical legend and map, a transparent copy of the 1:25,000 vegetation map was registered to an opaque copy of the soils map at the same scale. This allowed confirmation of tentative soil and vegetation relationships developed by Kuchar and Coen through field observations and subsequent discussions. By generalizing the soils concepts to the soilscape group level (Table 2), which eliminated separation of soilscape map units based on texture within a given landform, and by grouping some similar vegetation types, it was possible to develop the basic concept of a biophysical map unit[3] and a legend with 64 map unit concepts. At a scale of 1:50,000, and assuming that most uses of the biophysical map will entail studying a portion of a valley, the resource analyst will seldom need to work with more than about 18 map units, which is an acceptable number (Simonson 1971).

Conceptually the resulting map units represent fairly consistent, ecologically distinct landscape segments. As Jenny (1941) has noted there is a functional relationship between soils, vegetation, climate, topography and parent materials providing sufficient time has elapsed for the factors to influence each other. Thus, on stable landforms with near climax vegetation the biophysical map unit concepts are predictable and

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[3]Biophysical map unit - A conceptual aggregate of soil bodies, associated landforms and vegetation types occurring together in a natural and characteristic pattern over the land surface. Soil separations are made at the level of parent material, drainage and slope phases of Subgroups, and vegetation at the level of groupings of similar vegetation types.

Figure 4 - Components of the Montane zone, Lodgepole pine forests (right) are frequently associated with Orthic Eutric Brunisol soils (left)

Figure 5 - Components of the Lower Subalpine zone. Spruce-fir forests (right) are frequently associated with Orthic Humo-Ferric Podzol soils (left)

Figure 6 - Components of the Upper Subalpine zone. Open spruce-fir forests (right) are frequently associated with Orthic Humo-Ferric Podzol soils (left)

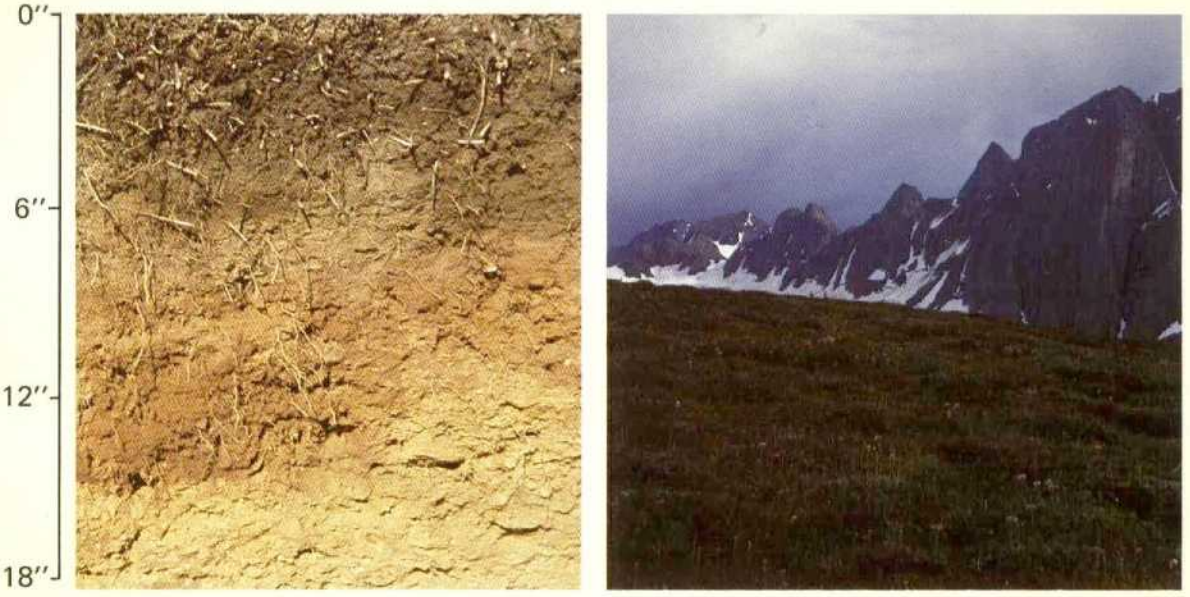

Figure 7 - Components of the Alpine zone. Heath-tundra vegetation (right) is frequently associated with Sombric Ferro-Humic Podzol soils (left)

uniform. Where fire has produced lodgepole pine stands over a fairly large area, current vegetation does not reflect inherent variations in climate, topography, and parent materials. Thus, one type of vegetation is associated with several different kinds of soils resulting in several distinct biophysical map units. On steep slopes subjected to continuous soil creep, soil horizons are prevented from forming and yet the vegetation will be very similar to adjacent slopes which are subjected to less creep, allowing the formation of distinctly different soils. Because of the practical implications of the above soil-vegetation combinations, they have each been treated as distinct and separable biophysical map unit concepts.

Where the National Topographic Series base maps provided only a few features which could also be located on the aerial photographs, independent transfer of the soils and vegetation information from the annotated photographs to the base maps occasionally resulted in lack of agreement between the vegetation and soils maps, even though the information was in agreement on the annotated photographs. For the most accurate comparison of the spacial distribution of soils and vegetation it was necessary to refer to the separate sets of annotated aerial photographs.

Combining vegetation and soil information and generalizing both the legend and the map resulted in the loss of some information on small areas, and about coarse fragments and soil texture. Table 3 provides information on the attributes of the biophysical map units. It also indicates the corresponding soil map units from Coen et al. (1977) and vegetation map units from Kuchar (1978). Consequently, when addressing site specific problems, analysts should refer to the reports by Coen et al. (1977) and Kuchar (1978) for more detailed explanations and in many cases reference to the annotated aerial photograph would be of value.

Map Symbol Convention

In order to retain a connotative relationship between the primary data sets (Coen et al. 1977; Kuchar 1978) the first element of the hyphenated symbol is the symbol for the dominant soilscape group making up the biophysical map unit concept. The second element, following the hyphen, is a connotative symbol for the vegetation type or a grouping of two vegetation types (Table 3, Table 4). Thus, the symbol OL-P has the soils and landform characteristics of the Ottertail soilscape group and the vegetation characteristics of the lodgepole pine vegetation type. More detailed information about the map unit concepts can be obtained from the map unit descriptions in the next section.

Table 3 - Biophysical map unit concepts and their respective soil and vegetation components

Vegetation Zone	Biophysical Map Unit	Textural Class	Drainage Class	Subgroup Classification	Soilscape Map Unit* Dominant	Soilscape Map Unit* Significant	Vegetation Grouping	Vegetation Map Units** Dominant	Vegetation Map Units** Significant
MONTANE		GLACIOFLUVIAL							
	TA-DSP	SiL / GSL	Well drained	Eluviated Eutric Brunisols	TA1	-	White spruce, Douglas fir, lodgepole pine	DS	PD, SDP
	TA-P	SiL-SL / VGSL-LS	Well drained	Eluviated Eutric Brunisols	TA1	OT1, HR2	Lodgepole pine, white spruce	P	PS
		FLUVIAL							
	KI-PSj	FSL / GSL	Imperfectly drained	Gleyed Cumulic Regosols	KI2	KI1	Lodgepole pine, white spruce,on floodplain	PSj	PS,P,Se,z
		FLUVIAL FAN							
	WR-SC	SiL	Moderately well drained	Gleyed Orthic Regosols	WR4	WR3	White spruce, western red cedar	SC	-
	WR-SPDT	SiL / GSL	Well drained	Orthic & Cumulic Regosols	WR1	WR3,WR2 KI1,KI2	White spruce, Douglas fir, lodgepole pine	SDP	SD,SP,ST
	WR-ST	GFSL-GSiL	Imperfectly drained	Gleyed Orthic Regosols	WR5	HO1,WR3	White spruce, poplar	ST	PS,PT,DS,T
	WR-P	SiL / GSL	Well drained	Orthic & Cumulic Regosols	WR3	WR1,HR2, TA1	Lodgepole pine, white & hybrid spruce	P	PS,S
		GLACIOLACUSTRINE							
	DS-PS	SiL SiCL	Well drained	Eluviated Eutric Brunisols	DS1	-	White & hybrid spruce, lodgepole pine	PS	PD,w,Se
		MORAINE							
	OL-SFDy	SiL	Imperfectly drained	Gleyed Eutric Brunisols	OL2	-	White spruce, subalpine fir, Douglas fir, western yew	SFDy	SDP
	OL-SDC	SiL / GSL -SiL	Well drained	Eluviated Eutric Brunisols	HR2	OL1,OG1	White spruce, Douglas fir, western red cedar	SDC	SDP
	OL-SPD	SiL	Well drained	Eluviated Eutric Brunisols	OL1	OL2,OG1, TO1	White spruce, Douglas fir, lodgepole pine	SDP	SD,PD,PS
	OL-SPD(b)	SiL	Well drained	Eluviated Eutric Brunisols	OL1	-	Recently burned Montane terrain	rec(D)	SDP, SP
	TO-PD	L-SiL	Well drained	Cumulic Regosols	TO1	Er	Lodgepole pine, Douglas fir	PD	PS,G
	OL-P	SiL	Well drained	Eluviated Eutric Brunisols	OL1	TO1,NI1	Lodgepole pine	PD	PS,PD,P
	CM-TS	L-SL	Well drained	Orthic Eutric Brunisols	CM1	Er,BG3	Aspen, balsam poplar, white spruce	TS	A,G
	OL-PT	SiL	Well drained	Orthic Eutric Brunisols	OL1	-	Lodgepole pine, poplar	PT	-
	OL-D	SiL-SL	Well drained	Eluviated Eutric Brunisols	OL1	CM1,TO1	Douglas fir, lodgepole pine, poplar	D	DP,DT
		COLLUVIAL							
	BG-SD(LS)	SL-L	Rapidly drained	Boulder field & Orthic Regosols	BG1	-	White spruce,Douglas fir, western red cedar,lodgepole pine	SDP	SDC
	BG-P	GSiL-GL	Rapidly drained	Orthic Regosols & some Orthic Eutric Brunisols	BG3	BG2,NI1, BG5	Lodgepole pine	P	BDS,PT
	FL-PD	GSiL-GL	Well drained	Orthic Eutric Brunisols	FL1	NI1	Lodgepole pine, Douglas fir, white spruce	P	PD,PSF SD, A
	FL-D	GSiL-GL	Well drained	Orthic Eutric Brunisols	FL1	-	Douglas fir, white spruce, lodgepole pine	DP	D,DS
	BG-DP	GSiL-GL	Rapidly drained	Orthic Regosols & some Orthic Eutric Brunisols	BG3	BG5,R	Lodgepole pine, Douglas fir, white spruce	PD	SDP
	BG-TD	Very cobbly SiL	Rapidly drained	Orthic Regosols	BG2	BG3,NI1	Aspen, Douglas fir	TD	BDS,A,TS
	BG-TS	GSL-SiL	Rapidly drained	Orthic & Cumulic Regosols	BG3	BG4A,BG5	Aspen-balsam poplar, white spruce	TS	PT
	BG-TB	GL-GSL	Rapidly drained	Cumulic & Orthic Regosols	WR2	BG2,BG3	Paper birch, aspen, Douglas fir	BT	BDS,A, DS,z
	BG-SD	very cobbly SiL	Rapidly drained	Cumulic & Orthic Regosols	BG2	BG3,NI1, BG5	White & hybrid spruce, Douglas fir	SD,DS	D,A
	BG-SD(b)	SiL	Rapidly drained	Cumulic Regosols	BG5	-	Recently burned Montane terrain	rec(D)	SP
	BG-DN	GL-GSL	Rapidly drained	Cumulic & Orthic Regosols	BG2	WR2,NI1, R	Douglas fir, limber pine	DN	Vt,A

MONTANE & SUBALPINE								
	ORGANIC							
NA-w	-	Very poorly drained	Terric Mesisols, Terric Mesic Fibrisols	NA1	NA2	Wetland scrub, sedge meadows & bog communities	w	0
	FLUVIAL							
BC-w	SL-SiL / GSL	Poorly and very poorly drained	Orthic & Rego Gleysols	BC1, BC2, BC3	KI2,HO1, KI1,VA1	Wetland scrub, sedge meadows	Se	w,G
BC-Se	SL-SiL / GSL	Poorly & very poorly drained	Orthic & Rego Gleysols	BC1	BC2,BC3, HO1,VA1	White spruce on poorly drained soil	Se	w,G
	FLUVIAL FAN							
CO-SDP	GSiL / VGSL	Well drained	Orthic Eutric Brunisols	CO1	MO1	White spruce, Douglas fir, lodgepole pine	SDP	PD, SDC, PSF
WR-GSd	GSL-GLS	Well drained	Orthic & Cumulic Regosols	WR1	KI1,KI2, WR5,SC	Open white & hybrid spruce, lodgepole pine	Sd,G	S,Se
LOWER SUBALPINE								
	GLACIOFLUVIAL							
TA-SF	SiL / GSL	Well drained	Eluviated Eutric Brunisols & Orthic Humo-Ferric Podzols	TA1	-	Lodgepole pine, spruce, fir	PSF	SF
TA-SF(b)	SiL / GSL	Well drained	Eluviated Eutric Brunisols & Orthic Humo-Ferric Podzols	TA1	WR1	Recently burned Subalpine forest	rec(SF)	-
KI-SF	FSL-SiL / GSL	Moderately well drained	Orthic & Cumulic Regosols	KI1	KI2,WR5	Engelmann spruce, subalpine fir	SF	-
	FLUVIAL FAN							
WR-SF	GSL-GLS	Well drained	Orthic & Cumulic Regosols	WR1	WR2,WR3	Engelmann spruce, subalpine fir	SF	PSF,SF,A
CO-SF	GSiL / VGSL	Well drained	Orthic Eutric Brunisols	CO1	-	Engelmann spruce, subalpine fir	SF	SF, TS
	GLACIOLACUSTRINE							
DS-SF	SiL-SiCL	Well & moderately well drained	Eluviated Eutric Brunisols	DS1	-	Engelmann spruce, subalpine fir	SF	PSF
	MORAINE							
OL-SF	SiL	Imperfectly drained	Gleyed Melanic Brunisols & Gleyed Eutric Brunisols	OL2	-	Engelmann spruce, subalpine fir	SF	SF,PSF
OH-SF	GLS-SL	Well drained	Orthic Humo-Ferric Podzols & Eluviated Dystric Brunisols	OH1	-	Engelmann spruce, subalpine fir	SF	-
CM-SF	SL-GSL	Well drained	Eluviated Dystric Brunisols & Orthic Humo-Ferric Podzols	CM1	VA1	Engelmann spruce, subalpine fir	SF	PSF
OG-SF	SiL	Well drained	Orthic Humo-Ferric Podzols & Eluviated Eutric Brunisols	OG1	OG2	Engelmann spruce, subalpine fir	SF	PSF
OG-SF(b)	SiL	Well drained	Orthic Humo-Ferric Podzols	OG2	-	Recently burned Subalpine forest	rec(SF)	-
TO-SF	L-SiL	Well drained	Cumulic Regosols	TO1	-	Engelmann spruce, subalpine fir	SF	SP
	COLLUVIAL							
FL-SF	GSiL-GL	Well drained	Orthic Eutric Brunisols & Orthic Humo-Ferric Podzols	FL1	NI1,BG3	Engelmann spruce, subalpine fir	SF	PSF,A,PS
FL-SF(b)	GSiL-GL	Well drained	Orthic Eutric Brunisols & Orthic Humo-Ferric Podzols	FL1	-	recently burned Subalpine forest	rec(SF)	-
BG-SF	Cobbly & GSiL	Well drained	Cumulic & Orthic Regosols	BG3, BG2	BG4A,BG5, NI1	Engelmann spruce, subalpine fir	SF	PSF,A,SP
BG-SF(LS)	SL-L	Well drained	Boulder field plus some Orthic Regosols	BG1	-	Engelmann spruce, subalpine fir	SF	PSF
BG-SF(b)	Cobbly & GSiL	Well drained	Cumulic & Orthic Regosols	BG3	BG2,BG5, NI1	Recently burned Subalpine forest	rec(SF)	A
BG-A	Cobbly & GSiL	Well drained	Cumulic & Orthic Regosols	BG4A	BG2,BG3	Avalanche scrub & meadow, Engelmann spruce, subalpine fir	A	SF, PSF

UPPER SUBALPINE		FLUVIAL							
	KI-Hm	FSL-GSL	Imperfectly & moderately well drained	Rego Gleysols & Cumulic Regosols	KI2	WR1,WI1, BC1,VA1	Upper Subalpine forb meadows & snowbeds	Hm	SF
		MORAINE							
	OD-F	SiL-SL	Well drained	Orthic Humo-Ferric Podzols	OD1	SI1	Subalpine fir	F	HF,SF
	OD-F(b)	SiL	Well drained	Orthic Humo-Ferric Podzols	OD1	-	Recently burned Upper Subalpine forest	rec(F)	-
	OD-aL	SiL-SL	Well drained	Orthic Humo-Ferric Podzols	OD1	-	Subalpine larch	aL	A,HaL
		COLLUVIAL							
	SI-F	SiL-SL	Well drained	Orthic & lithic Humo-Ferric Podzols	SI1, SI2	BG4A,BG2, BG3	Subalpine fir	F	A,HF,SF
	SI-F(b)	SiL-SL	Well drained	Lithic & Orthic Humo-Ferric Podzols	SI2	SI1,NI1	Recently burned Upper Subalpine forest	rec(F)	-
	SI-aL	SiL-SL	Well drained	Orthic & lithic Humo-Ferric Podzols	SI1	SI2,BG2	Subalpine larch	aL	HaL, A
	SI-aL(LS)	SL-L	Well drained	Boulder field plus some Orthic Regosols	BG1	-	Subalpine larch	aL	HaL,aLr
	SI-whP	SiL-SL	Rapidly drained	Orthic & lithic Eutric Brunisols & Orthic Humo-Ferric Podzols	SI1	SI2,BG2, NI1	Whitebark pine	whP	A,HF,F
ALPINE		MORAINE							
	SK-H	SiL-GSL	Well to moderately well drained	Sombric Humo-Ferric Podzols	SK1	OO1	Heath tundra, sparse subalpine fir	H	HF,HaL,Hm
		COLLUVIAL							
	OO-H	SiL-SL	Well drained	Lithic Sombric Humo-Ferric Podzols & Sombric Humo-Ferric Podzols	OO2, OO1	SI1,SK1	Heath tundra, sparse subalpine fir	H	HF,Hm,HaL

SPECIAL LAND UNITS

G Cobbleland associated with stream channels (SC in Soil survey of Yoho) which is unvegetated or sparsely covered with yellow dryad & willows.

R + H A mosaic of rock plus heath tundra supported by very shallow soils (generally less than 10 cm to bedrock).

R-F Rock with a sparse cover of subalpine fir supported directly on the rock or by very shallow soils (generally less than 10 cm to bedrock).

R-F(D) Rock with a sparse cover of scrub Douglas fir supported directly on the rock or by very shallow soils (generally less than 10 cm to bedrock).

R-whP Rock on south facing dry exposures with a cover of scattered whitebark pine supported directly on the rock or by very shallow soils (generally less than 10 cm to bedrock).

R-aL Steep rock cliffs, generally with a thin cover of colluvial rubble which supports sparse patchy stands of scrubby subalpine larch. Confined to the southeast quadrant of the Park.

X Lichen tundra comprised mainly of dark epipetric lichens on acid rock in the vicinity of Lake O'Hara.

R Unvegetated rock and colluvial rubble, generally at high elevations.

T Unvegetated talus and coalescing talus cones generally at high elevations.

M Unvegetated recent moraine generally associated with existing glaciers.

I Glaciers, ice and permanent snow fields.

z Grossly disturbed soil and vegetation.

* As defined in Coen et al. (1977).

** As defined in Kuchar (1978)

Table 4 - Attributes of the biophysical map unit concepts arranged in alphabetical order

BIOPHYSICAL MAP UNIT	VEGETATION ZONE	LANDFORM & MATERIALS	TEXTURAL CLASS	DRAINAGE CLASS	SUBGROUP CLASSIFICATION	VEGETATION GROUPING
BC-Se	Montane & Subalpine	Fluvial	SL-SiL / GSL	Poorly & very poorly drained	Orthic & Rego Gleysols	White spruce on poorly drained soil.
BC-w	Montane & Subalpine	Fluvial	SL-SiL / GSL	Poorly & very poorly drained	Orthic & Rego Gleysols	Wetland scrub, sedge meadows.
BG-A	Lower Subalpine	Colluvial	Cobbly & GSiL	Well drained	Cumulic & Orthic Regosols	Avalanche scrub & meadow, Engelmann spruce, subalpine fir.
BG-DN	Montane	Colluvial	GL-GSL	Rapidly drained	Cumulic & Orthic Regosols	Douglas fir, limber pine.
BG-DP	Montane	Colluvial	GSiL-GL	Rapidly drained	Orthic Regosols & some Orthic Eutric Brunisols	Lodgepole pine, Douglas fir, white spruce.
BG-P	Montane	Colluvial	GSiL-GL	Rapidly drained	Orthic Regosols & some Orthic Eutric Brunisols	Lodgepole pine
BG-SD	Montane	Colluvial	Very cobbly SiL	Rapidly drained	Cumulic & Orthic Regosols	White and hybrid spruce, Douglas fir.
BG-SD(LS)	Montane	Colluvial landslide	SL-L	Rapidly drained	Boulder field & Orthic Regosols	White spruce, Douglas fir, western red cedar, lodgepole pine.
BG-SF	Lower Subalpine	Colluvial	Cobbly & GSiL	Well drained	Cumulic & Orthic Regosols	Engelmann spruce, subalpine fir.
BG-TB	Montane	Colluvial	GL-GSL	Rapidly drained	Cumulic & Orthic Regosols	Paper birch, aspen, Douglas fir.
BG-TD	Montane	Colluvial	Very cobbly SiL	Rapidly drained	Orthic Regosols	Aspen, Douglas fir.
BG-TS	Montane	Colluvial	GSL-SiL	Rapidly drained	Orthic & Cumulic Regosols	Aspen-balsam poplar, white spruce.
CM-SF	Lower Subalpine	Moraine	SL-GSL	Well drained	Eluviated Dystric Brunisols & Orthic Humo-Ferric Podzols	Engelmann spruce, subalpine fir.
CM-TS	Montane	Moraine	L-SL	Well drained	Orthic Eutric Brunisols	Aspen, balsam poplar, white spruce.
CO-SDP	Montane & Subalpine	Fluvial fan	GSiL / VGSL	Well drained	Orthic Eutric Brunisols	White spruce, Douglas fir, lodgepole pine.
CO-SF	Lower Subalpine	Fluvial fan	GSiL / VGSL	Well drained	Orthic Eutric Brunisols	Engelmann spruce, subalpine fir.
DS-PS	Montane	Glaciolacustrine	SiL-SiCL	Well drained	Eluviated Eutric Brunisols	White and hybrid spruce, lodgepole pine.
DS-SF	Lower Subalpine	Glaciolacustrine	SiL-SiCL	Well & moderately well drained	Eluviated Eutric Brunisols	Engelmann spruce, subalpine fir.
FL-D	Montane	Colluvial	GSiL-GL	Well drained	Orthic Eutric Brunisols	Douglas fir, white spruce, lodgepole pine.
FL-PD	Montane	Colluvial	GSiL-GL	Well drained	Orthic Eutric Brunisols	Lodgepole pine, Douglas fir, white spruce.
FL-SF	Upper Subalpine	Colluvial	GSiL-GL	Well drained	Orthic Eutric Brunisols & Orthic Humo-Ferric Podzols	Engelmann spruce, subalpine fir.
KI-Hm	Upper Subalpine	Fluvial	GSL-GSL	Imperfectly & moderately well drained	Rego Gleysols & Cumulic Regosols	Upper Subalpine forb meadows and snowbeds.
KI-PSj	Montane	Fluvial	FSL / GSL	Imperfectly drained	Gleyed Cumulic Regosols	Lodgepole pine, white spruce on floodplain.
KI-SF	Lower Subalpine	Fluvial	FSL-SiL / GSL	Moderately well drained	Orthic & Cumulic Regosols	Engelmann spruce, subalpine fir.
NA-w	Montane & Subalpine	Organic		Very poorly drained	Terric Mesisols, Terric Mesic Fibrisols	Wetland scrub, sedge meadows and bog communities.
OD-F	Upper Subalpine	Moraine	SiL-SL	Well drained	Orthic Humo-Ferric Podzols	Subalpine fir.
OD-aL	Upper Subalpine	Moraine	SiL-SL	Well drained	Orthic Humo-Ferric Podzols	Subalpine larch.
OG-SF	Lower Subalpine	Moraine	SiL	Well drained	Orthic Humo-Ferric Podzols and Eluviated Eutric Brunisols	Engelmann spruce, subalpine fir.
OH-SF	Lower Subalpine	Moraine	GLS-SL	Well drained	Orthic Humo-Ferric Podzols and Eluviated Dystric Brunisols	Engelmann spruce, subalpine fir.
OL-D	Montane	Moraine	SiL-SL	Well drained	Eluviated Eutric Brunisols	Douglas fir, lodgepole pine, poplar.
OL-P	Montane	Moraine	SiL	Well drained	Eluviated Eutric Brunisols	Lodgepole pine.
OL-PT	Montane	Moraine	SiL	Well drained	Orthic Eutric Brunisols	Lodgepole pine, poplar.
OL-SDC	Montane	Moraine	SiL / GSL -SiL	Well drained	Eluviated Eutric Brunisols	White spruce, Douglas fir, western red cedar.
OL-SF	Lower Subalpine	Moraine	SiL	Imperfectly drained	Gleyed Melanic Brunisols & Gleyed Eutric Brunisols	Engelmann spruce, subalpine fir.
OL-SFDy	Montane	Moraine	SiL	Imperfectly drained	Gleyed Eutric Brunisols	White spruce, subalpine fir, Douglas fir, western yew.
OL-SPD	Montane	Moraine	SiL	Well drained	Eluviated Eutric Brunisols	White spruce, Douglas fir, lodgepole pine.
OO-H	Alpine	Colluvial	SiL-SL	Well drained	Lithic Sombric Humo-Ferric Podzols & Sombric Humo-Ferric Podzols	Heath tundra, sparse subalpine fir.
SI-aL	Upper Subalpine	Colluvial	SiL-SL	Well drained	Orthic & lithic Humo-Ferric Podzols	Subalpine larch.
SI-F	Upper Subalpine	Colluvial	SiL-SL	Well drained	Orthic & lithic Humo-Ferric Podzols	Subalpine fir.
SI-whP	Upper Subalpine	Colluvial	SiL-SL	Rapidly drained	Orthic & lithic Eutric Brunisols & Orthic Humo-Ferric Podzols.	Whitebark pine.
SK-H	Alpine	Moraine	SiL-GSL	Well to moderately well drained	Sombric Humo-Ferric Podzols	Heath tundra, sparse subalpine fir.
TA-DSP	Montane	Glaciofluvial	SiL / GSL	Well drained	Eluviated Eutric Brunisols	White spruce, Douglas fir, lodgepole pine.
TA-P	Montane	Glaciofluvial	SiL-SL / VGSL-LS	Well drained	Eluviated Eutric Brunisols	Lodgepole pine, white spruce.
TA-SF	Lower Subalpine	Glaciofluvial	SiL / GSL	Well drained	Eluviated Eutric Brunisols & Orthic Humo-Ferric Podzols	Lodgepole pine, spruce, fir.
TO-PD	Montane	Moraine	L-SiL	Well drained	Cumulic Regosols	Lodgepole pine, Douglas fir.
TO-SF	Lower Subalpine	Moraine	L-SiL	Well drained	Cumulic Regosols	Engelmann spruce, subalpine fir.
WR-GSd	Montane and Subalpine	Fluvial fan	GSL-GLS	Well drained	Orthic & Cumulic Regosols	Open white and hybrid spruce, lodgepole pine.
WR-P	Montane	Fluvial fan	SiL / GSL	Well drained	Orthic & Cumulic Regosols	Lodgepole pine, white and hybrid spruce.
WR-SC	Montane	Fluvial fan	SiL	Moderately well drained	Gleyed Orthic Regosols	White spruce, western red cedar.
WR-SF	Lower Subalpine	Fluvial fan	GSL-GLS	Well drained	Orthic & Cumulic Regosols	Engelmann spruce, subalpine fir.
WR-SPDT	Montane	Fluvial fan	SiL / GSL	Well drained	Orthic & Cumulic Regosols	White spruce, Douglas fir, lodgepole pine.
WR-ST	Montane	Fluvial fan	GFSL-GSiL	Imperfectly drained	Gleyed Orthic Regosols	White spruce, poplar.

SPECIAL LAND UNITS

G	Cobbleland associated with stream channels (SC in Soil survey of Yoho) which is unvegetated or sparsely covered with yellow dryad and willows.
R + H	A mosaic of rock plus heath tundra supported by very shallow soils (generally less than 10 cm to bedrock).
R-F	Rock with a sparse cover of subalpine fir supported directly on the rock or by very shallow soils (generally less than 10 cm to bedrock).
R-F(D)	Rock with a sparse cover of scrub Douglas fir supported directly on the rock or by very shallow soils (generally less than 10 cm to bedrock).
R-whP	Rock on south facing dry exposures with a cover of scattered whitebark pine supported directly on the rock or by very shallow soils (generally less than 10 cm to bedrock).
R-aL	Steep rock cliffs, generally with a thin cover of colluvial rubble which supports sparse patchy stands of scrubby subalpine larch. Confined to the southeast quadrant of the Park.
X	Lichen tundra comprised mainly of dark epipetric lichens on acid rock in the vicinity of Lake O'Hara.
R	Unvegetated rock and colluvial rubble, generally at high elevations.
T	Unvegetated talus and coalescing talus cones generally at high elevations.
M	Unvegetated recent moraine generally associated with existing glaciers.
I	Glaciers, ice and permanent snow fields.
z	Grossly disturbed soil and vegetation.

BIOPHYSICAL MAP UNIT DESCRIPTIONS

Detailed descriptions of each map unit concept used on the accompanying maps are provided in this section. Table 4 provides a key to the attributes of the biophysical map unit concepts arranged in alphabetical order, with the special land units grouped at the end. The detailed descriptions expand upon the information in Table 4 and provide information relative to systematic variation in map unit concepts and information about exceptions and inclusions in map unit concepts.

BIOPHYSICAL MAP UNITS

BC-Se

Poorly drained, medium and coarse textured, calcareous Gleysolic soils associated with white spruce canopy and Labrador tea-willow understory growing on stratified level fluvial landforms.

Map Unit Concept

This map unit is characterized by white spruce growing on Gleysolic soils. The vegetation type consists of three community types: Labrador tea, horsetail, and willow-dwarf birch. Small areas of w (wetland scrub sedge meadows and bog communities) and G (yellow dryad on recently deposited fluvial gravels and sand) are included in the areas mapped as BC-Se. The floodplain and gently sloping fan (HO1 soilscape map units) landforms are comprised of deep, medium to coarse textured materials over stratified gravelly fluvial materials. A small area near Clawson Creek is located on a morainic landform (VA1 soilscape, map unit) with silty material near the surface.

Differentiating Characteristics

Within the Montane zone, the BC-Se map unit is separated from most others because it occurs on gently sloping fluvial landforms with a high water table. It differs from KI-PSj which has a fluctuating water table and droughty periods. The occurrence of a white spruce forest differentiates BC-Se from BC-w which is characterized by a heterogeneous assemblage of several shrub and herb communities.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 52 to 57, 77 and 135)

and detailed information about the vegetation can be found in Kuchar 1978 (p. 120).

BC-w

Poorly drained, medium and coarse textured, calcareous, Gleysolic soils associated with a heterogeneous assemblage of shrub and herb communities growing on saturated stratified level fluvial landforms.

Map Unit Concept

This map unit is characterized by level, wet fluvial areas generally of small size, supporting an unmappable heterogeneous assemblage of several shrub and herb communities. The largest areas occur in the Ottertail flats and the Leanchoil-Beaverfoot areas. Gleysolic and peaty Gleysolic soils, and occasionally in areas where the organic layer is greater than 40 cm thick, Organic soils dominate this map unit. Soil textures are generally medium to coarse, with occasional gravel lenses. The soils remain at or above field capacity throughout most of the summer and are usually flooded in the spring and early summer. Small areas of better drained soils and small areas covered with white spruce and/or subalpine fir are also included. Several of the BC-w map units occur in the Subalpine zone near Takakkaw Falls, Sherbrooke and Wapta Lakes and the McArthur valley.

Differentiating Characteristics

Within the Montane zone, BC-w is separated from most other map units because it occurs on gently sloping and level fluvial floodplains and fans with a high water table. The KI-PSj map unit differs from BC-w because of a fluctuating water table and both KI-PSj and BC-Se differ because they contain trees rather than only herbs and shrubs.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 52 to 57, 77, 85 and 135) and detailed vegetation information can be found in Kuchar 1978 (pp. 167-177).

BG-A

Well drained, angular cobbly and angular gravelly, medium textured, calcareous, Regosolic soils developed on snow avalanched colluvial slopes

and associated with avalanche scrub and meadow vegetation.

Map Unit Concept

This map unit is characterized by slopes which are subject to snow avalanches at sufficiently frequent intervals to prevent the re-establishment of a forest canopy and in many cases avalanches occur nearly every year. Soil materials vary from angular, very cobbly to very gravelly, medium textured, colluvial material distributed in variable sized tracts throughout the entire Park at elevations of approximately 1500 to 2000 m asl. Vegetation characterizing this map unit is made up of eight communities (Kuchar 1978) distributed in a fairly predictable pattern throughout each avalanche track. In general, snowbed communities occur near the top of the track and in the upper half, coniferous-deciduous scrub communities occur. In the lower sections of the track the scrub is comprised of mainly deciduous species, often dominantly willows but in some cases green alder. At the lower end of many avalanched slopes is a herb meadow dominated by grasses and some forbs usually important to ungulates. There are frequently undisturbed islands of spruce-subalpine fir vegetation sitting in an avalanche track. Soils are characterized by Cumulic and Orthic Regosols and in situations where the avalanching snow does not disturb the soil nor deposit mineral debris, Brunisolic soils may occur.

Differentiating Characteristics

The BG-A map units can be distinguished from many others in the Lower Subalpine because it is characterized by colluvial landforms. Some tracts of FL-SF and BG-SF may have up to 25% of the terrain affected by avalanching snow whereas BG-A usually has 75 to 100% of the terrain affected by avalanching snow. Tracts of FL-SF(b) and BG-SF(b) lack a forest canopy and thus superficially look similar to BG-A. An examination of the vegetation allows the recently burned terrain of the former to be distinguished from the avalanched terrain of the latter.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 60 to 67) and detailed vegetation information can be found in Kuchar 1978 (pp. 127 to 137, 101 and 106).

BG-DN

Rapidly drained (dry) coarse textured, calcareous, Regosolic soils developed on shallow colluvium over bedrock, and open stands of small Douglas fir and limber pine.

Map Unit Concept

This map unit is characterized by warm dry rocky colluvial and talus slopes. The two areas on Mt. Burgess and Mt. Field are on mid to lower slope positions where a sufficient detrital mantle has accumulated to permit the development of Cumulic and Orthic Regosols. Vegetation is characterized by a sparse cover of trees and shrubs, mainly small Douglas fir, and limber pine.

Differentiating Characteristics

The BG-DN map unit differs from most Montane map units because it is associated with rocky colluvial landforms. The closed forests and Brunisolic soils of FL-PD and FL-D separate them from the BG-DN. In general, the very sparse cover of Douglas fir and limber pine, both being stunted and scrubby, separates BG-DN from other Montane BG- map units. The BG-DN map unit is the only one which is characterized by limber pine.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 60, 143 and 195) and detailed vegetation information can be found in Kuchar 1978 (p.97).

BG-DP

Rapidly drained, cobbly and gravelly, medium textured, calcareous, Regosolic and some Brunisolic soils developed on colluvium and associated with lodgepole pine, Douglas fir and white spruce forests.

Map Unit Concept

This map unit concept is characterized by colluvial slopes which are being continuously affected by soil creep. It is widely distributed on steeply sloping (50 to 70%) warm (west and south) aspects. Soil materials vary from very cobbly to gravelly and only slightly gravelly,

medium textured, calcareous colluvium, depending upon the geologic material of the colluvial source. Elevation ranges from 1200 to 1600 m and occasionally up to 2000 m asl. Vegetation is characterized by lodgepole pine and/or Douglas fir as canopy dominants. Most are even-aged post-fire stands with spruce co-dominant in some stands. Some stands are characterized by large Douglas fir amongst the post-fire lodgepole pine. A depauperate understory includes buffaloberry, showy aster and twinflower or perhaps in slightly moister situations bunchberry, feathermosses and leafy lichens (*Peltigera* spp.). Because of the influence of soil creep, the soils characterizing this map unit are dominantly Orthic Regosols and occasionally weakly developed Orthic Eutric Brunisols.

Differentiating Characteristics

The BG-DP map unit differs from many Montane map units because it is associated with colluvial landforms. The FL-PD and FL-D map units differ from BG-DP because they occur on sufficiently stable landforms that Brunisolic soils are able to develop. The presence of significant amounts of aspen in BG-TS, BG-TB and BG-TD differentiates them from BG-DP. The lack of appreciable Douglas fir in BG-P separates it from BG-DP. Very stunted Douglas fir and the occasional limber pine separate BG-DN from BG-DP. The large, fairly old trees of white spruce and/or Douglas fir, with a few lodgepole pine distinguish BG-SD from the even-aged lodgepole pine and Douglas fir forests of BG-DP.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 60 and 62) and detailed vegetation information can be found in Kuchar 1978 (pp.93 and 116).

BG-P

Rapidly drained, cobbly and gravelly medium textured, calcareous, Regosolic and some Brunisolic soils developed on colluvium and associated with lodgepole pine forests.

Map Unit Concept

This map unit is characterized by colluvial slopes which are being continuously affected by soil creep. It is scattered throughout the Park on steeply sloping (50 to 70%) valley walls along the Kicking Horse Valley. Soil

materials vary from very cobbly to gravelly and only slightly gravelly, medium textured, calcareous colluvium, depending upon the geologic material of the colluvial source. Vegetation is characterized by generally large, even-aged tracts having lodgepole pine as a dominant in pure stands or mixed in varying proportions with white and hybrid spruce. In general, increasing amounts of spruce indicate increasing moisture. Most stands are 70 to 120 years old. Aspen and Douglas fir are minor components, increasing in dominance and number in drier stands. Total understory vascular cover is generally around 50%, higher in some clearings but decreasing to virtually nil under very dense canopy. Buffaloberry is the dominant understory species along with prickly rose, meadowsweet and common juniper. Because of the influence of soil creep, the soils characterizing this map unit are dominantly Orthic Regosols and occasionally weakly developed Orthic Eutric Brunisols.

Differentiating Characteristics

The BG-P map unit differs from many Montane map unit concepts because it is associated with colluvial landforms. The FL-PD and FL-D map units differ from the BG-P concept because they occur on sufficiently stable landforms that Brunisolic soils are able to develop. The presence of significant amounts of aspen in the canopy of BG-TS, BG-TB and BG-TD map units differentiates them from BG-P. The presence of significant amounts of Douglas fir and lack of lodgepole pine distinguishes BG-SD and BG-DN from BG-P. Douglas fir in appreciable amounts also separates BG-DP from BG-P.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 62, 60 and 64) and detailed vegetation information can be found in Kuchar 1978 (pp. 97 and 116).

BG-SD

Rapidly drained, angular cobbly and angular gravelly, medium textured, calcareous, Regosolic soils developed on colluvium and associated with white-hybrid spruce and Douglas fir-lodgepole pine forests.

Map Unit Concept

This map unit is characterized by colluvial slopes being continuously affected by soil creep. It is widely

distributed on steeply sloping (50 to 70%) warm (west and south) aspects. Soil materials vary from very cobbly to gravelly and to only slightly gravelly medium textured, calcareous, colluvium depending upon the geologic material comprising the colluvial sources. Elevations range from 1400 to 2000 m, the majority of the tracts forming a discontinuous band between 1600 and 1900 m on west aspects. Vegetation is characterized by white and hybrid spruce with Douglas fir as a co-dominant or understory species. Many stands are old (250 to 300 years) with large trees. A west facing tract in the lower portion of the Kiwetinok valley is strongly affected by snow avalanching. Occasional dry, rocky, steeply sloping tracts supporting Douglas fir stands are also included in this map unit concept. Because of the influence of soil creep the soils are characterized by Cumulic and Orthic Regosols.

Differentiating Characteristics

The BG-SD map unit concept differs from many Montane map unit concepts because it is associated with colluvial landforms. The FL-PD and FL-D map units differ from BG-SD because they are sufficiently stable landforms so that Brunisolic soils are able to develop. Also BG-SD differs from BG-DP and BG-P because both of the latter are characterized by even-aged, fairly young post-fire stands having lodgepole pine as a canopy co-dominant or dominant respectively. The BG-SD map unit differs from BG-TS, BG-TB and BG-TD because of the significant to dominant amounts of aspen in the canopy of the latter three. The drier and rockier members of the BG-SD map unit concept are similar to the BG-DN map unit concept but the latter is distinguished because of the stunted Douglas fir and the occasional limber pine.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 60, 62, 95 and 64) and detailed vegetation information can be found in Kuchar 1978 (pp. 84, 86, and 95).

BG-SD(b)

Rapidly drained, angular cobbly and angular gravelly, medium textured, calcareous, Regosolic soils developed on colluvium and associated with recently burned Montane terrain.

Map Unit Concept

This map unit concept is essentially the same as BG-SD except that the existing vegetation is made up of characteristic pioneer species regenerating after a recent forest fire. The main colonizers are fireweed and asters. The lone example of this map unit concept is on the northwest corner of Mount Hurd.

Detailed vegetation information can be found in Kuchar 1978 (p. 138).

BG-SD(LS)

Boulder field comprised of varying amounts of boulders 2 to 30 m in diameter mixed with some medium textured, Regosolic soils and associated with white spruce, Douglas fir and western red cedar forests.

Map Unit Concept

This map unit is characterized by large calcareous boulders and associated fine materials accumulated at the base of a large ancient landslide originating from the Cathedral Crags. Elevation ranges from 1300 to 1400 m asl. The vegetation characteristic of this single map unit delineation is fairly old open canopied white spruce stands. The understory has an abundant composition of subalpine fir saplings mixed with the distinctly Montane species Douglas fir and western red cedar, both as scattered trees and saplings. The shrub layer is characterized by menziesia and tall bilberry indicative of a moist habitat. Bunchberry and five-leaved bramble characterize the herb-dwarf shrub layer. A dense surface layer of feathermosses is also characteristic. The landform has an irregular hummocky surface typical of landslides. Where sufficient soil material is present Orthic Regosols characterize the landscape between the boulders.

Differentiating Characteristics

The BG-SD(LS) map unit differs from all other Montane map units because it is characterized by a landslide landform. The vegetation characterizing this map unit is indicative of moister sites than characterize the other Montane colluvial map units.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 58) and detailed

vegetation information can be found in Kuchar 1978 (p. 76).

BG-SF

Well drained, angular cobbly and angular gravelly, medium textured, calcareous, Regosolic soils developed on colluvium and associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by slopes being continually affected by soil creep. It is widely distributed throughout the Park at elevations of approximately 1550 to 2000 m. The lower limit of the extent of this map unit is much higher on south and west aspects and grading into the BG-SD map concept at lower elevations on these warm aspects. Soil materials vary from angular, very cobbly to gravelly, medium textured, calcareous, colluvium depending upon the geologic material comprising the colluvial sources. Vegetation is characterized by an Engelmann spruce and subalpine fir forest canopy. Menziesia is the usual dominant shrub although any given tract may be dominated by other shrub species such as grouseberry, green alder and twinflower. Feathermosses are ubiquitous. Included in this concept are areas in which fires have disturbed the climax (or near climax) spruce-fir vegetation and a canopy of lodgepole pine has regenerated with varying amounts of understory and/or co-dominant Engelmann spruce and subalpine fir. The BG-SF map unit concept is characterized by Cumulic and Orthic Regosol soils.

Differentiating Characteristics

The BG-SF map unit concept can be distinguished from many other Lower Subalpine map units because it is characterized by colluvial landforms. Brunisolic soils serve to distinguish FL-SF and FL-SF(b) from BG-SF. The landslide landform associated with BG-SF(LS) distinguishes it from the uniform colluvial slopes characterizing the BG-SF map unit concept. Both BG-SF(b) and BG-A lack a forest canopy, the first because of fire and the second because of snow avalanche destruction, either of which distinguishes them from the well developed forests of BG-SF.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 57 to 67 and 95) and

detailed vegetation information can be found in Kuchar 1978 (pp. 101, 106, 97 and 127).

BG-SF(b)

Well drained, angular cobbly and angular gravelly, medium textured, calcareous, Regosolic soils developed on colluvium and associated with recently burned Subalpine terrain.

Map Unit Concept

This map unit concept is characterized by slopes being continuously affected by soil creep. It is essentially similar to the BG-SF map unit concept except for the effects of relatively recent forest fires on the vegetation. Soil materials vary from angular, very cobbly to gravelly, to nearly coarse fragment-free (on Mount Hurd) colluvial material depending upon the geologic material comprising the colluvial sources. Rock cliffs are a frequent inclusion within this map concept, notably a large cliff on the northeast corner of Mount Hurd. The associated vegetation, as exemplified by the recently burned tracts in the upper Amiskwi, and mid Porcupine Valleys and on the north corner of Mount Hurd, is characterized by the lack of forest cover. Shrub and herb species which were regenerating were quite variable, fireweed being the predictable exception. The BG-SF(b) map unit concept is characterized by Cumulic and Orthic Regosol soils.

Differentiating Characteristics

The BG-SF(b) map unit concept can be distinguished from many other Lower Subalpine map unit concepts because it is characterized by colluvial landforms. Also BG-SF(b) can be distinguished from most other Lower Subalpine map units developed on colluvium because of the lack of forest canopy associated with recent forest fires. The BG-SF(b) map unit can be distinguished from the FL-SF(b) because the latter has evident horizon development associated with Brunisolic and Podzolic soils while the former is characterized by Regosolic soils.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 60 to 67 and 95) and detailed vegetation information can be found in Kuchar 1978 (pp. 139 and 127).

BG-SF(LS)

Boulder field comprised of varying amounts of boulders 2 to 10 m in diameter mixed with some medium textured, Regosolic soils on landslide landforms and associated with an Engelmann spruce and subalpine fir forest canopy.

Map Unit Concept

This map unit concept is exemplified by large calcareous boulders and associated fines on landslide landforms north of Cathedral Crags and on the west valley wall south of Narao Lakes in the Cataract Brook valley. The valley wall, prior to the catastrophic slide, appears to have been mantled with till some of which moved downslope intact providing small areas of till-like materials within the slide perimeter. Associated vegetation, where not affected by recent disturbances, is characterized by Engelmann spruce and subalpine fir forest canopy. Where regeneration is occurring after disturbance (north of Cathedral Crags) lodgepole pine may form the canopy with spruce and fir as understory and/or co-dominant species. Orthic Regosols characterize those areas between the boulders where there is sufficient material to be considered soil.

Differentiating Characteristics

The BG-SF(LS) map unit concept can be distinguished from other Lower Subalpine map unit concepts because it is characterized by a colluvial landslide landform. The Montane vegetation of BG-SD(LS) separates it from BG-SF(LS). The subalpine larch of the Upper Subalpine SI-aL(LS) map unit concept also distinguishes it from BG-SF(LS).

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 58) and detailed vegetation information can be found in Kuchar 1978 (pp. 101 and 106).

BG-TB

Rapidly drained, very cobbly and gravelly, coarse textured, calcareous, Regosolic soils developed on steep, fluvial and colluvial landforms with associated paper birch, aspen and some Douglas fir vegetation.

Map Unit Concept

This map unit concept is characterized by steep colluviating fluvial fans and aprons which are intimately mixed with colluvial landforms. The sometimes stratified, very cobbly and gravelly, coarse textured, calcareous materials are associated with landscapes which frequently have portions subjected to snow avalanching. Elevations range from about 1200 to about 1650 m. Vegetation is characterized by paper birch and/or aspen as canopy dominants in stands up to 15 m tall and from fairly dense to open. A few small Douglas fir are usually present as well. The understory is exceedingly variable in composition and percent cover. Some stands have a high percent cover of large shrubs especially mountain maple and red osier dogwood along with dry-slope species such as shrubby cinquefoil, bearberry and snowberry. The lower portions of the slopes sometimes grade into a BDS (paper birch-Douglas fir-white spruce) type. Snow avalanching across these map units commonly provides a swath of frequently disturbed vegetation of variable composition and referred to as avalanche scrub and meadow. Because of the influence of soil erosion, deposition and creep, these soils are characterized by Cumulic and Orthic Regosols.

Differentiating Characteristics

The BG-TB map unit concept differs from many Montane map unit concepts because it is associated with steep colluviating fluvial and colluvial landforms. The FL-PD and FL-D map units differ from BG-TB because they are on sufficiently stable landforms to allow Brunisolic soils to develop. The WR-ST and WR-GSd map units differ from the BG-TB because they both are associated with fairly gentle (<15%) sloping landforms, also WR-ST is characterized by imperfectly drained sites and WR-GSd has appreciable dryas as ground cover. The lack of either paper birch or aspen separates the BG-SD(LS), BG-SD, BG-DP, and BG-DN map unit concepts from the BG-TB. The lack of appreciable paper birch and the presence of white spruce and Douglas fir respectively separate BG-TS and BG-TD from the BG-TB map unit concept.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 143, 60, 62 and 95) and detailed vegetation information can be found in Kuchar 1978 (pp. 90, 87 and 126).

BG-TD

Rapidly drained, cobbly and gravelly, medium textured, calcareous, Regosolic soils developed on colluvium and associated with aspen and Douglas fir forests.

Map Unit Concept

This map unit concept is characterized by colluvial slopes which are being continuously affected by soil creep. The two areas identified as BG-TD are located on steep valley walls (30 to 70%) in the lower Porcupine valley. Elevations range from 1300 to 1600 m asl. Soil materials vary from very cobbly to gravelly, medium textured, calcareous, colluvium. Vegetation is characterized by young, post-fire open-canopied, mixed stands of Douglas fir and aspen in varying proportions. Some spruce and lodgepole pine are scattered throughout. The understory is typical of the warmer and drier Montane forests providing an intermediate amount of ground cover. Species such as buffaloberry, showy aster and twinflower typify the understory. Next to the valley bottoms, near the base of the dry slopes on the south aspect of the Porcupine valley there is a stand of paper birch-Douglas fir-white spruce on very loose unstable dry surfaces sometimes subject to snow avalanching. Because of the influence of soil creep the soils are characterized by Orthic Regosols.

Differentiating Characteristics

The BG-TD map unit concept differs from many Montane map units because it is associated with colluvial landforms. The FL-PD and FL-D map units differ from the BG-TD concept because they are sufficiently stable landforms so that Brunisolic soils are able to develop. The BG-P, BG-DP, BG-DN and BG-SD map units differ from BG-TD because they lack a significant aspen component. The BG-SD(LS) map unit concept is moister, contains some western red cedar and is characterized by a colluvial landslide landform which differentiates it from the BG-TD concept. The significant proportion of paper birch, in sometimes nearly pure stands, characterizes the BG-BT map unit concept and serves to distinguish it from the BG-TD map unit concept. The BG-TS map unit is characterized by slightly moister sites on cooler north and northwest aspects and lacking significant Douglas fir which allows separation from BG-TD.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 60, 62, and 97) and detailed vegetation information can be found in Kuchar 1978 (pp. 91, 87, 89 and 127).

BG-TS

Rapidly drained, cobbly and gravelly, medium textured, calcareous, Regosolic soils developed on steep colluvial landforms and associated with an open forest of 50 year old aspen and spruce.

Map Unit Concept

This map unit concept is characterized by colluvial slopes which are being continuously affected by soil creep. The areas of BG-TS found in the Porcupine valley, near Clawson Creek and the northwest side of Mount Hurd are on the lower slope positions and somewhat moister than BG-TD or similar habitats. Soil materials are calcareous and vary from cobbly and gravelly, medium textured, colluvium to nearly stone-free, medium textured, colluvium (the latter on Mount Hurd). Elevations range from 1400 to 1600 m (except for the Mount Hurd tract which is lower, drier and contains little spruce, and more lodgepole pine). Vegetation is characterized by open stands of approximately 50 year old aspen and spruce with smaller amounts of balsam poplar, subalpine fir, lodgepole pine and Douglas fir. The open shrub layer, with species from both Montane and Subalpine zones, has among others, tall bilberry, bristly black currant, and willows. The herb-dwarf shrub layer is fairly sparse with no dominants although bunchberry and twinflower are fairly abundant. Disturbance by snow avalanching is present in the Porcupine valley tracts resulting in vegetation of variable composition and referred to as avalanche scrub and meadow. Because of the influence of soil creep the soils are characterized by Orthic and Cumulic Regosols.

Differentiating Characteristics

The BG-TS map unit concept differs from many Montane map unit concepts because it is associated with colluvial landforms. The FL-PD and FL-D map units differ from BG-TS because they are on sufficiently stable landforms so that Brunisolic soils are able to develop. Also BG-P, BG-DP, BG-DN and BG-SD differ from BG-TS because they lack a significant aspen component. The moister BG-SD(LS) map unit contains some western red cedar and is characterized

by colluvial landslide landforms which differentiates it from the BG-TS. The occurrence of significant proportions of paper birch and Douglas fir in BG-TB and BG-TD respectively distinguishes these somewhat drier map unit concepts from BG-TS.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 62 to 64) and detailed vegetation information can be found in Kuchar 1978 (pp. 89 and 93).

CM-SF

Well drained, medium to coarse textured, Brunisolic and Podzolic soils developed on calcareous, morainic landforms associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by valley wall and valley bottom morainic landforms which are somewhat coarser and less calcareous than most morainic landforms in Yoho. Occasional seepage areas occur on valley bottom landforms, particularly in the Wapta Lake region. These map units are physically located mainly in the eastern part of the Park where the tills are influenced by extensive outcroppings of non-calcareous quartzites. The exception is a few tracts in the upper Porcupine Valley. Soils at the surface are somewhat finer textured than are the tills below. Associated vegetation is characterized by Engelmann spruce and subalpine fir. Menziesia and in some areas white rhododendron are characteristic understory species. Tree throw mounds are common, contributing to a complex mosaic of Eluviated Dystric Brunisols and Orthic Humo-Ferric Podzols both of which tend to be transitional to each other.

Differentiating Characteristics

The CM-SF map unit concept can be separated from many other Lower Subalpine map units because it is associated with morainic landforms. The TO-SF map unit can be distinguished from CM-SF because of its steeply sloping landforms and associated Regosolic soils. The OL-SF, OG-SF and OG-SF(b) map units are finer textured (SiL) and have shallower carbonates, less than 1 m from the surface, than does CM-SF which is coarser textured (SL) and generally has carbonates which are greater than 1 m from the surface. The OH-SF map unit is distinguished

from CM-SF mainly because it is developed on non-calcareous very stony and bouldery till.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 67 and 135) and detailed vegetation information can be found in Kuchar 1978 (pp. 101 and 106).

CM-TS

Well drained, medium to coarse textured, Brunisolic soils developed on till and associated with an open forest canopy of 50 year old aspen and spruce.

Map Unit Concept

This map unit concept is characterized by calcareous, dense, medium to coarse textured till at about 1400 to 1600 m asl in the lower Porcupine Valley. The single tract is characterized by an open forest of 50 year old aspen and spruce, with smaller amounts of balsam poplar, subalpine fir, lodgepole pine and Douglas fir. The open shrub layer, with species from both Montane and Subalpine zones has, among other species, tall bilberry, bristly black currant and willows. The herb-dwarf shrub layer is fairly sparse, with no dominants although bunchberry and twinflower are fairly abundant. The steep (45 to 60%) valley wall till landforms are characterized by Orthic Eutric Brunisol soils, some of which are losing horizons through erosion.

Differentiating Characteristics

The CM-TS map unit concept differs from many Montane map unit concepts because it is characterized by till materials on steep (45 to 60%) valley walls. In general OL-SPD, OL-SFDy, OL-SDC and TO-PD are moister and the occurrence of western red cedar and/or moist understory species such as blueberries or menziesia distinguishes them from CM-TS. The CM-TS map unit differs from OL-D because the latter has vegetation which is usually dominated by Douglas fir. Lodgepole pine dominates OL-P which effectively differentiates it from the spruce and poplar dominated vegetation in CM-TS. The OL-PT and CM-TS map units are fairly similar except that lodgepole pine is the consistent dominant species in the former, whereas aspen and spruce, in a mosaic pattern, are usually the dominants in the latter. Also the soils in CM-TS are somewhat coarser.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 67) and detailed vegetation information can be found in Kuchar 1978 (p. 89).

CO-SDP

Well drained, gravelly, coarse textured, calcareous, Brunisolic soils with associated white spruce, Douglas fir and lodgepole pine forests growing on moist fluvial fan landforms.

Map Unit Concept

This map unit is characterized by white spruce-Douglas fir-lodgepole pine communities growing on gently to moderately sloping (<20%) fluvial fans which have Orthic Eutric Brunisol soils developed on gravelly, coarse textured materials. The streams are entrenched, preventing them from overflowing their banks and flooding the surface. The vegetative growth on most sites mapped as CO-SDP indicates ample groundwater moisture is available to maintain a moist forest habitat. The two areas west of Emerald lake are somewhat finer textured than the other areas mapped as CO-SDP (although they do have abundant coarse fragments). The soils in the Ice River area mapped as CO-SDP are developed on non-calcareous fan materials and have Orthic Humo-Ferric Podzol soils. The area south of Emerald lake and west of Mount Burgess, as well as portions of one area in the Beaverfoot valley, have a drier forest type (PD).

Differentiating Characteristics

This map unit is separated from most others in the Montane zone because it has Brunisolic soil development on fluvial fan material and is associated with Douglas fir in a moist habitat. Both WR-SC and WR-SPDT are characterized by moist habitat but can be differentiated from CO-SDP by Regosolic soils. Even though moist, CO-SDP sites do not flood and thus are distinguishable from KI-PSj, BC-Se and BC-w even after the vegetation may have been disturbed.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 70 and 89) and detailed information about the vegetation can be found in Kuchar 1978 (pp. 116, 93 and 76).

CO-SF

Well drained, coarse textured, Brunisolic soils developed on calcareous, fluvial fan materials and associated with Engelmann spruce and subalpine fir forest.

Map Unit Concept

This map unit concept is characterized by fairly stable fluvial fan landforms located near Takakkaw Falls, in the mid Porcupine Valley and along the lower McArthur Creek. These landforms, probably coincidentally, all fall very near 1500 m asl. The coarse textured, calcareous, fluvial materials frequently have a gravelly silty surficial deposit on the surface into which the upper solum has developed. Associated vegetation is characterized by an Engelmann spruce and subalpine fir forest canopy. Menziesia and feathermosses comprise the major proportion of the understory cover. Deeply incised streams at the fan apex appear to prevent the channel from shifting allowing the development of Orthic Eutric Brunisol soils.

Differentiating Characteristics

The CO-SF map unit concept is separated from most Lower Subalpine map unit concepts because it is associated with fluvial landforms. Both KI-SF(b) and KI-Hm can be distinguished from CO-SF because of the lack of forest in the former two. The KI-SF and WR-SF map units are characterized by Regosolic soils with little horizon development whereas CO-SF is associated with Brunisolic soils with evident pedogenic horizons.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 70) and detailed vegetation information can be found in Kuchar 1978 (p. 101).

DS-PS

Well drained, medium to fine textured, Brunisolic soils with associated lodgepole pine, white spruce and occasionally some Douglas fir on shallow glaciolacustrine landforms.

Map Unit Concept

This map unit concept is characterized by small sized areas of calcareous, silty, glaciolacustrine materials, shallow (often less than 1 m) to till. Vegetation characteristic of this map unit is lodgepole pine forests with a varying component of white spruce as a subdominant and in the understory. Some sites also support modest amounts of Douglas fir. Typically these glaciolacustrine deposits occur on benches well above the river level near the steep valley walls of major valleys. Small seepage areas occur associated with these benches. Thus many areas mapped as DS-PS have, as an integral part of that map concept, very small sized areas that had they been larger, would have been mapped as BC-w (Coen et al. 1977, p. 72, Fig. 39). This is especially true of the DS-PS area mapped along the south side of the lower Amiskwi valley. A small tract in the Leanchoil area was mapped as DS-P(z) indicating that a large proportion of the vegetation on that tract had been grossly disturbed. Silt loam to silty clay loam, stone-free Eluviated Eutric Brunisol soils with thin solums characterize this map unit.

Differentiating Characteristics

The DS-PS map unit is differentiated from other map unit concepts in the Montane because it is characterized by glaciolacustrine materials. The dominantly spruce-subalpine fir vegetation in the Lower Subalpine zone differentiates DS-SF from DS-PS.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 72) and detailed information about the vegetation can be found in Kuchar 1978 (pp. 97 to 101 and 167).

DS-SF

Well and imperfectly drained, medium textured, Brunisolic soils developed on shallow, calcareous, nearly coarse fragment-free glaciolacustrine materials and associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by small sized areas of shallow (often less than 1 m) calcareous, silty glaciolacustrine materials over till. These map

units occur on benches near the valley bottoms in the Goodsir Valley, near Takakkaw falls and east of Wapta Lake at elevations of 1500 and 1600 m. Associated vegetation at Takakkaw falls is a stand of mature Engelmann spruce part of which has been disturbed by a snow avalanche. East of Wapta Lake the spruce-fir vegetation has been replaced by post-fire lodgepole pine serial to a spruce-fir forest. In the Goodsir Valley much of the area is affected by seepage and has an unusual spruce-fir-Labrador tea community described by Kuchar 1978 (p. 122). The somewhat heterogeneous mixture of vegetation is grouped together to allow recognition of the somewhat uncommon and significant glaciolacustrine materials upon which are developed thin Eluviated Eutric Brunisols and some associated Gleyed members especially in the Goodsir Valley.

Differentiating Characteristics

The DS-SF map unit concept is separated from all other Lower Subalpine map units because it is associated with shallow glaciolacustrine landforms which have dense silty nearly stone-free calcareous materials.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 72) and detailed vegetation information can be found in Kuchar 1978 (pp. 101 and 106).

FL-D

Well drained, angular gravelly, medium textured, Brunisolic soils developed on colluvium and associated with Douglas fir forests.

Map Unit Concept

This map unit is characterized by angular gravelly, calcareous, medium textured colluvium. There are several tracts located in the lower Yoho and Ice River valleys, near Steep Creek and west of the Ottertail Flats. Vegetation is characterized by mature stands of Douglas fir mostly on south and west facing slopes. A number of smaller mature stands occur in a mosaic with young post-fire pine and spruce and/or poplar forest stands. Some of these post-fire stands have large Douglas fir in small groups or as solitary individuals. White spruce is a common secondary dominant throughout the canopy. Understory structure and composition is rather variable but generally poor in cover and species. Red osier

dogwood, buffaloberry and prickly rose are among the species commonly associated with the understory.

Differentiating Characteristics

The FL-D map unit concept differs from many Montane map unit concepts because it is characterized by colluvial materials. Most of the Montane map unit concepts developed on colluvium are characterized by Regosolic soils (i.e. those designated at BG-) which differentiates them from the FL-D map unit concept. Also the vegetation of the remaining colluvial Montane units differentiates them from the vegetation of the FL-D map unit concepts. The FL-D map unit differs from FL-DP mainly because of the admixture of lodgepole pine and occasional white spruce on landforms with infrequent rock outcrop in the latter, whereas the former is dominated by Douglas fir canopy, generally where rock outcrops are frequent.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 75) and detailed vegetation information can be found in Kuchar 1978 (p. 95).

FL-PD

Well drained, angular gravelly, medium textured, Brunisolic soils developed on calcareous colluvium and associated with lodgepole pine and Douglas fir forests.

Map Unit Concept

This map unit is characterized by angular gravelly, calcareous, medium textured colluvium. There are several tracts located in the Amiskwi, Ottertail, Ice River and Kicking Horse valleys. Vegetation is characterized by even-aged post-fire stands with canopy dominants of lodgepole pine and Douglas fir. Small amounts of aspen and paper birch can also be found in localized areas. In the drier stands, Buffaloberry, showy aster, and twinflower are common understory components whereas in slightly moister stands bunchberry, feathermosses and leafy lichens (*Peltigera* spp,) are more common. The fairly uniformly steeply sloping (30 to 60%) landforms are generally located well above the valley floor and are characterized by Orthic Eutric Brunisol soils.

Differentiating Characteristics

The FL-PD map unit concept differs from many Montane map unit concepts because it is characterized by colluvial material. Most of the Montane map unit concepts developed on colluvium are characterized by Regosolic soils (i.e. those designated as BG-) which differentiates them from the FL-PD. Also, except for the BG-DP map unit concept, the vegetation differs sufficiently to allow differentiation from the FL-PD map unit concept. The FL-PD map unit differs from FL-D mainly because of a predominance of lodgepole pine with Douglas fir and some spruce generally on soils with infrequent rock outcrops in the former whereas the latter tends to have a predominance of Douglas fir and occurs where rock outcrops are more frequent.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 75) and detailed vegetation information can be found in Kuchar 1978 (p. 93).

FL-SF

Well drained, angular gravelly, medium textured, Brunisolic and Podzolic soils developed on calcareous colluvium and associated with an Engelmann spruce and subalpine fir forest.

Map Unit Concept

This widespread and frequently ocurring map unit concept is characterized by angular gravelly, calcareous, medium textured colluvium on generally steeply sloping landforms without significant rock outcrops above the slopes. Elevations range from approximately 1550 to 2000 m. Associated vegetation is characterized by Engelmann spruce and subalpine fir forests. Understory ranges from a fairly dense cover of menziesia to thinner menziesia and thicker grouseberry especially at higher elevations. Common species include green alder, twinflower, meadowsweet and arnica. Included in this concept are areas in which, in a significant number of instances, fires have disturbed the climax (or near climax) spruce-fir vegetation and a canopy of lodgepole pine has regenerated with varying amounts of understory and/or co-dominant Engelmann spruce and subalpine fir. The FL-SF map unit concept is characterized by Orthic Eutric Brunisols grading to Orthic Humo-Ferric Podzols. Occasional small sized areas of lithic soils and/or Regosolic soils are included within this map unit

concept.

Differentiating Characteristics

The FL-SF map unit concept can be distinguished from many other Lower Subalpine map unit concepts because it is characterized by colluvial landforms. The FL-SF map unit can be distinguished from BG-SF, BG-SF(LS), BG-SF(b) and BG-A because of the evident horizon development associated with Brunisolic and Podzolic soils in the former. Also FL-SF(b) can be distinguished from FL-SF because of the lack of forest canopy associated with recent forest fires.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 75, 97 and 62) and detailed vegetation information can be found in Kuchar 1978 (p. 101).

FL-SF(b)

Well drained, angular gravelly, medium textured Brunisolic and Podzolic soils developed on calcareous colluvium and associated with recently burned Lower Subalpine terrain.

Map Unit Concept

This map unit concept is essentially similar to the FL-SF map unit concept except for the effects of a recent forest fire on the vegetation. It is characterized by angular gravelly, calcareous, medium textured colluvium on generally steeply sloping landforms without significant rock outcrop above the slopes. Elevations range from approximately 1550 to 2000 m. Typified by tracts in the upper Amiskwi and upper McArthur valleys the vegetation is characterized by the lack of a prominent tree layer. Current vegetation is mainly fireweed and various regenerating shrubs. The FL-SF(b) map unit concept is characterized by Orthic Eutric Brunisols grading to Orthic Humo-Ferric Podzols.

Differentiating Characteristics

The FL-SF(b) map unit concept can be distinguished from many other Lower Subalpine map unit concepts because it is characterized by colluvial landforms. It can be distinguished from most other Subalpine map unit concepts developed on colluvium because of the absence of forests

associated with recent forest fires. The BG-SF(b) map unit can be distinguished from FL-SF(b) because the latter has evident horizon development associated with Brunisolic and Podzolic soils while the former is characterized by Regosolic soils.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 75) and detailed vegetation information can be found in Kuchar 1978 (p. 139).

KI-Hm

Moderately well and imperfectly drained, calcareous and noncalcareous, coarse textured soils ranging from Gleysols to Regosols on fluvial fan and fluvial terrace landforms and associated with Alpine and Upper Subalpine forb meadows and snowbeds.

Map Unit Concept

The map unit concept is characterized by a heterogeneous grouping of fluvial terraces and fans in the Upper Subalpine to Alpine ecotone on generally concave slope positions. The soils tend to have ample to surplus moisture throughout much of the growing season; wet areas frequently have melting snowbeds as a water source throughout most of the summer. Fluvial soil parent materials are usually calcareous, but the concept is broad enough to allow non-calcareous materials as exemplified by O'Hara Meadows and Amiskwi Pass, as members. Most of these areas are subject to what appears to be very slow continual windblown additions of sand and silt sized materials which in aggregate comprise 10 to 30 cm of nearly stone-free material. Elevations range from 1900 to 2150 m. Associated vegetation is typically a complex mosaic of herb meadow communities often including subalpine fir and/or Engelmann spruce, both having a krummholz habit. Kuchar (1978) has identified 18 plant communities, any or all of which might be represented in a tract mapped as KI-Hm. Some very small wet communities occur adjacent to stream margins or others downslope from snowbeds. Exaggerated microrelief provides many small sized varied habitats for the myriad of generally colorful forb plant communities. Willows and occasionally shrubby cinquefoil are the two shrubs that occasionally provide sufficient cover to be considered as shrub communities. In the very wet communities Rego Gleysols can be identified. Where streams flood, seasonally providing detritus, Orthic Regosols and Gleyed Regosols occur. On fairly stable landforms, as exemplified by

O'Hara Meadows or Amiskwi Pass, Orthic Humo-Ferric Podzol soils represent a portion of the map unit concept.

Differentiating Characteristics

The KI-Hm map unit concept is separated from most Upper Subalpine map unit concepts because it is associated with fluvial landforms. The Engelmann spruce and subalpine fir forest canopy allows KI-SF, WR-SF and CO-SF to be easily separated from the forb meadow communities typifying KI-Hm. The KI-SF(b) map unit is characterized by a recently burned and regenerating forest community which separates it from the forb meadow communities typifying KI-Hm.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 87, 140, 137, 138 and 52) and detailed vegetation information can be found in Kuchar 1978 (p. 146).

KI-PSj

Moderately well and imperfectly drained, calcareous, medium and coarse textured Regosolic soils with associated lodgepole pine-white spruce forests on stratified recent fluvial landforms.

Map Unit Concept

This map unit concept is characterized by the broad floodplains occurring along the Kicking Horse River near the confluence with the Amiskwi, Porcupine and Beaverfoot Rivers. Vegetation is characteristic of sites with a rapidly fluctuating watertable. Flooding may occur in early spring during snowmelt and again in July when hot weather results in rapid melting of glacier ice. In between high river levels the subsoils are coarse enough that they quickly drain and have little water holding capacity resulting in some fairly dry microsites. The canopy is usually comprised of post-fire stands of white spruce and lodgepole pine. Lower vegetation is a mosaic of wet sites in channels and hollows and dry sites on very slight rises and around tree clumps. The Regosolic soils characteristic of this map unit are generally gleyed and are sandy loam near the surface with gravelly strata at depth (generally >20 to 50 cm).

Differentiating Characteristics

Within the Montane zone the KI-Psj map units are separated from most others because they occur on floodplains with a high water table. Both BC-Se and BC-w occur on areas with a high watertable throughout much of the summer rather, as in the case with the KI-PSj map units, than having wet and dry cycles and wet and dry contrasting microsites.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 87) and detailed information about the vegetation can be found in Kuchar 1978 (pp. 122 and 97).

KI-SF

Moderately well drained, calcareous, coarse and medium textured, Regosolic soils developed on fluvial materials and associated with an Engelmann spruce and subalpine fir forest.

Map Unit Concept

This map unit concept is characterized by the confined linear floodplains along the Otterhead and Otto Creeks and the Amiskwi River. The recently deposited, stratified, calcareous, fluvial materials tend to have ample to surplus moisture for some period of most years. Elevations range from 1500 to 1900 m. Associated vegetation is characterized by Engelmann spruce and subalpine fir forests. Menziesia and feathermosses comprise the major portion of the understory cover. Because these areas are occasionally flooded, profile development seldom occurs and soils are mainly Orthic and Cumulic Regosols.

Differentiating Characteristics

The KI-SF map unit concept is separated from most Lower Subalpine map unit concepts because it is associated with fluvial landforms and materials. The WR-SF and CO-SF map units are characterized by fan shaped fluvial landforms whereas KI-SF is associated with linear fluvial terrace landforms. In addition the CO-SF landforms are typically sufficiently stable to allow the development of evident soil horizons. The lack of trees and the presence of forb meadows allows the KI-Hm concept to be easily distinguished from the KI-SF map concept. The recently burned and regenerating forests allow the

KI-SF(b) concept to be easily distinguished from the KI-SF concept.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 84 and 147) and detailed vegetation information can be found in Kuchar 1978 (p. 101).

KI-SF(b)

Imperfectly drained, calcareous, coarse and medium textured, Regosolic soils developed on fluvial materials and associated with recently burned Lower Subalpine terrain.

Map Unit Concept

This map unit concept is characterized by confined linear floodplains along the upper Amiskwi River. The recently deposited calcareous stratified fluvial materials are frequently saturated with water for a significant portion of the year. Elevations range from 1500 to 1600 m. Vegetation, as exemplified by the Amiskwi burn, is characterized by the lack of a prominent tree layer. Fireweed and willows are the most prominent species. Gleyed Orthic and Gleyed Cumulic Regosol soils characterize this map unit.

Differentiating Characteristics

The KI-SF(b) map unit concept is separated from most Lower Subalpine map unit concepts because it is associated with fluvial landforms. Vegetation indicative of a recently burned area separates this map unit from the rest of the fluvial Lower Subalpine map unit concepts.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 87 and 52) and detailed vegetation information can be found in Kuchar 1978 (p. 139).

NA-w

Very poorly drained Organic soils associated with wetland scrub, sedge meadow and bog communities.

Map Unit Concept

This map unit concept is characterized by flat bog and horizontal fen landforms covered with greater than 40 cm and less than 130 cm of heterogeneous organic material over calcareous, medium textured fluvial mineral material. This map unit occurs in the Montane (Ottertail Flats and Beaverfoot areas) and in the Lower Subalpine (Narao Lakes and upper McArthur Creek areas) zones at elevations of about 1100 to 1200 m in the former and 1700 to 1800 in the latter. Vegetation is characterized by a permanently high water table and flora quite distinct from upland communities. The conceptual vegetation sequence within a mapped area grades from open-water communities to sedge meadows and then to scrub meadows near the margins of the wet area. Each of these more-or-less concentric zones has a complex assemblage of vegetation communities. Near the open water, sedges are common and near the margins, willows and/or bog birch are fairly common. Soils grade from Typic Mesisols near the centre of the wet areas and then outward to Terric Mesisols and then peaty Gleysols in the lower elevation sites, and from Mesic Fibrisols near the centre to Terric Mesic Fibrisols and peaty Gleysols near the margins in the higher elevation sites.

Differentiating Characteristics

The NA-w map unit concept differs from all other map unit concepts in that it is characterized by Organic soils (i.e. >40 cm of organic material above a mineral horizon). Superficially the NA-w map units may be similar to the BC-w map unit concept but the latter are characterized by less than 40 cm of organic material above the mineral material.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 97) and detailed vegetation information can be found in Kuchar 1978 (p. 167).

OD-F

Well drained, medium and coarse textured, Podzolic soils developed on generally calcareous, morainic landforms and associated with open canopied or ribbon stands of mainly subalpine fir and some Engelmann spruce.

Map Unit Concept

This map unit concept is characterized by dense, calcareous, medium and coarse textured tills at elevations ranging from about 1900 to 2200 m. In the Dutchesnay Creek area a tract designated as OD-F occurs as a variant on coarse textured, non-calcareous till. Landscapes mapped as OD-F occur on steeply sloping (30 to 60%) valley wall moraines throughout the Park. Vegetation characteristic of this map unit concept is a mosaic or ribbon forest of mainly subalpine fir with some Engelmann spruce and open patches between the ribbons comprised of heath tundra and meadows. Mature trees are stunted with a crown height of 15 to 20 m and layering often occurs in trees at the ribbon margin. The shrub layer is open and has very few species, usually only tall bilberry, rhododendron and menziesia. The herb-dwarf shrub layer is dominated by mountain heathers, grouseberry and low bilberry along with arnicas, mountain valerian and western anemone. Soils are characterized by Orthic Humo-Ferric Podzols which often have a thin (0 to 5 cm) H or turfy Ah-like horizon over well developed light colored Ae and bright Bf horizons.

Differentiating Characteristics

The OD-F map unit concept differs from most Upper Subalpine map unit concepts because it is developed on morainic landforms. The OD-aL map unit concept differs from the OD-F map unit concept because the former has a significant component of subalpine larch whereas the latter is dominated by mainly open canopied subalpine fir stands. The OD-F(b) map concept differs because a recent fire has destroyed most or all of the forests associated with the OD-F map unit concept. The SK-H map unit concept differs because it is characterized by treeless Alpine vegetation and the occasional clump of subalpine fir and Engelmann spruce having a Krummholz habit.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 97 and 122) and detailed vegetation information can be found in Kuchar

1978 (pp. 111, 144 and 101).

OD-F(b)

Well drained, medium textured, Podzolic soils developed on calcareous, morainic landforms and associated with recently burned Upper Subalpine forests.

Map Unit Concept

This map unit concept is characterized by dense, calcareous, medium textured till occurring in the upper Porcupine Valley and the mid Amiskwi Valley west of Kiwetinok Peak. Vegetation is characterized by a sparse cover of regenerating timberline herbs with very little fireweed. In former forest sites where the fire was not too intense it is revegetating rapidly through resprouting of dwarf shrubs and some herbs. The tract in the Upper Porcupine Valley has an approximately 50 year old stand which has been designated OD-F(b) because revegetation has been so sluggish that there is no real forest yet. Soils are characterized by Orthic Humo-Ferric Podzols having well developed bright horizons.

Differentiating Characteristics

The OD-F(b) concept differs from most Upper Subalpine map unit concepts because it is developed on morainic landforms. Both OD-F and OD-aL are associated with ribbon or open forests whereas in OD-F(b) these forests have been destroyed through fire. Evidence, such as charred tree trunks and spars, stumps and standing live trees all identify the OD-F(b) map unit concept as being distinct from the SK-H which does not exhibit these features.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 97) and detailed vegetation information can be found in Kuchar 1978 (p. 139).

OD-aL

Well drained, medium and coarse textured, Podzolic soils developed on generally calcareous, morainic landforms and associated with open stands of subalpine larch and some subalpine fir.

Map Unit Concept

This map unit concept is characterized by dense, calcareous, medium and coarse textured tills. Elevations range from 2000 to 2300 m with slightly lower tracts in the Mount Goodsir area. Slopes are seldom linear and are less than 60% and greater than 15%. The large tract in McArthur Pass is a variant of OD-aL in that it is associated with non-calcareous till having abundant large boulders 1 to 3 m across dotting the ground surface. This map unit does not occur in the northern third of the Park and is rare in the remainder other than the O'Hara and Goodsir areas. Vegetation is characterized by stands of subalpine larch with sometimes co-dominant subalpine fir. Heathers are the dominant understory cover, but in some stands a high proportion of herbs especially arnicas, mountain valerian and bracted lousewort is usual. Shrubs are usually very scarce. Soils are characterized by Orthic Humo-Ferric Podzols having well developed bright Bf horizons below a thin (0 to 5 cm) H or turfy Ah horizon.

Differentiating Characteristics

The OD-aL map unit concept differs from most Upper Subalpine map unit concepts because it is developed on morainic landforms. The lack of subalpine larch in the OD-F map unit concept allows it to be distinguished from the OD-aL map unit concept. Evidence of a recent fire in the OD-SF(b) map unit concept distinguishes it from the OD-aL map unit concept. The lack of, or near lack of, trees in the SK-H map unit concept distinguishes it from the OD-aL.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 97) and detailed vegetation information can be found in Kuchar 1978 (pp. 114, 127 and 145).

OG-SF

Well drained, medium textured, Podzolic and Brunisolic soils developed on valley wall, calcareous, morainic landforms and associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by valley wall morainic landforms in numerous fairly extensive

tracts in all except the Cataract-O'Hara Valley and the Porcupine Valley. Elevations range from about 1550 to 2000 m. The tills are compact, strongly calcareous, medium textured and stony. Non-stony silty surficial deposits from 10 to 50 cm thick are common, especially in the Amiskwi Valley. Associated vegetation is characterized by an Engelmann spruce-subalpine fir canopy, with menziesia and feathermosses as the typical understory along with green alder, grouseberry, bunchberry and twinflower. Tree throw mounds are common, contributing to a complex mosaic of Orthic Humo-Ferric Podzols and Eluviated Eutric Brunisols both of which tend to be transitional to each other.

Differentiating Characteristics

The OG-SF map unit concept can be separated from many other Upper Subalpine map unit concepts because it is associated with morainic landforms. The TO-SF map unit concept can be distinguished from the OG-SF map unit concept because of its steeply sloping landforms and associated Regosolic soils. Imperfectly drained soils characterize OL-SF which distinguishes it from OG-SF. The OH-SF and CM-SF map units are characterized by loamy sand and sandy loam textures which distinguish them from OG-SF which is characterized by silt loam textures. The OG-SF(b) map unit is defined as having recently burned and regenerating vegetation which distinguishes it from OG-SF which has well developed forests.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp.100 to 105) and detailed vegetation information can be found in Kuchar 1978 (pp. 101 and 106).

OG-SF(b)

Well drained, medium textured, Podzolic soils developed on calcareous, valley wall morainic landforms and associated with recently burned Lower Subalpine terrain.

Map Unit Concept

This map unit concept is characterized by valley wall morainic landforms which have greater than 25 cm of friable stone-free silty surficial material over the dense, calcareous, medium textured, stony till. Typified by tracts located at about 1650 to 2100 m in the Otterhead and Upper Amiskwi Valleys this map unit

identifies portions of two recent forest fires. Vegetation, as exemplified by the Amiskwi burn, is characterized by the lack of a prominent tree layer. Fireweed and scattered other herbs and some areas where tall bilberry and grouseberry are regenerating characterize the current revegetation. The OG-SF(b) map unit concept is characterized by Orthic Humo-Ferric Podzol soils.

Differentiating Characteristics

The OG-SF(b) map unit concept can be separated from many other Lower Subalpine map unit concepts because it is associated with morainic landforms. The OG-SF(b) map unit concept is the only Lower Subalpine map concept that occurs on morainic landforms and does not have a forest stand.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 103) and detailed vegetation information can be found in Kuchar 1978 (p. 139).

OH-SF

Well drained, coarse textured, Podzolic soils developed on non-calcareous, morainic landforms and associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by bouldery, coarse textured, noncalcareous morainic landforms derived from glaciers having their headwalls in the thick, non-calcareous quartzitic rock cliffs around Lake O'Hara. Elevations range from around 1800 to 2100 m. Associated vegetation is characterized by an Engelmann spruce and subalpine fir forest. Feathermosses dominate the ground cover with open stands of menziesia throughout. Soils are characterized by a thick L-F organic horizon and a generally thick Ae horizon. Tree throw mounds are common contributing to a microhummocky topography. Soils are characterized by Orthic Humo-Ferric Podzols and Eluviated Dystric Brunisols.

Differentiating Characteristics

The OH-SF map unit concept can be separated from many other Lower Subalpine map unit concepts because it is associated with morainic landforms. The TO-SF map unit can be distinguished from OH-SF because of its steeply sloping landforms and associated Regosolic soils. Imperfectly drained soils characterize OL-SF which distinguises it from OH-SF. Medium textures and calcareousness of OG-SF and OG-SF(b) distinguish them from OH-SF. Map unit concepts defining CM-SF are characterized by carbonates in the parent till at depths greater than 1 m whereas there are no carbonates in the definition of the OH-SF map unit concept.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 105) and detailed vegetation information can be found in Kuchar 1978 (p. 101).

OL-D

Well drained, medium textured, Brunisolic soils associated with Douglas fir forests which have admixed lodgepole pine and/or aspen growing on sloping calcareous, morainic landforms.

Map Unit Concept

This map unit is characterized by calcareous, medium textured till near the outlets of Porcupine Creek and Steep Creek. Associated vegetation is characterized by young stands of Douglas fir mixed with lodgepole pine at Steep Creek and with aspen at Porcupine Creek. Islands of mature Douglas fir communities are present at both locations. The west-facing area mapped between Talon and Steep Creek occurs up to nearly 1800 m whereas the east-facing areas in the Porcupine Creek are between 1300 and 1550 m. The landforms are fairly steeply sloping. Eluviated Eutric Brunisols with thin sola characterize this map unit. Regosolic soils occur locally on steep slopes in the Porcupine Valley.

Differentiating Characteristics

The OL-D map unit concept differs from many Montane map unit concepts because it is characterized by till materials. The occurrence of western red cedar and/or western yew indicating moist sites distinguishes OL-SFDy and OL-SCD from OL-D. The lack of significant amounts of

Douglas fir in OL-P, OL-PT and CM-TS distinguishes them from OL-D. The TO-PD map unit differs from OL-D because the former is characterized by Regosolic soils. The main distinguishing characteristic between OL-SPD and OL-D is that the former is characterized by a fairly moist habitat as indicated by species rich understory communities providing a high percent cover, whereas the latter is characterized by a species poor understory which provides only sparse ground cover.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 108, 67, 132) and detailed vegetation information can be found in Kuchar 1978 (pp. 95 and 91).

OL-P

Well drained, medium textured, Brunisolic soils associated with large even-aged tracts of lodgepole pine forest growing on sloping calcareous, morainic landforms.

Map Unit Concept

This map unit is characterized by calcareous, medium textured till at elevations generally less than 1550 m in fairly extensive tracts especially in the vicinity of the Ottertail Flats. Associated vegetation is characterized by even-aged post-fire stands of lodgepole pine with trees generally from 40 to 80 years of age. The understory is dominated by buffaloberry with varying amounts of prickly rose, meadowsweet and bracted honeysuckle. In aggregate the vascular plants in the understory provide from a trace to 50% cover depending upon the density of the canopy. Increasing amounts of white and hybrid spruce occur as stands become older or as sites are moister. The landforms are gently to steeply sloping (15 to 50%) morainal blankets over inclined bedrock. Pockets of the till may have been reworked by water during deposition giving spotty gravel deposits and occasionally small areas of glaciolacustrine materials. Eluviated Eutric Brunisol soils with thin sola characterize this map unit.

Differentiating Characteristics

The OL-P map unit concept differs from many Montane map unit concepts because it is characterized by till materials. In general OL-SPD, OL-SFDy, OL-SDC and TO-PD are moister and the admixtures of white spruce, Douglas

fir, western red cedar and western yew allow separation of these concepts from the OL-P map unit concept. The significant occurrence of Douglas fir and aspen in OL-D, OL-PT and CM-TS map unit concepts respectively separates these map units from the OL-P map unit concept.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 108 and 100) and detailed vegetation information can be found in Kuchar 1978 (p. 97).

OL-PT

Well drained, medium textured, Brunisolic soils associated with a mosaic of lodgepole pine and aspen forest stands growing on calcareous morainic landforms.

Map Unit Concept

This map unit is characterized by calcareous, medium textured, dense till at elevations of generally less than 1200 m. There is only one tract within the Park, near the west gates, but there appears to be fairly large areas further west. Associated vegetation is characterized by lodgepole pine as a canopy dominant plus varying amounts of aspen, white spruce, Douglas fir, and possibly balsam poplar. Buffaloberry dominates the well developed shrub layer and pinegrass the herb layer. The characteristic landform is ridged moraines in the valley bottom. Orthic Eutric Brunisol soils with thin sola characterize the soils in this map unit.

Differentiating Characteristics

The OL-PT map unit concept differs from many Montane map unit concepts because it is characterized by till materials. In general OL-SPD, OL-SFDy, OL-SDC and TO-PD are moister and the occurrence of western red cedar and/or moist understory species such as blueberries or menziesia rather than buffaloberry distinguishes these map unit concepts from OL-PT. The OL-PT map unit differs from the OL-D because the latter has a canopy usually dominated by Douglas fir. The OL-P map unit concept does not have, as a significant understory component, aspen or Douglas fir which distinguishes it from OL-PT. The OL-PT and CM-TS map units are fairly similar except that lodgepole pine is the consistent canopy dominant in the former whereas aspen and spruce in a mosaic pattern are usually the dominants in the latter. Also the soils in

CM-TS are somewhat coarser.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 108) and detailed vegetation information can be found in Kuchar 1978 (p. 93).

OL-SDC

Well drained medium and coarse textured, Brunisolic soils on calcareous morainic landforms and associated with white spruce, Douglas fir and western red cedar.

Map Unit Concept

This map unit concept is characterized by calcareous, dense, medium textured till in the tract northeast of Field and by the same till plus a coarse textured fairly well sorted glaciofluvial kame terrace in the Beaverfoot-Ice River tract. Elevations range from about 1250 to 1500 m. Associated vegetation is characterized by fairly old stands of white spruce with an open canopy. The understory has an abundant composition of subalpine fir saplings mixed with the distinctly Montane species Douglas fir and western red cedar, both as scattered trees and saplings. The shrub layer is characterized by menziesia and tall bilberry indicative of a moist habitat. Bunchberry and five-leaved bramble characterize the herb-dwarf shrub layer. A dense surface layer of feathermosses is also characteristic. The landform in the tract northeast of field is an inclined (45 to 60%) moraine and the landform in the Beaverfoot-Ice River tract is a rolling (15 to 30%) terrace at low elevations changing to an inclined (30 to 60%) moraine at the upslope positions. Eluviated Eutric Brunisol soils characterize this map unit with medium textures associated with the inclined moraines and coarse textures associated with the rolling terrace in the Beaverfoot-Ice River tract.

Differentiating Characteristics

The steep, uniformly sloping landform of the map unit concepts on colluvial landforms separates them from the OL-SDC map unit concept. The OL-SDC map unit in the Beaverfoot-Ice River tract differs from the TA-DSP and CO-SDP map unit concepts because the latter are drier, supporting significant Douglas fir and failing to support western red cedar. The OL-P, OL-D, CM-TS and OL-PT map

units are all drier than OL-SDC and fail to support western red cedar. The generally moist habitat of OL-SDC contrasts with the occurrence of seepage sites in the lower slope positions of the OL-SPD map unit concept. The latter also lacks western red cedar. The occurrence of western yew as a characteristic species in the OL-SFDy map unit concept separates it from the OL-SDC. The lack of western red cedar and the uniformly steep slopes of TO-SDC separate it from OL-SDC.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 80 and 108) and detailed vegetation information can be found in Kuchar 1978 (p. 76).

OL-SF

Imperfectly drained, medium textured Gleyed Brunisolic soils developed on lower valley, calcareous, morainic landforms and associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map concept is characterized by lower valley morainic landforms which are subject to groundwater discharge resulting in saturated soils for significant periods early in most summers. Elevations in the Amiskwi and Otterhead Valleys are around 1350 to 1650 m and in the McArthur Creek area are around 1800 m. Many small tracts that might be mapped as OL-SF are too small to be delineated at the 1:50,000 scale of mapping and thus are inclusions in delineations designated as OG-SF and CM-SF. Thick organic horizons (L-F-H) and silty slope wash accumulations are common occurrences over the till associated with this map unit concept. Associated vegetation is characterized by Engelmann spruce and subalpine fir. Thin stands of understory shrubs plus an almost complete cover of feathermosses characterize the understory. Gleyed Melanic Brunisol and Gleyed Eutric Brunisol soils characterize this map unit concept. Near the Amiskwi burn an area of poorly drained soils developed on till has been included in tracts designated OL-SF.

Differentiating Characteristics

The OL-SF map unit concept can be separated from many other Lower Subalpine map unit concepts because it is associated with morainic landforms. The steeply

sloping landforms and associated Regosolic soils of TO-SF distinguish it from OL-SF. The CM-SF, OG-SF, OG-SF(b) and OH-SF map units are characterized by well drained soils whereas OL-SF is characterized by imperfectly drained soils.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 110) and detailed vegetation information can be found in Kuchar 1978 (pp. 101 and 106).

OL-SFDy

Imperfectly drained, medium textured, Brunisolic soils associated with a heterogeneous forest comprised of white spruce, subalpine and Douglas fir and some western yew growing on sloping, calcareous, morainic landforms.

Map Unit Concept

This map unit is characterized by calcareous, medium textured till at one location northwest of Emerald Lake. The nature of both the soils and vegetation communities is strongly influenced by groundwater discharge throughout the landform. The forest has a strikingly heterogeneous assemblage of thick tree clumps and alternate woodland-like boggy sections. The tree layer has large spruce, short subalpine fir, occasional very large Douglas fir and a sparse occurrence of lodgepole pine and paper birch. Western hemlock and western red cedar are rare. A thick growth of western yew and subalpine fir saplings in localized locations comprises a significant portion of the map unit concept. Gleyed Eutric Brunisol soils on 30 to 50% slopes with frequent seepage spots and associated Gleysolic soils characterize this map unit.

Differentiating Characteristics

The OL-SFDy map unit concept differs from many Montane map unit concepts because it is characterized by till materials. It also has the wettest moisture regime of the Montane morainic map unit concepts. The OL-P, OL-PT, OL-D and CM-TS map units are much drier than OL-SFDy as indicated by dominantly lodgepole pine or Douglas fir and/or aspen with relatively sparse understories. The TO-PD and OL-SDC map units are characterized by few groundwater discharge areas and the absence of western yew, which separates them from

OL-SFDy. The prominent moist and dry areas of OL-SPD differentiate it from OL-SFDY which has few non-moist areas. Also the absence of western yew in OL-SPD serves to further distinguish it from all other map unit concepts in the Park.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 110) and detailed vegetation information can be found in Kuchar 1978 (p. 83).

OL-SPD

Well drained, medium textured, Brunisolic soils developed on sloping, calcareous, morainic landforms and associated with white spruce and Douglas fir stands and having variable amounts of lodgepole pine.

Map Unit Concept

This map unit is characterized by calcareous, medium textured, morainic materials at elevations below 1500 m, near the valley bottoms adjacent to the mouths of the major tributaries of the Kicking Horse River. Most of the areas mapped as OL-SPD have vegetation characterized by white spruce, Douglas fir and lodgepole pine forests. The upslope portion of this map unit is generally characterized by fairly dry, mature white spruce-Douglas fir forests, and in lower slope positions seepage may be important resulting in an abundant cover of understory communities indicative of moist to wet sites. Silt loam (often with a silty surficial layer) Eluviated Eutric Brunisol soils with thin sola characterize this map unit.

Differentiating Characteristics

The OL-SPD map unit concept differs from many Montane map unit concepts because it is characterized by till materials. The lone area of OL-SFDy is located west of Emerald Lake. The wet soils and associated occurrence of western yew separate this map unit concept from the OL-SPD map unit concept. The generally moist soils and habitat supporting western red cedar separate OL-SDC from OL-SPD. The lack of Douglas fir in OL-P, OL-PT and CM-TS separates these map unit concepts from OL-SPD. The OL-D map unit is characterized by drier sites with sparse understory cover, which allow its separation from the characteristically moister OL-SPD. Steep (50 to 60%) slopes which support even-aged post-fire stands of often co-dominant lodgepole pine and Douglas fir characterize

TO-PD. This contrasts with OL-SPD which is generally less steeply sloping (<40%) and has a major component of white spruce in older uneven aged stands.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 108, 67 and 133) and detailed vegetation information can be found in Kuchar 1978 (pp. 116 and 84).

OL-SPD(b)

Well drained, medium textured, Brunisolic soils developed on calcareous morainic landforms and associated with recently burned Montane terrain.

Map Unit Concept

The map unit concept is essentially the same as OL-SPD except that the existing vegetation is made up of characteristic pioneer species regenerating after a recent forest fire. The main colonizers are fireweed and aster. The lone example of this map unit concept is on the northwest corner of Mount Hurd.

Detailed vegetation information can be found in Kuchar 1978 (p. 138).

OO-H

Well drained, medium and coarse textured, Podzolic soils developed on generally calcareous, colluvial landforms and associated with heath tundra vegetation.

Map Unit Concept

This map unit concept is characterized by calcareous, flaggy, colluvial and residual materials usually deposited as a veneer over bedrock. Lithic soils (<50 cm to bedrock) are common. Vegetated colluvial rubble occurring on rounded ridge crests is included as part of this map unit concept. Elevations range from about 2150 to 2400 m depending upon aspect, slope and other environmental factors. This map unit occurs throughout the Park in numerous, generally small delineations sandwiched between the rock cliffs and the forests below or where the cliffs are absent the heath tundra mantles the ridge tops above the tree line. Convex

ridge crests and steeply sloping (45 to 70%) uniform slopes characterize the map unit concept. Evidence of wind transported additions of fine sand and silt sized materials occurs throughout many of the landscapes in this map unit. Solifluction and evidence of frost action, such as stone stripes, are also common attributes. Vegetation is characteristically made up of a large number of distinct community types each one too small to be cartographically distinct at a mapped scale of 1:50,000. The typifying vegetation is the mountain heathers which occupy a median position along a moisture gradient. In moister sites, receiving snowmelt water throughout much of the summer, forb meadows occur. Mountain heather dominated terrain may also have an occasional subalpine larch and/or krummholz subalpine fir and Engelmann spruce. Soils are characterized by dark Ah horizons and reddish Bf horizons and classified as Sombric Humo-Ferric Podzols which are also frequently lithic.

Differentiating Characteristics

OO-H is the only Alpine map unit concept characterized by colluvial landforms, which allow its distinction from SK-H. The presence of appreciable trees separates SI-F, SI-aL and SI-whP from OO-H.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 114 and 122) and detailed vegetation information can be found in Kuchar 1978 (pp. 158, 144, 146 and 145).

SI-aL

Well drained, medium and coarse textured, Podzolic soils developed on calcareous, colluvial landforms and associated with open stands of subalpine larch and some subalpine fir.

Map Unit Concept

This map unit concept is characterized by stable colluvial materials, often shallow to bedrock. Elevations range from approximately 1900 to 2200 m. Landscapes mapped as SI-aL occur on uniform steeply sloping (45 to 70%) valley walls generally without massive rock cliffs above the tracts although outcrops may interrupt the slope. Areas of snow avalanching and unstable soils which are too small to show at a scale of 1:50,000 are consistent components of this map concept. This map unit

does not occur in the northern third of the Park and is rare in the remainder other than in the O'Hara and Goodsir areas. Vegetation is characterized by stands of subalpine larch with sometimes co-dominant subalpine fir. Heathers are the dominant understory cover but in some stands a high proportion of herbs, especially arnicas, mountain valerian and bracted lousewort is usual. Shrubs are usually very scarce. Soils are characterized by Lithic and Orthic Humo-Ferric Podzols having well developed bright colored Bf horizons below a thin light colored Ae horizon in turn below a thin turfy Ah (or H) horizon.

Differentiating Characteristics

The SI-aL map unit concept differs from most Upper Subalpine map unit concepts because it is developed on colluvial landforms. The lack of appreciable subalpine larch in SI-F and SI-whP differentiates them from SI-aL. SI-F(b) differs because a recent fire has destroyed most or all of the forest. The landslide landform associated with SI-aL(LS) distinguishes it from the uniform colluvial slopes characterizing SI-aL. Heath tundra vegetation characteristic of OO-H differentiates it from SI-aL.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 122 and 60) and detailed vegetation information can be found in Kuchar 1978 (pp. 114, 145 and 127).

SI-aL(LS)

Boulder field comprised of varying amounts of boulders 2 to 10 m in diameter mixed with some medium textured, Regosolic soils on landslide landforms and associated with open stands of subalpine larch and some subalpine fir.

Map Unit Concept

This map unit concept is exemplified by large calcareous boulders and associated fines on two landslide landforms near Goodsir pass. The valley wall, prior to the catastrophic slide, appears to have been mantled with till some of which has moved downslope intact providing small areas of till-like material within the slide perimeter. Vegetation is characterized by stands of subalpine larch mixed with subalpine fir. Much of the land surface is covered with unvegetated boulders. Soils

are characterized by Orthic Regosols developed on a minor proportion of the landscape.

Differentiating Characteristics

The SI-aL(LS) map unit concept differs from most other map concepts in the Park because it is developed on a landslide landform. The distinctly Upper Subalpine SI-aL(LS) map unit concept allows differentiation from the Lower Subalpine BG-SF(LS) and the Montane BG-SDC(LS) map unit concepts.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 58) and detailed vegetation information can be found in Kuchar 1978 (pp. 114 and 145).

SI-F

Well drained, medium and coarse textured, Podzolic soils developed on calcareous, colluvial landforms and associated with open canopied or ribbon stands of mainly subalpine fir and some Engelmann spruce.

Map Unit Concept

This map unit concept is characterized by stable colluvial materials generally shallow to bedrock. Elevations range from approximately 1900 to 2200 m. Landscapes mapped as SI-F occur throughout the Park on uniform, steeply sloping (45 to 70%) valley walls generally without rock cliffs above the slopes. Areas of snow avalanching and unstable soils which are too small to map at 1:50,000 are consistent components of this map unit concept. Vegetation characteristic of this map unit concept is a mosaic of mainly subalpine fir with some Engelmann spruce and open patches between the ribbons comprised of heath tundra and meadows. Mature trees are stunted with a crown height of 15 to 20 m and layering often occurs in trees at the ribbon margin. The shrub layer is open and has very few species usually only tall bilberry, white rhododendron and menziesia. The herb-dwarf shrub layer is dominated by mountain heathers, grouseberry and low bilberry along with arnicas, mountain valerian and western anemone. Soils are characterized by frequently lithic Orthic Humo-Ferric Podzols which often have a thin turfy Ah (or H) horizon over well developed light colored Ae and bright colored Bf horizons.

Differentiating Characteristics

The SI-F map unit concept differs from most Upper Subalpine map unit concepts because it is developed on colluvial landforms. The presence of appreciable subalpine larch in SI-aL and SI-aL(LS) differentiates them from SI-F. The occurrence of appreciable whitebark pine in rather exposed rocky arid sites distinguishes SI-whP from SI-F. The SI-F(b) map unit differs because a recent fire has destroyed most or all of the forests associated with the SI-F map unit concept. Heath tundra vegetation characteristic of OO-H differentiates it from SI-F.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 122 and 58) and detailed vegetation information can be found in Kuchar 1978 (pp. 11, 127, 144 and 101).

SI-F(b)

Well drained, medium and coarse textured, Podzolic soils developed on calcareous, colluvial landforms and associated with recently burned Upper Subalpine forest.

Map Unit Concept

This map unit concept is characterized by stable colluvial and undifferentiated materials generally shallow to bedrock. Elevations range from approximately 1900 to 2200 m. Landscapes mapped as SI-F(b) occur in three tracts in the upper Amiskwi Valley. Vegetation is characterized by a sparse cover of regenerating timberline herbs with very little fireweed. In former forest sites, where the fire was not too intense, rapid revegetation is occurring through resprouting of dwarf shrubs and some herbs. Soils are characterized by often lithic Orthic Humo-Ferric Podzols having well developed bright colored Bf horizons.

Differentiating Characteristics

The SI-F(b) map unit concept differs from most Upper Subalpine map unit concepts because it is associated with colluvial and undifferentiated landforms. The SI-F, SI-aL, SI-aL(LS) and SI-whP map units differ from SI-F(b) because the latter is characterized by landscapes where the forests have been destroyed by fire. Evidence such as charred tree trunks and spars, stumps and standing live

trees all identify SI-F(b) as being distinct from OO-H which does not exhibit those features.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 122 and 95) and detailed vegetation information can be found in Kuchar 1978 (p. 139).

SI-whP

Rapidly drained, medium and coarse textured, Brunisolic and Podzolic soils developed on calcareous, colluvial landforms and associated with open stands of whitebark pine mixed with varying proportions of Engelmann spruce and subalpine fir.

Map Unit Concept

This map unit concept is characterized by generally stable colluvial materials, often shallow to bedrock. Rock outcrops and snow avalanche tracks are common attributes of this map unit concept. The often cobbly and flaggy materials on steep (45 to 70%) slopes result in many very rapidly drained situations especially near the timberline where the whitebark pine tend to be most prevalent. Elevations range from 1800 to 2200 m. Vegetation is characterized by an open and low (<15 m) canopied forest of whitebark pine co-dominant with Engelmann spruce and subalpine fir. If the canopy is taller than about 15 m whitebark pine is effectively an understory species. Many stands are characterized by a shrub layer of common juniper, shrubby cinquefoil, buffaloberry and willows with menziesia and rhododendron in the moister sites. Soils are characterized by often lithic Orthic Eutric Brunisols associated with the steep, fairly dry sites. Lithic and Orthic Regosol soils are common below cliffs and in other unstable situations where horizons do not have an opportunity to develop.

Differentiating Characteristics

The SI-whP map unit concept differs from many Upper Subalpine map unit concepts because it is developed on colluvial landforms. The presence of appreciable whitebark pine allows distinction of SI-whP from the remaining Upper Subalpine colluvial map unit concepts.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 122, 60 and 95) and detailed vegetation information can be found in Kuchar 1978 (p. 108, 127, 144 and 111).

SK-H

Well drained, medium and coarse textured, Podzolic soils developed on generally calcareous, morainic landforms and associated with heath tundra vegetation.

Map Unit Concept

This map unit concept is characterized by dense, calcareous medium and coarse textured, morainal landforms. In the Lake O'Hara and Eagles Eyrie areas there are non-calcareous coarse textured variants of the SK-H map unit. Occasional areas of colluvial material too small to be separated at 1:50,000 occur as part of the delineation identified as SK-H. Elevations range from about 2150 to 2400 m depending upon aspect, slope and other environmental factors. This map unit occurs throughout the Park, in numerous, generally small delineations on somewhat more gently sloping terrain than the surrounding landforms and often associated with the heads of valleys. There is usually 10 to 30 cm of nearly coarse fragment free wind transported silty surficial material over the tills in these high elevation situations. Vegetation is characteristically made up of a large number of distinct community types each one too small to be cartographically distinct at a mapped scale of 1:50,000. The typifying vegetation is the mountain heathers which occupy a median position along a moisture gradient. In moister sites forb meadows and snowbeds occur. Mountain heather dominated terrain may also have an occasional subalpine larch or Krummholz subalpine fir and Engelmann spruce. Soils are characterized by Sombric Humo-Ferric Podzols having a dark Ah colored horizon over a bright colored Bf horizon.

Differentiating Characteristics

The SK-H map unit concept is the only Alpine map unit occurring on morainic landforms. The presence of appreciable trees separates OD-F and OD-aL.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 125 and 114) and detailed vegetation information can be found in Kuchar 1978 (pp. 158, 144, 145 and 146).

TA-DSP

Well drained Brunisolic soils developed on calcareous, gravelly sandy loam, glaciofluvial materials and associated with white spruce, Douglas fir and lodgepole pine vegetation.

Map Unit Concept

This map unit, where found in the Porcupine and Beaverfoot Valleys, is characterized by dry open Douglas fir stands with associated white spruce and lodgepole pine. The area mapped at the mouth of the Otterhead Valley has somewhat moister white spruce-Douglas fir vegetation indicative of seepage. Both areas are dominated by Eluviated Eutric Brunisol soils with thin sola developed on steep, calcareous, glaciofluvial slopes.

Differentiating Characteristics

The glaciofluvial landform separates this map unit concept from other map unit concepts in the Montane zone except for TA-P. The TA-P map unit differs from TA-DSP mainly because of the lack of Douglas fir as a component of the forest.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 129 and 81) and detailed information about the vegetation component can be found in Kuchar 1978 (pp. 86, 93 and 116).

TA-P

Well drained Brunisolic soils developed on calcareous, gravelly sandy loam, glaciofluvial and fluvial landforms associated with even-aged lodgepole pine forests.

Map Unit Concept

This map unit is characterized by post-fire, even-aged stands of lodgepole pine growing on gently sloping fluvial terraces near the outlets of the Amiskwi and Ice Rivers and on more steeply sloping (30 to 45%) glaciofluvial terraces along the Ottertail and Porcupine Rivers. More spruce is evident in the understory in the

moister areas along the upper Ottertail Valley and in the Ice River area and aspen poplar is significant in the post-fire stands in the Porcupine Valley. The soils are characterized by Eluviated Eutric Brunisols with thin sola on the fluvial terraces and by slightly deeper sola on the glaciofluvial landforms.

Differentiating Characteristics

The gravelly and cobbly, coarse textured soils on fluvial landforms with Brunisolic development separates this map unit from all but those with "TA" designators in the Montane zone. The lack of Douglas fir in this map unit separates it from the TA-DSP map units.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 129, 120 and 81) and detailed information about the vegetation component can be found in Kuchar 1978 (pp. 97 and 89).

TA-SF

Well drained Brunisolic and Podzolic soils developed on calcareous, gravelly sandy loam, glaciofluvial materials and associated with lodgepole pine, Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by small sized areas of gravelly, coarse textured, calcareous, glaciofluvial materials, generally located in valley bottom kame terrace positions adjacent to stream channels. Elevations range from 1450 to 1650 m with the exception of a small area near Lake O'Hara which is at about 1750 m. Vegetation is characterized by Engelmann spruce and subalpine fir either as canopy dominants or as understory components. Several areas have been burned and now support 60 to 80 year old stands of lodgepole pine. There are several understory shrub species the most usual being menziesia, bracted honeysuckle and tall bilberry. Dwarf shrubs and herbs include a sparse cover of arnicas, bunchberry, bristly goundpine, low bilberry, wintergreens and twinflower. In stands where lodgepole pine is dominant the understory vegetation grades to that in the Montane pine forests. Eluviated Eutric Brunisol and occasionally Orthic Humo-Ferric Podzol soils characterize this map unit concept.

Differentiating Characteristics

The glaciofluvial landform separates this map unit concept from other map unit concepts in the Lower Subalpine zone except for the TA-SF(b) concept which can be distinguished because it is characterized by recently burned terrain where there is no tree layer.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 129) and detailed vegetation information can be found in Kuchar 1978 (pp. 101 and 106).

TA-SF(b)

Well drained Podzolic soils developed on calcareous, gravelly sandy loam, glaciofluvial materials and associated with recently burned Lower Subalpine terrain.

Map Unit Concept

This map unit is characterized by calcareous, gravelly, coarse textured kame terrace and esker landforms as exemplified by a tract near Otto Creek in the mid Amiskwi Valley. Included also is a small area of coarse textured fluvial fan material. Elevations are around 1500 m. Vegetation, as exemplified by the Otto Creek burn, is characterized by fireweed and a variety of other herbs and shrubs especially menziesia and willows. Small conifers, pines and spruces, dot the landscape. Hollows and gullies have much denser cover than convex slopes. Orthic Humo-Ferric Podzol soils are found on the single tract mapped as TA-SF(b) in Yoho National Park.

Differentiating Characteristics

The glaciofluvial landform separates this map unit concept from other map unit concepts in the Lower Subalpine zone. The TA-SF(b) map unit is a recently burned variant of the TA-SF map unit concept.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 129) and detailed vegetation information can be found in Kuchar 1978 (p. 139).

TO-PD

Well drained, medium and occasionally coarse textured, Regosolic soils associated with lodgepole pine and Douglas fir stands on steep river banks.

Map Unit Concept

This map unit concept is characterized by calcareous, medium textured till, with occasional pockets of superimposed glaciofluvial gravels on steeply sloping (60 to 70%) landforms along the lower Amiskwi River Valley. Elevations range from 1250 to 1500 m. Associated vegetation is characterized by lodgepole pine and Douglas fir as canopy dominants in even-aged post-fire stands. White spruce is common in the understory. Menziesia, bunchberry and feathermosses predominate in the understory. The steeply sloping landforms are sufficiently unstable that the characteristic soils are Cumulic Regosols.

Differentiating Characteristics

The TO-PD map unit concept differs from many Montane map unit concepts because is is developed on till materials. The steep unstable slopes and associated Regosolic soils separate this map unit from the remaining map unit concepts on morainic landforms. In general OL-P, OL-D, OL-PT and CM-TS are drier and are not likely to have the high percent understory cover characteristic of the TO-PD map unit concept. The occurrence of significant western yew and/or western red cedar in the moist OL-SFDy and OL-SDC map unit concepts provides another distinguishing feature to separate these concepts from the TO-PD map unit concept. The OL-SPD map unit is generally less steeply sloping (<40%) and has a major component of white spruce in older uneven aged stands which separates it from TO-PD.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 132) and detailed vegetation information can be found in Kuchar 1978 (p. 93).

TO-SF

Well and moderately well drained, medium textured, Regosolic soils on steeply sloping (45 to 70%) valley wall morainal landforms and associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by steeply sloping valley wall morainal landforms typified by three tracts on the northeast corner of Mount Hurd and one on the northwest slope of Mount Burgess. Slope instability results from very steep slopes on Mount Burgess and from temporary excess moisture because of smowmelt in the spring on Mount Hurd. Slumps, flow scars and curved trees indicate slope instability on these tracts. Elevations range from about 1350 to 1800 m. Associated vegetation is characterized by Engelmann spruce and subalpine fir forests. The tract on Mount Hurd, although in a spruce-fir environment, is characterized by post-fire lodgepole pine stands with regenerating spruce and fir. The unstable slopes result in sufficient soil creep to prevent the development of soil horizons resulting in Cumulic Regosol soils being characteristic of the map unit concept.

Differentiating Characteristics

The TO-SF map unit concept can be separated from many other Lower Subalpine map unit concepts because it is associated with morainic landforms. There may be some difficulty distinguishing TO-SF map units from BG-SF map units. Although unstable, the TO-SF map unit does not receive debris from cliffs above, thus has fewer flag and cobble sized coarse fragments and is denser and firmer with depth than would be the BG-SF map unit concept. The TO-SF map unit concept differs from the remaining Lower Subalpine morainic landforms because it is characterized by Regosolic soils.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (p. 132) and detailed vegetation information can be found in Kuchar 1978 (pp. 101 and 97).

WR-GSd

Well drained, calcareous, gravelly, coarse textured, Regosolic soils associated with open stands of white and hybrid spruce having yellow dryad as an understory growing on fluvial fan and floodplain landforms.

Map Unit Concept

This map unit concept is characterized by gently sloping, calcareous, gravelly, sandy loam fluvial fans and floodplains in both the Montane and the Lower Subalpine zones. The WR-GSd map unit north of Emerald Lake is in the Montane zone but the areas on the floodplains of the Ice and Goodsir Rivers and near Narao Lake are more closely related to the Lower Subalpine zone. The map unit is characterized by open stands of white and hybrid spruce (with some lodgepole pine) and areas of recent alluvium covered with yellow dryad. These sites are dry during much of the season but may flood in the spring or at times of rapid glacier melting. Regosolic soils, lacking even Ah horizons, characterize this map unit. The WR-GSd map units in the Takakkaw Falls area have significant portions with moister sites and Gleyed Regosolic soils included along with the seasonally dry soils on the floodplain.

Differentiating Characteristics

The occurrence of open white and hybrid spruce with a yellow dryad understory on seasonally dry, coarse fluvial material separates the WR-GSd map unit from other map units in the Montane and Lower Subalpine vegetation zones.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 141 to 148, and 85) and detailed information about the vegetation can be found in Kuchar 1978 (pp. 123 and 180).

WR-P

Well drained, calcareous, coarse textured, Regosolic soils associated dominantly lodgepole pine forests growing on gently sloping fluvial fan and floodplain landforms.

Map Unit Concept

This map unit is characterized by intermediate sized fans impinging upon the Kicking Horse floodplain and to some extent, the floodplain itself. The vegetation is characterized predominantly by even-aged post-fire lodgepole pine forests with increasing amounts of understory white spruce in increasingly moister sites. At the moist end of the WR-P map unit concept white spruce is sometimes a co-dominant with the lodgepole pine.

Buffaloberry, twinflower, and bunchberry are the common understory species. Two areas are designated as WR-P(z) indicating that the vegetation on these tracts has been severely modified by the development of a campsite and cabins on the fan near the confluence of the Yoho and Kicking Horse Rivers and a ranch on the floodplain west of Field. The dominant soils are gravelly sandy loam Regosolics situated on calcareous, stratified, gently sloping fluvial deposits.

Differentiating Characteristics

Within the Montane zone the occurrence of this map unit on fluvial deposits separates it from map units characterized by other geologic materials. The well drained soils and associated mesic forests separate the WR-P map units from the map units characterized by wetter sites such as KI-PSj, BC-Se, BC-w, CO-SDP, WR-SC, and WR-SPDT. The WR-GSd map unit is drier and characterized by open stands of white spruce and/or lodgepole pine with yellow dryad and creeping juniper characteristic of the understory, rather than vegetation as described above for WR-P. The presence of poplar species in the WR-ST map unit differentiates it from the WR-P map unit.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 141 to 145) and detailed information about the vegetation can be found in Kuchar 1978 (pp. 97 to 101).

WR-SC

Moderately well drained, calcareous, medium textured, Regosolic soils associated with white spruce and western red cedar forests growing on moist fluvial fan landforms.

Map Unit Concept

This map unit concept is characterized by old (decadent) white spruce-western red cedar forests with the odd Douglas fir as a minor component. The abundance of devil's club in the understory is also very typical. The above vegetation community is associated with medium textured Regosolic soils on fluvial fan materials which have ample moisture for good vegetative growth. There are three areas mapped as WR-SC, two of which are located on the east side of Emerald Lake and have deep, silt loam Gleyed Cumulic Regosolic soils and appear to be slightly moister sites than the one north of the Field townsite.

This may, in part, be because the latter fan has soils with a greater percentage of coarse fragments at depth and thus they have a lower water holding capacity, or perhaps because it is that the smaller groundwater supply is less dependable.

Differentiating Characteristics

Within the Montane zone the WR-SC map units are separated from most other units because of their moist Regosolic soils on fluvial fans which flood infrequently and seldom have a high water table. The old (decadent) white spruce-western red cedar vegetation with an understory of devil's club serves to distinguish WR-SC from WR-SPDT, WR-ST and WR-GSd.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 141 to 148) and detailed information about the vegetation can be found in Kuchar 1978 (p. 118).

WR-SF

Well drained, calcareous, coarse textured, Regosolic soils on fluvial fan landforms and associated with Engelmann spruce and subalpine fir forests.

Map Unit Concept

This map unit concept is characterized by a few fairly steep (15 to 30%) fluvial fan landforms located in the mid Ice River Valley, upper McArthur Creek, near Narao Lakes and near Takakkaw Falls. The recently deposited, calcareous, cobbly, fluvial materials are generally located at elevations between 1500 and 1800 m except for the tract at Narao Lakes which extends somewhat higher. Associated vegetation is characterized by an Engelmann spruce and subalpine fir forest. Menziesia and feathermosses comprise the major proportion of the understory cover. Periodic shifting of the stream channel and surface flow of silt-laden water results in the soils being characterized by Orthic and Cumulic Regosols.

Differentiating Characteristics

The WR-SF map unit concept is separated from most Lower Subalpine map unit concepts because it is

associated with fluvial landforms. The KI-SF(b) and KI-Hm map unit concepts can be distinguished from WR-SF because of the lack of a forest canopy in the former two. The CO-SF map unit is characterized by Brunisolic soils on stable landforms which differentiate it from WR-SF which has little soil profile development. The KI-SF map unit is associated with linear fluvial terrace landforms rather than the fluvial fan landforms characterizing WR-SF.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 140 to 146) and detailed vegetation information can be found in Kuchar 1978 (p. 101).

WR-SPDT

Well drained, calcareous, coarse textured, Regosolic soils associated with white spruce-Douglas fir-lodgepole pine canopy and associated understory growing on gently sloping moist fluvial fan and floodplain landforms.

Map Unit Concept

This map unit concept is characterized by sloping fluvial fans and floodplains adjacent to the Kicking Horse and Beaverfoot Rivers. These generally moist sites are characterized by a complex mixture of tree species, the most abundant being white spruce, and Douglas fir is usually common. Other species such as subalpine fir, western red cedar, lodgepole pine, balsam poplar and paper birch occur in varying proportions. Three community types namely spruce-lodgepole pine-Douglas fir/menziesia-green alder, spruce-Douglas fir/ wild sarsaparilla and spruce-Douglas fir-lodgepole pine/Labrador tea-bunchberry characterize the understory of the moist sites. The calcareous Regosolic soils characteristic of this map unit are gravelly sandy loam in texture, but seldom show gleying characteristic of a high water table. The small area near the confluence of the Yoho and Kicking Horse Rivers has dominantly pine (P) vegetation growing on floodplain materials and appears to be somewhat less moist than the sites near the confluences of the Porcupine and Beaverfoot Rivers. The WR-SPDT map unit upstream from Field has an upslope component of fairly steep coarse fan material which is somewhat drier and supports mainly (SD) spruce-Douglas fir vegetation.

Differentiating Characteristics

Within the Montane zone the WR-SPDT map unit concepts are separated from most other map unit concepts by moist Regosolic soils on fluvial fans and floodplains which seldom flood. The old stands of white spruce-western red cedar separate the WR-SC map units from the somewhat less moist white spruce-Douglas fir-Lodgepole pine forests of WR-SPDT map units. The WR-ST map units are similar in moisture to the WR-SPDT units except perhaps the soils might not be as continuously supplied with seepage and the vegetation does not have the Douglas fir component and lodgepole is less evident or absent. Tracts mapped as WR-P and especially WR-GSd are drier sites and easily distinguishable by the vegetation types.

Specific soil and landform characteristics can be obtained from Coen et al. 1977 (pp. 14 to 148 and 85) and detailed information about the vegetation can be found in Kuchar 1978 (pp. 116, 84 and 125).

SPECIAL MAP UNITS

WR-ST

Imperfectly drained, calcareous, coarse and medium textured Regosolic soils associated with white spruce-poplar forests growing on gently sloping moist fluvial fan landforms.

Map Unit Concept

This map unit concept is characterized by gently sloping, imperfectly drained, calcareous, fluvial materials in the Kicking Horse River Valley. Vegetation is characterized by dominantly white spruce plus balsam poplar or in some cases dominantly balsam poplar with some trembling aspen. The understory vegetation typically includes willows and other species indicative of moist sites. The soils of this map unit are characterized by gravelly, fine sandy loam Gleyed Orthic Regosols.

Differentiating Characteristics

Within the Montane zone the occurrence of this map unit on fluvial deposits separates it from map units characterized by other geologic materials. The

imperfectly drained soils and moist sites with significant poplars separate this map unit from WR-P and WR-GSd map unit concepts. The BC-w and BC-Se map units have a high water table throughout a significant portion of the summer which separates them from WR-ST. The Douglas fir component in WR-SPDT separates it from WR-ST. A significant presence of poplars separates WR-ST from the remaining CO-SDP and WR-SC map units with similar moisture regimes.

Specific soil and landform characteristics can be obtained from Coen et al. (pp. 145 to 148 and 77) and detailed information about the vegetation can be found in Kuchar 1978 (pp. 125 and 126).

SPECIAL LAND UNITS

G

Cobbleland associated with stream channels, unvegetated or sparsely covered with yellow dryad and/or willows.

Map Unit Concept

This map unit concept is typified by the floodplain of the Kicking Horse River up and downstream from Field. The coarse nature of the fluvial materials plus rapidly fluctuating water table results in surplus moisture for varying periods and a moisture deficit for other periods during the growing season. These braided stream channels result in continued disturbance of the vegetation cover that does invade the fresh debris. Elevations range from about 1100 m near Wapta Falls to around 1800 m in the upper Yoho Valley. This map unit is mapped only along the major rivers because the other valleys are too confined to have areas falling within the G concept that are large enough to be delineated at a scale of 1:50,000. Vegetation is characterized by yellow dryad and occasionally white dryad at high elevations. Occasional willows may also obtain a tenuous foothold in these gravels. Cobbleland and poorly developed Regosolic soils characterized this map unit concept.

Detailed vegetation information can be found in Kuchar 1978 (p. 180).

R + H

A mosaic of rock plus heath tundra supported by very shallow soils.

Map Unit Concept

This map unit concept is typified by rock, talus and colluvial rubble landforms which are above the tree line and have sufficient weathered mantle to support a heath tundra vegetation. Elevations are generally above 2200 and below 2400 m. The mantle may occasionally be thicker than the 10 cm required to be considered a soil, and in these cases the soils are classified as Regosolic. Vegetation is characterized by heath tundra consisting mainly of the mountain heathers. White mountain heather dominates the bulk of the stand with sometimes co-dominant grouseberry or yellow and red mountain heather. Sparse numbers of herbs such as western anemone and woolly pussytoes are consistently present as well. Drought resistant stands are characterized by stony tundra on exposed or unstable sites. Plants occur in very small or prostrate forms in mats, cushions, rosettes and tufts. White dryad is one of the more common plants with a few other species such as moss campion, little clubmoss and purple saxifrage also being present often as single clumps or plants in a protected microsite.

Detailed vegetation information can be found in Kuchar 1978 (pp. 158 and 146).

R-F

Rock with a sparse cover of subalpine fir supported directly on the rock or by very shallow soils.

Map Unit Concept

This map unit concept is typified by rock, talus and occasionally colluvial rubble landforms which are near the upper limit of the tree line. Elevations range from 1900 to 2200 m. The mantle may occasionally be thicker than the 10 cm required to be considered a soil, and in these cases the soils are classified as Regosolic. Vegetation is characterized by slow growing, short, open fir stands on the steep cliffs and by dense scrub fir on the upper slopes of avalanche chutes. Engelmann spruce can be seen as a companion or co-dominant tree in this map unit concept. Patches of sparsely vegetated cliffs

and talus as well as bare rock are part of this map unit concept. Avalanched talus chutes partially vegetated with dense scrub fir commonly interrupt the thin canopy of the rocky cliffs typical of this map unit concept.

Detailed vegetation information can be found in Kuchar 1978 (pp. 111, 127, and 183).

R-F(b)

Rock associated with a recently burned Upper Subalpine terrain.

Map Unit Concept

This map unit concept is essentially the same as R-F except that the existing vegetation is made up of characteristic regenerating pioneer species of timberline herbs, with very little fireweed.

Detailed vegetation information can be found in Kuchar 1978 (p. 139).

R-whP

Rock on south and west facing dry exposures with a cover of scattered whitebark pine supported directly on the rock or by very shallow soils.

Map Unit Concept

This map unit concept is typified by rock and occasionally colluvial rubble landforms on warm, dry, generally south and west aspects at elevations of around 1800 to 2200 m, just below the tree line. Where the mantle is greater than 10 cm thick, the resulting soils are classified as Regosolic and weakly developed Brunisolic. Vegetation is characerized by open canopied stands of low growing (<15 m) whitebark pine co-dominant with Engelmann spruce and subalpine fir. Many stands are characterized by a shrub layer of common juniper, shrubby cinquefoil and buffaloberry.

Detailed vegetation information can be found in Kuchar 1978 (p. 108).

R-F(D)

Rock with a sparse cover of scrub Douglas fir supported directly on the rock or by very shallow soils.

Map Unit Concept

This map unit is typified by south and west facing rock outcrop and rock cliffs at about 1500 to 2000 m. The lone example of this map concept is the west facing cliff north of the Mount Hunter fire lookout. The vegetation is characterized by sparse stands of scrubby Douglas fir with a low cover of understory species. There are few sites with sufficient weathered mantle (>10 cm) to be considered soil and these would be Regosolic.

R-aL

Steep rock cliffs, generally with a thin cover of colluvial rubble which supports sparse patchy stands of scrubby subalpine larch.

Map Unit Concept

This map unit concept is characterized by steep rocky cliffs with patches of thin colluvial rubble at and near the upper limit of the tree line. Elevations are mainly 2000 to 2300 m in the southeast quadrant of the Park. Only rarely does the colluvial rubble mantle contain sufficient fines to be considered a Regosolic soil. Vegetation is characterized by a sparse cover of subalpine larch with little understory vegetation.

Detailed vegetation information can be found in Kuchar 1978 (pp. 114,aLr).

X

Lichen tundra comprised mainly of dark epipetric lichens on acid rock in the vicinity of Lake O'Hara.

Map Unit Concept

This map unit concept is characterized by "bare" acid rock outcrops generally above the tree line. Outcrops of the Gog Formation (Allan 1914) closely coincide with the areal distribution of this map unit concept. The vegetation characterizing this map unit concept is an abundance of rock lichens, in places approaching 100% cover. Other vegetation is nil or extremely sparse, mainly tiny herbs rooted in crevices and fissures or on small rock ledges with rock debris. The dominant lichens are green (*Rhizocarpon geographicum*) and black (*Lecidea, Lecanora, Umbilicariaceae*) which at a distance results in a distinctive dark, greenish cast to the rock surfaces. The lichen cover is very slow growing and the rocks and colluvial rubble must remain stable for hundreds of years to have the dark greenish cast.

Detailed vegetation information can be found in Kuchar 1978 (p. 184).

R

Unvegetated rock and colluvial rubble, generally at high elevations.

Map Unit Concept

This map unit concept is characterized by all natural areas of rock outcrop in the Park where plant life is totally absent, or present but extremely sparse, generally less than 0.1% cover. Landforms include Alpine and Subalpine bedrock and outcrops, exposed Alpine colluvial rubble slopes and ridges, active rock-avalanche, chutes and bare cliffs. In crevices and other stable sites which provide some moisture during the growing season there may be a few plants, mostly Alpine species such as snow willow, mountain sorrel, broad-leaved fireweed and several others.

Detailed vegetation information can be found in Kuchar 1978 (p. 186).

T

Unvegetated talus and coalescing talus cones, generally at high elevations.

Map Unit Concept

This map unit concept is characterized by areas dominated by talus which is so active and/or at such extreme elevations that either or both preclude or very nearly preclude plant life. What vegetation that is present would provide less than 0.1% cover. Snow avalanching is often active on these landforms. In relatively stable sites where some moisture is available during the growing season there may be a few solitary plants, generally Alpine species such as snow willow, mountain sorrel, broad-leaved fireweed and several others.

Detailed vegetation information can be found in Kuchar 1978 (p. 186).

M

Unvegetated recent moraine, generally associated with existing glaciers.

Map Unit Concept

This map unit concept is characterized by areas dominated by recent moraines (including rock glaciers) generally associated with existing glaciers. Elevations are generally higher than 2100 m and below 2600 m with occasional lobes as low as 1900 m. The lateral morainic ridges are frequently so steep, and have such "knife edged" crests, that erosion (as well as climate) prevents colonization by plants. In relatively stable sites there may be a few solitary plants, generally Alpine species such as snow willow, mountain sorrel, broad-leaved fireweed and several others.

Detailed vegetation information can be found in Kuchar 1978 (p. 186).

I

Glaciers, ice and permanent snow fields.

Map Unit Concept

This map unit concept is characterized by areas dominated by glaciers and permanent snowfields which occur near and above tree line in Yoho National Park.

Over a period of several years the ice front can be quite dynamic and result in relatively frequent changes in the area which might be mapped as I. However, in terms of areal extent, given a mapping scale of 1:50,000 these changes over 10 to 50 years are not discernible on the maps. Vegetation on the snowfields is limited to patches which, during portions of the year, may support a fairly extensive very thin layer of algae. In the Rockies these patches of "red snow" are caused by snow algae, mainly *Chlamydomonas nivalis* (Kol 1964).

z

Grossly disturbed soil and vegetation.

Map Unit Concept

This map unit concept is characterized by borrow and gravel pits and other disturbances to the soil and vegetation. There are of course many areas, especially along roads and in the townsite, that fit the above concept but that cannot be shown on a map at a scale of 1:50,000. Areas where the vegetation but not the soil has been grossly disturbed by man's activities are indicated by a z in brackets after a biophysical symbol on the map. For example, DS-P(z) indicates a site with the biophysical characteristics of DS-P with the vegetation being severely disturbed.

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APPENDIX - Common and scientific names used in this report.

TREES

Common Names	Scientific Names
aspen (trembling)	*Populus tremuloides*
birch, paper	*Betula papyrifera*
cedar, western red	*Thuja plicata*
Douglas fir	*Pseudotsuga mensiesii*
fir, subalpine	*Abies lasiocarpa*
hemlock, western	*Tsuga heterophylla*
larch, subalpine	*Larix lyallii*
pine	*Pinus spp.*
pine, limber	*Pinus flexilis*
pine, whitebark	*Pinus albicaulis*
poplar	*Populus spp.*
poplar, balsam	*Populus balsamifera*
spruce	*Picea spp.*
spruce, Engelmann	*Picea engelmannii*
spruce, hybrid	*Picea glauca x engelmannii*
spruce, white	*Picea glauca*
yew, western	*Taxus brevifolia*

SHRUBS

alder, green	*Alnus crispa*
bearberry	*Arctostaphylos uva-ursi*
bilberry	*Vaccinium membranaceum*
birch, dwarf	*Betula glandulosa*
black currant, bristly	*Ribes lacustre*
blueberry	*Vaccinium spp.*
bramble, five-leaved	*Rubus pedatus*
buffaloberry	*Shepherdia canadensis*
bunchberry	*Cornus canadensis*
cinquefoil, shrubby	*Potentilla fruticosa*
devil's-club	*Oplopanax horridum*
dogwood, red osier	*Cornus stolonifera*
dryad, yellow	*Dryas drummondii*
dryad, white	*Dryas octopetala var. hookeriana*
grouseberry	*Vaccinium scoparium*
heather, yellow	*Phyllodoce glanduliflora*
heather, purple	*Phyllodoce empetriformis*
heather, white mountain	*Cassiope mertensiana*
honeysuckle, bracted	*Lonicera involucrata*
juniper, common	*Juniperus communis*
juniper, creeping	*Juniperus horizontalis*
Labrador tea	*Ledum groenlandicum*
maple, mountain	*Acer glabrum*
menziesia	*Menziesia ferruginea*
rhododendron, white	*Rhododendron albiflorum*
rose, prickly	*Rosa acicularis*

snowberry	*Symphoricarpos sp.*
willow	*Salix spp.*
willow, snow	*Salix nivalis*
HERBS	
anemone, western	*Anemone occidentalis*
arnica	*Arnica spp.*
aster	*Aster spp.*
aster, showy	*Aster conspicuus*
clubmoss, little	*Selaginella densa*
fireweed	*Epilobium angustifolium*
fireweed, broad-leaved	*Epilobium latifolium*
groundpine, bristly	*Lycopodium annotinum*
horsetail	*Equisetum spp.*
lousewort, bracted	*Pedicularis bracteosa*
moss campion	*Silene acaulis*
pinegrass	*Calamagrostis rubescens*
pussytoes, woolly	*Antennaria lanata*
sarsaparilla, wild	*Aralia nudicaulis*
saxifrage, purple	*Saxifraga oppositifolia*
sedge	*Carex spp.*
sorrel, mountain	*Oxyria digyna*
twinflower	*Linnaea borealis*
valerian, mountain	*Valeriana sitchensis*
wintergreen	*Pyrola spp.*
MOSSES	
feathermosses	*Hylocomium splendens* *Pleurozium schreberi* *Ptilium crista-castrensis*