Tsitika Mountain

Ref No. 1192

BACKGROUND REPORT

TSITIKA MOUNTAIN ECOLOGICAL RESERVE

(Draft, July 1994)

Prepared By:

David Oppenheim
Volunteer Warden, ER 122#

SUMMARY

This report provides background information about the Tsitika Mountain Ecological Reserve (#122). It describes its situation and surroundings in the lower Tsitika River Valley on northeastern Vancouver Island. The Reserve comprises a small plateau with lake and fens, and the mountain slopes above. The biophysical context is given along with descriptions of the flora and fauna. Activities on and near the reserve are described and some management issues are reviewed.

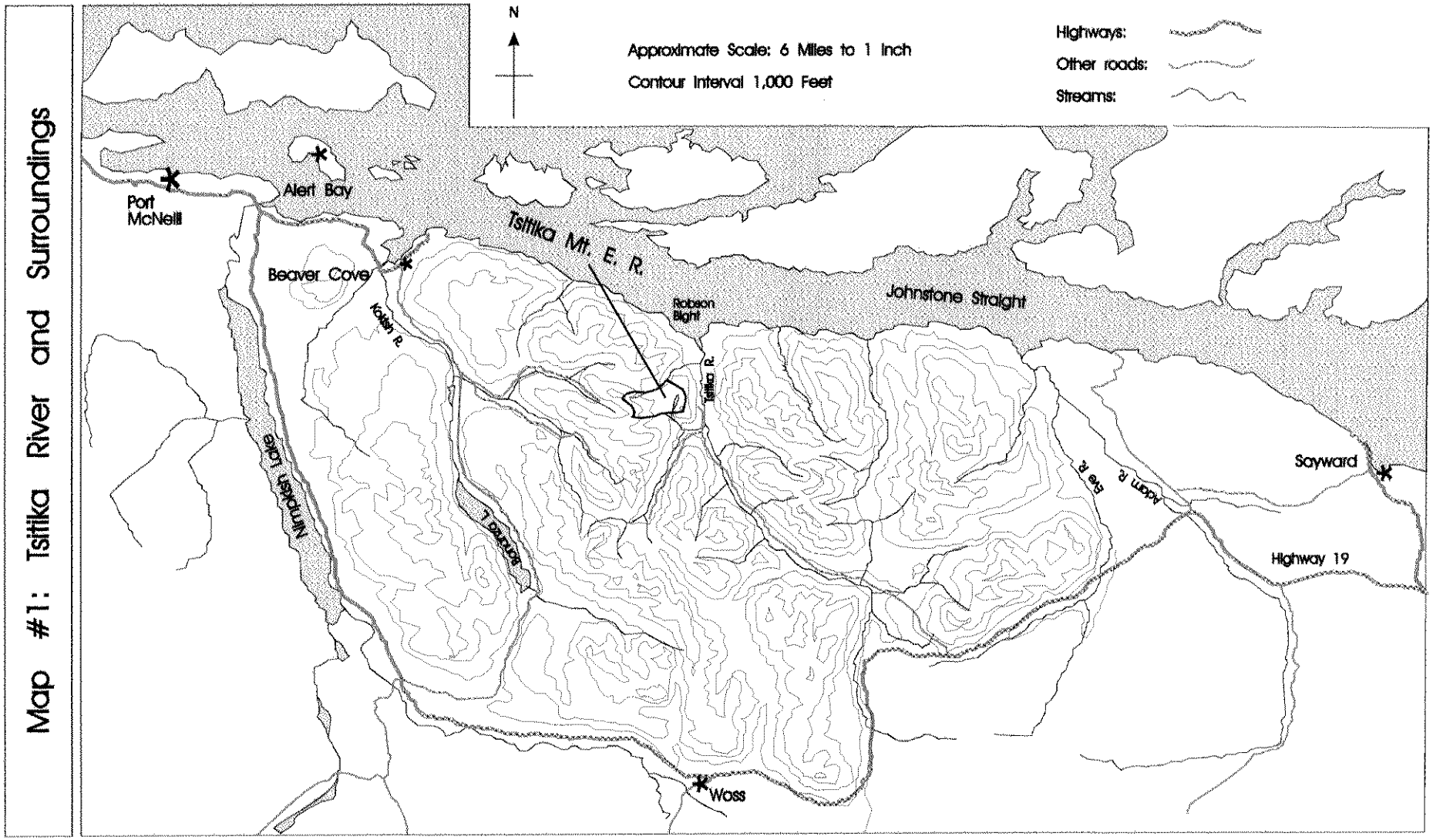
I. INTRODUCTION

The Ecological Reserve Program for British Columbia has been established to preserve representative and special ecosystems, and their components, within the Province. It is managed by BC Parks, Ministry of Environment, Land and Parks through their Region, District and Zone staffs. Ecological Reserves are created to set aside representative examples of landscape components; to protect rare and endangered species of plants and animals; to protect unique, rare or outstanding botanical, zoological or geological features; to ensure perpetuation of important genetic resources; and to provide for research and education about the natural environment.

Tsitika Mountain Ecological Reserve (#122) was created in 1989 to protect representative montane and subalpine forest and bog communities. It is located on the side of the lower Tsitika River valley on the northeast coast of Vancouver Island - see Map #1. It comprises within its 554 ha. a small plateau with a small lake and terraced fens, bounded on the east by a low forested ridge and on the west by a higher subalpine ridge. To the west, the reserve is bounded by Tree Farm 2, TimberWest Ltd., within the Kokish River drainage. To the north, east and south it is bounded by Tree Farm 39, MacMillan Bloedel Ltd. The nearest cutblocks have been between 1 and 2 km. from reserve boundaries. Because of the recent Land Use Plan for Vancouver Island, some of the land north and east may come under reserve in the near future.

This Report provides information on E.R. #122, and its surroundings, to enhance understanding and effectiveness of the Management Plan for the Reserve. In Section II., the Reserve is described, with technical details in Appendices. In Section III., past, present and possible future land use of the Reserve and its surroundings is discussed. In Section IV., management to date is described. In Section V., future resource issues are discussed.

Map #1: Tsitika River and Surroundings



II. RESERVE DESCRIPTION

A. LOCATION AND ACCESS

Tsitika Mountain Ecological Reserve is located in the lower Tsitika River valley, on the northeast coast of Vancouver Island, about 4 km. above Robson Bight (see Map 1). The centre of the Reserve is at approximately latitude 50°26.5' North, longitude 126°37' West. The Reserve's east boundary is 1.5 km west of the river and 650 m. above it. The closest road access is on MacMillan Bloedel's Tsitika Main logging road, about 30 km. from Highway 19. The logging road has restricted access beyond the locked gate at the Catherine Creek bridge, about 2 km. before the end.

B. SIZE AND BOUNDARIES

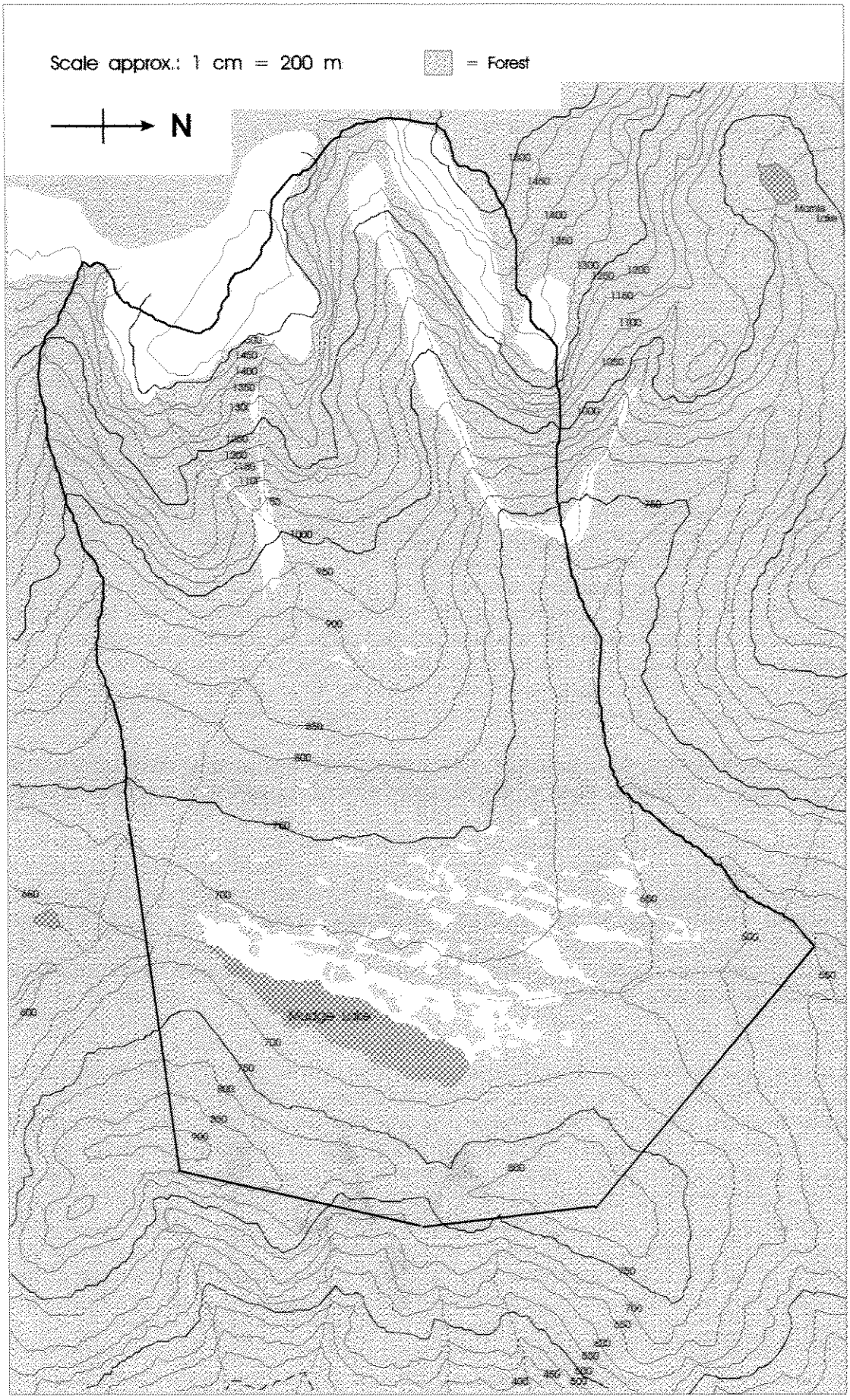
The Reserve is an irregular rectangle approximately 3.5 km. east to west and 1.5 km north to south (see Map #2), containing about 554 hectares. The west boundary is at the height of land between the Tsitika River drainage, and the Kokish River drainage. The north boundary drops to and follows a stream (known locally as Keefer Creek) which flows north and east to the Tsitika River. The east boundary rises from the creek to near the height of a low ridge, which it follows south. The south boundary drops from the ridge, crosses the outlet creek of the lake (known locally as Mudge Lake) and follows an unnamed creek back to the height of land at the west boundary. The west boundary is also the boundary between Tree Farm 39 and Tree Farm 2. The legal boundary description is in Appendix A.

The lowest elevations in the reserve are at 550 meters on Keefer Creek and 650 m. on the outlet creek of Mudge Lake. The highest elevation is on the West boundary at 1575 m. Mudge Lake is at about 670 m., while the fens extend west up to 750 m. and north down to about 630 m.

C. RESERVE ESTABLISHMENT

The Reserve was established by Order-in-Council no. 1179, 10 August 1989. The Reserve was one of six identified during development of the Tsitika Watershed Integrated Resource Plan.

Map #2: Tsitika Mt. Ecological Reserve



D. BIOPHYSICAL FRAMEWORK

A biophysical habitat map at 1:20,000 scale covering the whole lower Tsitika Moratorium Area, was done for BC Parks in 1993 (Norecol, 1993). Some of the information relevant to the Reserve is presented in Appendix B. The Reserve lies within the Northern Island Mountains Ecosection of the Western Vancouver Island Ecoregion within the Coast and Mountains Ecoprovince. The low areas around Mudge Lake fall within the Montane Variant of the Very Wet Maritime Coastal Western Hemlock biogeoclimatic subzone (CWHvm2). The top of the east ridge and the lower slopes of the west ridge fall within the Windward Variant of the Moist Maritime Mountain Hemlock subzone (MHmm1). The highest levels on the west ridge fall within the Windward Variant of the Moist Maritime Parkland Mountain Hemlock subzone (MHmmp1).

1. Climate (REDO THIS)

Climate data is not available for the Reserve or for any nearby place of similar altitude. Data for Vancouver, Prince Rupert, Port Hardy and Comox are given in Appendix C.

Applying the methods of Indicator Plants of Coastal British Columbia (Klinka, 1989) to the data from the current inventory of plants will eventually give a better picture of various site factors, including climate, on the Reserve.

2. Topography, Geology, Geomorphology and Soils

The Reserve topography varies from gentle slopes to the west of Mudge Lake, to moderately steep slopes leading up to both the east and west ridges, to extremely steep near the top of the high west ridge. At the top of this ridge is sub-alpine area with gentle to moderate slopes.

The bedrock underlying the whole Reserve is of the Triassic Karmutsen Formation, made up of Basaltic lavas, pillow lavas, breccia, aquagene tuff and greenstone with minor limestone (Roddick, 1983). There are extensive outcrops of volcanics in the form of broken cliffs on the higher slopes. Below these there are colluvial materials over glacial till. On the lowest areas, the till is covered by organic soil, which in the fens is up to 1 m. thick (see Appendix D).

3. Water Regime

There are three streams which drain the high west ridge within the Reserve. The two northerly ones start in avalanche

chutes, becoming somewhat incised on the gentler slopes. The north boundary stream, Keefer Creek, flows into the Tsitika River outside the Reserve. The central stream joins the Mudge Lake outlet stream near the southern boundary of the Reserve (not the north boundary stream as shown on the NTS 92L/7 topo. map). The southern boundary stream leaves the Reserve before joining the Mudge Lake outlet stream, which in turn flows down to Catherine Creek.

The soil drainage on the Reserve varies from rapid on the high slopes, to moderate on the middle slopes and very poor within the fens. The latter seems to be caused by a pan which has formed near the top of the till material (author's observation). From the fens south of the north end of Mudge Lake, the drainage is into the lake. The fens further north drain into Keefer Creek.

4. Vegetation

The vegetation on the reserve is typical for the biogeoclimatic subzones involved. A forest cover map is reproduced in Appendix E.

In the fen area, the dominants are various sedges, such as Sitka, beaked and cottongrass, and mosses, such as various Sphagnum species. Some of the drier areas have extensive cover of crowberry. Many other species of wetland plants occur, such as western Bog-laurel, Labrador Tea, White Bog Orchid and Great Burnet. See Appendix F for a more complete list.

The forested parts of the reserve have yellowcedar, mountain and western hemlock, amabilis fir and western white pine. Shrubs include several huckleberries, false azalea and salal. Among the herbs are twin flower, Calypso, deer fern, spotted and striped coralroot, foam flower, heart-leaved twayblade and canada dogwood.

In the subalpine area at the top of the west ridge are pink and white mountain-heather, elephant head, penstemon and partridgefoot.

5. Fauna

The known vertebrates for the Reserve are what would be expected in this area and include: black-tailed deer, black bear, cougar and wolf, red squirrels, gray jays, crows, bald eagles, rufous hummingbird, tree frog. Of particular note are three bird species nesting at the lake: mew gulls, red-throated loons and common goldeneye. For a more complete list, see Appendix F.

6. Representative and special features

The Reserve provides representative montane forested and subalpine areas, with the exception of southern aspects and low elevations. The fen area on slopes north and west of the lake is representative and has special interest because of terracing at two scales. There are many small pools with 'dams' on the down hill side consisting of organic soil. Some of these are a meter tall. In a few of the pools with more water flow, the bottom of the pool is often at the underlying till surface. Most pools exhibit little drainage. As a larger feature, there are bands of treed, hummocky, bouldery, slightly steeper terrain alternating with fen areas, parallel with the lake shore. The origin of both of these features is unclear.

E. CULTURAL AND HISTORICAL FEATURES

As far as is known, the only cultural features on the reserve are: an old camp near the north end of the lake (not of great age, as it was constructed with modern nails); old blazes on scattered trees in the fen, running parallel to the lake; and 10 numbered stakes which were marked with orange and white stripes. These last are wired to scattered trees in one area near the lake and were undoubtedly part of some study.

III. LAND USE

A. REGIONAL CONTEXT

The area surrounding the Reserve is uninhabited forest land. The nearest population centers are at Woss, Beaver Cove and Sayward. These are 25, 20, and 50 km. straight line distance, and much more by road. The forest industry employs many of the people at these and other centers, with service and tourism as lesser employment.(REF?)

B. ON RESERVE ACTIVITIES

There is currently an inventory in progress utilizing the methods of "Describing Ecosystems In The Field" (Luttmerding, 1990). The purpose of the project is to provide base-line data on the flora and fauna of the Reserve, with emphasis on the fens. It is being carried out by the volunteer wardens in consultation with BC Parks staff.

Because of the relatively remote location and difficult access, there is at present no educational use, and little or no recreation use of the Reserve. There is little evidence of any other use, though the old camp mentioned above could have been part of a trapping or hunting use. There is no sign that whatever use it represents is continuing today.

C. SURROUNDING ACTIVITY

At present, logging activity is fairly removed from the reserve. Once logging starts on the west side of Catherine Creek, there is a chance that roads will approach the south boundary of the reserve. The effect of the Vancouver Island Land Use Plan on the east and north boundary areas is not known at this time. To the west, road building and logging have been moving up 'No.1' Creek on Br.257 off the E. Kokish Main.

There is a good deal of recreational and other traffic on Johnstone Straight, with much whale watching in the Robson Bight area. In addition, there is some hiking to Robson Bight from the Catherine Creek bridge, despite the closure of Michael Bigg E.R. to such use.

IV. RESERVE MANAGEMENT

To date there has been little management activity associated with the Reserve: volunteer wardens are in place; a couple of Ecological Reserve signs have been posted; and an unimproved trail has been made to the reserve boundary from cut-block 101 (check this no.) at the end of the Tsitika Main. A base-line inventory of flora and fauna has been started to allow for future monitoring of changes on the Reserve.

As logging gets closer to the Reserve, it will become necessary to mark portions of the boundaries on the ground in conjunction with the tenure holders. For this to happen, a possible ambiguity in the legal description will have to be resolved: the starting point is described as being on Keefer Creek; and as being a fixed distance south and west of District Lot 223, which may not bring one to the creek.

The ground water regime on the Reserve is quite important to the existence of the fens. The present boundaries would appear to protect the source of this water adequately. The only possible threat would seem to be from disturbance of the outlet stream of Mudge Lake. If this led to an increased rate of down-cutting, and if this lowered height moves upstream, the lake level could be effected. This seems a remote possibility at present, but the stream is already quite incised a short distance below the lake.

The representativeness of the Reserve could be enhanced if there were extensions on the south and east side, down to Catherine Creek and the Tsitika River. This would provide the full altitude range for the locality and a southern aspect. Whether this is possible depends in part on the outcome of the V.I. Land Use Plan.

That decision will also effect access to and attractiveness of the lower Tsitika valley for recreational use. If there is a significant increase of this type of use, it may become necessary to post more signs and provide guidance about use of the Reserve. In particular, the fen area is fragile, as are the bog pool 'dams' which could break down with increased foot traffic. Also fishing in the lake should be discouraged, as the nesting loons utilize this resource. In addition, consideration might be given to getting the Reserve marked on the Vancouver VFR air navigation chart, to discourage floatplane landings. It is not known whether planes use the lake at present.

REFERENCES

Hare, E.K. and M.K. Thomas. 1974. Climate Canada. Wiley Publishers of Canada. Toronto

Luttmerding, H.A., D.A. Demarchi, E.C. Lea, D.V. Meidinger and T. Vold. 1990. Describing Ecosystems in the Field. Second Edition. MOE Manual 11, Ministry of Environment. Victoria, BC.

Norecol, Dames and Moore, Inc. 1993. Biophysical Habitat Map For the Upland Portion of Robson Bight Ecological Reserve and Tsitika Moratorium Area, with Expanded Legend. BC Parks South Coast Region. Vancouver, BC.

Phillips, D. 1990. The Climates of Canada. Environment Canada. Ottawa.

Reader's Digest. 1981. Atlas of Canada. The Reader's Digest Association (Canada) Ltd. No location given.

Roddick, J.A. and T.E. Muller, compilers. 1983. Geology of Alert Bay - Cape Scott, Map 1552A. Geological Survey of Canada. Ottawa.

APPENDIX A: LEGAL BOUNDARY DESCRIPTION

TSITIKA MOUNTAIN SCHEDULE

The Crown land in Rupert District described as:

Commencing at a point on the right bank natural boundary of an unnamed creek, said point lying 1.625 kilometres west and 2.500 kilometres south of the southwest corner of District Lot 223;

thence South 51° East a distance of 1.225 kilometres;

thence South 6° East a distance of 600 metres;

thence South 13° West a distance of 850 metres;

thence South 81° West a distance of 1.100 kilometres, more or less, to the point of intersection with left bank natural boundary of an unnamed creek;

thence Westerly along the said left bank natural boundary a distance of 2.580 kilometres, more or less, to a height of land, said height also being the westerly boundary of TFL 39, as shown on NTS Topo Map 92L7, Edition 3;

thence Northerly along said TFL boundary a distance of 2.060 kilometres, more or less, to a height of land;

thence Easterly along said height of land to the headwaters of the unnamed creek, upon which lies the point of commencement;

thence in a general Easterly direction along the right bank natural boundary of said unnamed creek to the point of commencement;

the whole containing 554 hectares, more or less.

APPENDIX B: BIOPHYSICAL MAP OF THE LOWER TSITIKA VALLEY

In 1992-93 a study was done of the Robson Bight - Tsitika Moratorium area for BC Parks (Norecol, 1993). A portion of the resulting 1:20,000 Biophysical Habitat Map is reproduced here as Map #3. The following information is adapted from the "Expanded Legend ..." which accompanies the map. Please see the original for more detail.

1. Methods

Soils, terrain, vegetation and wildlife habitat were assessed by field work undertaken in October and November, 1992. Data were collected at 22 sample plots throughout the study area [none within E.R. #122 - true?]. Data were collected following the forms and procedures as described in "Describing Ecosystems in the Field" (Luttmerding, 1990)....

The habitat potential ratings for the Red Listed and Blue Listed Wildlife species that may occur in the study area were based on the following factors:

- cover/escape terrain
- food availability
- reproductive utilization; and
- animal movement routes....

The Red Listed and Blue Listed Species were taken from a 1993 list prepared by BC Wildlife Branch and included the following:

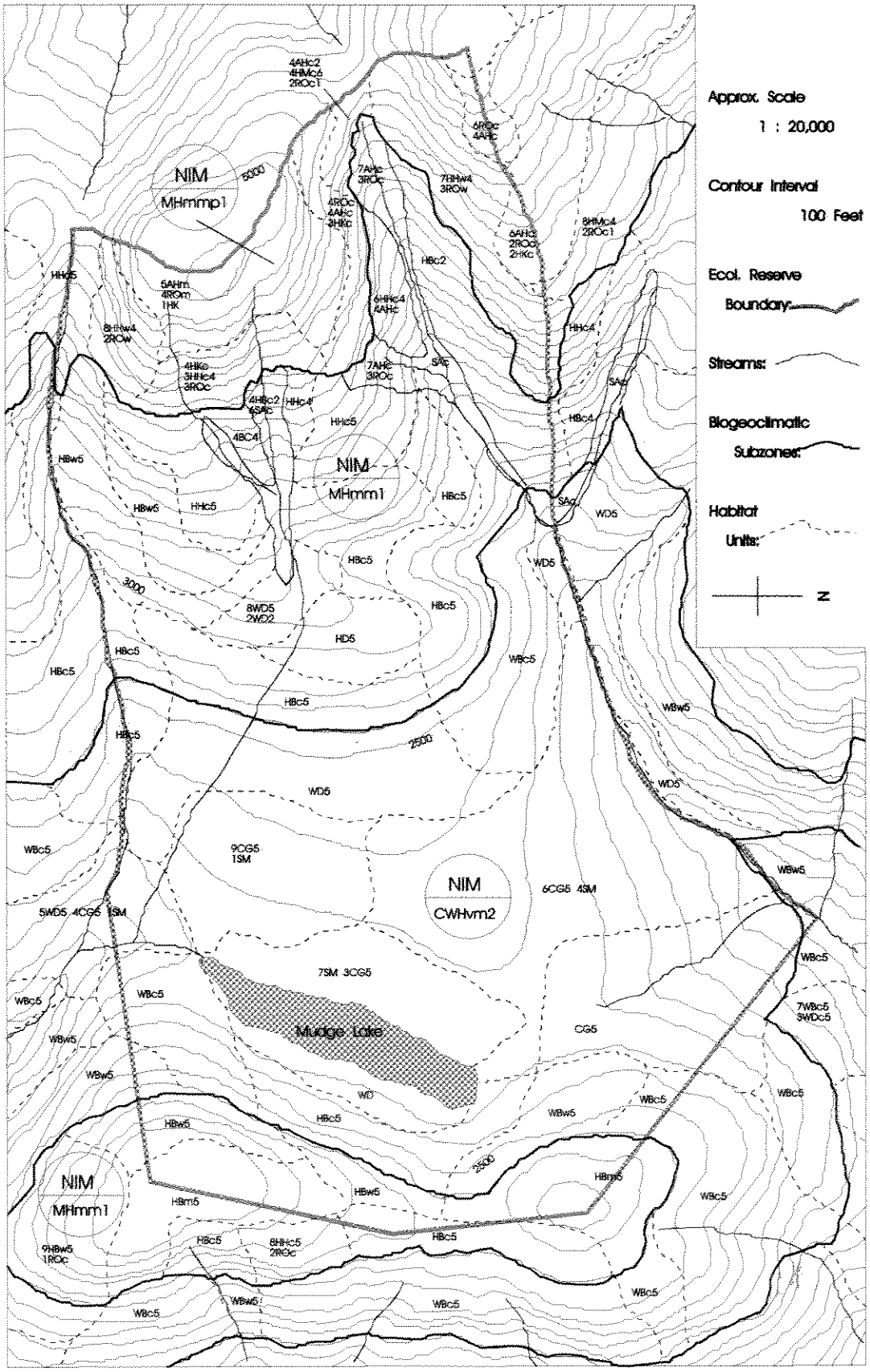
Red List

Northern Goshawk	Accipiter gentilis laingi
Water Shrew	Sorex palustris brooksi
Keen's Long-eared Myotis	Myotis keenii
Wolverine	Gulo gulo vancouverensis

Blue List

Bald Eagle	Haliaeetus leucocephalus
White-tailed Ptarmigan	Lagopus leucurus saxatilis
Marbled Murrelet	Brachyramphus marmoratus
Western Screech-owl	Otus kennicottii kennicottii
Northern Pygmy-owl	Glaucidium gnoma swarthi
Ermine	Mustela erminea anguinae
Roosevelt Elk	Cervus elaphus roosevelti

Map #3: Biophysical Habitats



2. Map Symbols and Labels

For Ecosection ---------- NIM
& Biogeoclimatic Unit --- CWHvm2

where: NIM stands for Northern Island Mountains Ecosection
CWHvm2 stands for Very Wet Maritime Coastal Western Hemlock - Montane Variant
MHmm1 stands for Moist Maritime Mountain Hemlock - Windward Variant
MHmmp1 stands for Moist Maritime Parkland Mountain Hemlock - Windward Variant

The Biogeoclimatic Units are described as follows:

CWHvm2: This variant occurs on middle to lower mountain slopes above about 600 m. The CWH zone has cool summers and mild winters. This is one of the wetter subzones. Western hemlock, amabilis fir and western redcedar are the common tree species, with yellow-cedar and mountain hemlock present at higher elevations or on cool, wet sites. The shrub layer includes red huckleberry, Alaskan blueberry, and salal, with salmonberry on wetter sites. Deer fern and sword fern are found in the herb layer.

MHmm1: This subzone occurs on middle to upper mountain slopes above the CWHvm subzone. It has short, cool summers and long, cool, wet winters. Mountain hemlock, amabilis fir and yellow-cedar are the dominant tree species. The shrub layer consists of black huckleberry, Alaskan and oval-leaved blueberry, copperbush, false azalea and white rhododendron. Mountain-heathers are common on slightly dried sites (shallow soils).

MHmmp1: This subzone occurs on the upper mountain slopes and mountain tops. This subalpine parkland is subject to deeper winter snowpack which is slow to disappear and a shorter growing season than the HMmm1 subzone. Tree growth is poorer and tree cover is not continuous: patches of trees are interspersed with subalpine meadows, wetlands and exposed bedrock.

3. Biophysical Habitat Classes

Each polygon is marked for habitat class, aspect and successional stage (where appropriate). If a polygon has more than one significant, intermixed classes, they are given preceded by their

respective areal coverage in tenths.

Aspects are given by w = warm; c = cold; and m = gentle to moderate slopes.

Successional stages are given as:

1 Herb-shrub
2 Pole-sapling (20 - 40 years)
3 Young forest (40 - 100 years)
4 mature forest (100 - 250 years)
5 Old growth (over 250 years)

For example: 4HKc 3HHc4 3ROc

means the polygon is 40% Mountain hemlock - mountain heather krummholz, 30% Mountain hemlock - mountain-heather mature forest, and 30% Rock outcrop, all with cool aspect.

The symbols and habitat classes relevant to the Reserve area are:

AH Mountain-heather meadow
CG Yellow-cedar - goldthread, very moist site
HB Mountain hemlock - blueberry
HD Mountain hemlock - deer cabbage, very moist site
HH Mountain hemlock - mountain-heather, dry site
HK Mountain hemlock - mountain-heather krummholz
HM Mountain hemlock - mountain-heather parkland
LH leatherleaf saxifrage - hellebore, moist meadow
MB Mountain hemlock - bramble, moist site
RO Rock outcrop
SA Sitka alder avalanche chute
SM Sedge wetland
TA talus and rubble
WB Western hemlock - blueberry
WD Western hemlock - deer fern, moist gentle slope
WS Western redcedar - salal, dry site

Please see the original study for more detailed descriptions of the terrain, soils, drainage, vegetation and potential use by Red List and Blue List species for each habitat class.

APPENDIX C: CLIMATE DATA

The Atlas of Canada (Reader's Digest, 1981) has small scale maps which show (not reliably) that the Reserve has:

precipitation: 1600-2400 mm per year
January avg. daily temperature: 0-5°C.
July avg. daily temperature: 10-15°C
high summer days: 80 days with avg. temp above 18°C
bright sunshine, avg. annual hours: 1400-1600
rain, avg. annual number of days: 160-200
snowfall, avg.annual: 160-280 cm.
snow cover, avg. annual number of days: less than 80
growing season, avg. number of days above 5.6°C: 220+

The Climates of Canada (Phillips, 1990) shows the following information on small scale maps of Canada and BC the Reserve area with:

1400-1600 hours of sunshine (average annual)
30 days per year with some fog (this seems very low, having seen fog there frequently)
2400 mm average annual precipitation
200-400 cm ave. annual snowfall
0.7 kPa January av. vapour pressure
1.2-1.4 kPa July av. vapour pressure
600-700 mm av. annual lake evaporation
150-200 days per year with rain and snow
0°C. av. January night-time temperature
20°C. av. July afternoon temperature

It also contains climate tables for Vancouver International Airport (elev. 3 m.):
1994 °C. growing degree-days (>5°C.)
1113 mm av. total annual precipitation
1.02 kPa av. annual vapour pressure
1920 hours av. annual bright sunshine
55 days av. annual with freezing temperature
156 days av. annual with rain
15 days av. annual with snow
2.5°C. av January daily temperature
17.3°C. av. July daily temperature
9.8°C. av. annual daily temperature
33.3°C. highest temp. ever
-17.8°C. lowest temp. ever

and Prince Rupert Airport (elev. 52 m.):
1148°C. growing degree-days (>5°C.)
2523 mm. av.annual total precipitation
0.88 kPa av. annual vapour pressure
1224 hours av. annual bright sunshine

107 days av. annual with freezing temp.
218 days av. annual with rain
35 days av. annual with snow
-0.2°C. av. January daily temp.
12.8°C. av. July daily temp.
6.7°C. av. annual daily temp.
28.7°C. highest temp. ever
-24.4°C. lowest temp. ever

Climate Canada (Hare, 1974) gives the following data:

For Vancouver:

Temperature (°C):		
mean daily max.	13.6	
mean daily min.	6.0	
mean daily	9.8	
maximum (1937-1970)	33.3	
mimimum (1937-1970)	-17.8	
mean degree days - growing	1875	
freezing temp. days, mean	57	
Precipitation:		
yearly mean total	1068	mm
snowfall, yearly mean	52	cm
precip. days, yearly mean	161	
snowfall days, yearly mean	12	
Sunshine:		
yearly mean duration (hours)	1931	

For Prince Rupert:

Temperature (°C):		
mean daily max.	10.8	
mean daily min.	4.6	
mean daily	7.7	
maximum (1908-1963)	32.2	
minimum (1908-1963)	-21.1	
mean degree days - growing	1187	
freezing temp. days, mean	71	
Precipitation:		
yearly mean total	2415	mm
snowfall, yearly mean	113	cm
precip. days, yearly mean	227	
snowfall days, yearly mean	21	
Sunshine:		
yearly mean duration (hours)	1036	

For Port Hardy:

mean daily temperature	7.9 °C
mean January daily temp.	2.4
mean July daily temp.	13.6
mean yearly precipitation	1730 mm

For Comox:

mean daily temperature	9.3 °C
mean January daily temp.	2.1
mean July daily temp.	17.3
mean yearly precipitation	1207 mm

APPENDIX D: TERRAIN MAP OF THE LOWER TSITIKA VALLEY

This map was produced along with the Biophysical Habitat Map (see appendix B). A portion of the map is reproduced here as Map #4.

The terrain unit symbols show surficial material and surface expression and sometimes, process. For example, Rs-V means that there is bedrock (R) on a steep slope (s) caused by gullying (V). The symbols are combined, eg. Mv.Cv if they are of about equal extent; Rh/Cv if the first covers 60-80% extent; and Mvb . to show that Mvb overlies Ruh Ruh

Below the terrain unit is shown the soil drainage class. Two symbols mean both occur. If they are separated by a dash, then all intermediate classes occur.

Materials:

C colluvium - products of gravitational movement
F fluvial sediments - products of water transport
M till - morainal and other glacier deposits
R bedrock - outcrops and near surface bedrock

Surface Expression:

a moderate slope - 16° to 26°
b blanket - general topography from underlying material; 1-2 m. thick
h hummocky - steep hillocks and hollows; slopes >16°
j gentle slopes - 3° to 15°
k moderately steep slopes - 27° to 35°
s steep slopes - greater than 35°
u undulating - hillocks and hollows; slopes 3° to 15°
v veneer - surface expression from underlying material; thin

Processes:

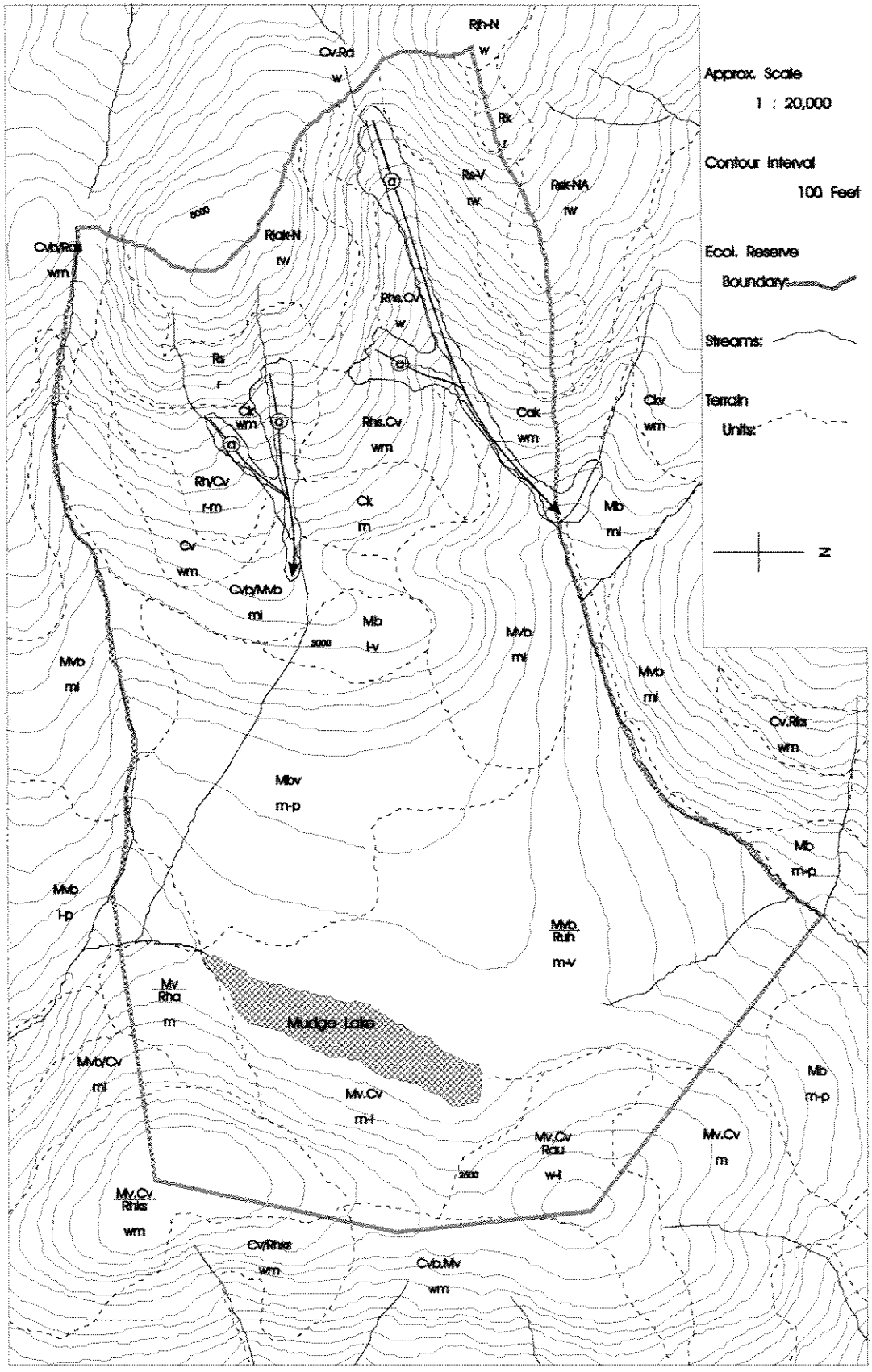
A avalanches - slopes modified by frequent snow slide
N nivation - hollowing around semipermanent snowbanks
V gullying - slope affected by gully erosion

Soil Drainage Classes:

r rapidly drained
w well drained
m moderately well drained
i imperfectly drained
p poorly drained
v very poorly drained

Avalanche tracks are shown with an arrow and "a" in a circle.

Map #4: Terrains



APPENDIX E: FOREST COVER MAP

A modified portion of MacMillan Bloedel Ltd's forest cover map **(GET PERMISSION?)** 92L.047 showing the Reserve area is reproduced here as Map #5.

The symbols show, for example: CYH-1
670

the species: check these
- H hemlock
- B true fir
- CY yellow-cedar

and site class (growing ability) 5=high to 1=very poor; check these

and the volume of timber in cubic metres per hectare.

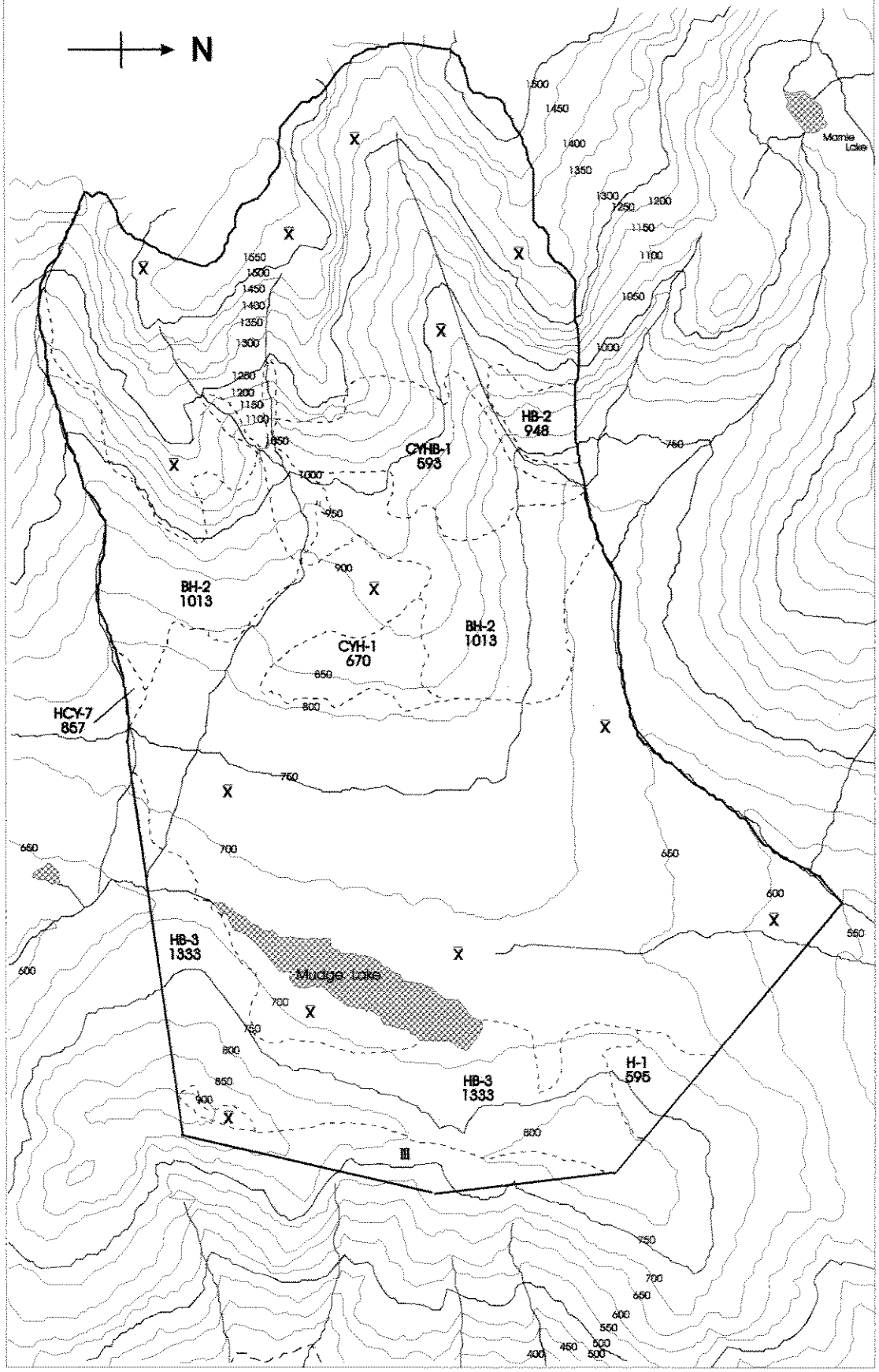
The symbol $\bar{X}$ indicates scrub growth.

The symbol III indicates the stand is inaccessible.

Map #5: Forest Cover

Scale approx.: 1 cm = 200 m

Forest Type Unit: ----------



APPENDIX F: DATA FROM WARDEN OBSERVATIONS

The following lists of flora and fauna have been compiled by the volunteer wardens since September of 1991. In the lists, (?) indicates that the identification is not reliable, or based on sign rather than sighting. In the bird list, * indicates the there is good evidence of breeding.

BIRDS

Red-throated Loon *
Great Blue Heron
Mallard
Common (?) Goldeneye *
Bufflehead
Bald Eagle
Kestrel (?)
Ruffed Grouse
Mew Gull *
Barred owl (?)
Rufous Hummingbird
Northern Flicker
Gray Jay
Stellar's Jay
Northwestern(?) Crow
Chestnut-backed Chickadee
Red-breasted Nuthatch
Winter Wren (?)
Varied Thrush
Dark-eyed Junco *

OTHER VERTEBRATES

Black-tail Deer
Red Squirrel
Black Bear (?)
Wolf (?)
Tree Frog
Red-legged Frog (?)

PLANTS

Amabilis fir	Abies amabilis
Alpine fir	Abies lasiocarpa (?)
Bog rosemary	Andromeda polifolia
Moss	Aulacomnium palustre (?)
Deer fern	Blechnum spicant
Calypso	Calypso bulbosa
Craw's sedge	Carex crawei (?)
Pale sedge	Carex livida (?)
Sedge	Carex pluriflora (?)

Inflated sedge	Carex vesicaria (?)
White mountain-heather	Cassiope mertensiana
Yellow cedar	Chamaecyparis nootkatensis
Fern-leaved gold thread	Coptis asplenifolia
Three-leaved goldthread	Coptis trifolia
Western coralroot	Corallorhiza maculata ssp.mertens.
Striped coralroot	Corallorhiza striata
Canada dogwood	Cornus canadensis
Great sundew	Drosera anglica
Round-leaved sundew	Drosera rotundifolia
Few-flowered spike-rush	Eleocharis pauciflora
Crowberry	Empetrum nigrum
Purple fleabane	Erigeron (?) Peregrinus
Cotton grass	Eriophorum angustifolium (?)
Deer cabbage	Fauria cristi-galli
Salal	Gaultheria shallon
Swamp gentian	Gentiana douglasiana
Rattlesnake-plantain	Goodyera oblongifolia
Oak fern	Gymnocarpium dryopteris
Bog rein orchid	Habenaria dilatata
Green Flowered bog orchid	Habenaria hyperborea
Swamp laurel	Kalmia microphylla
Labrador tea	Ledum groenlandicum
Twin-flower	Linnaea borealis
Northwestern twayblade	Listera caurina (?)
Heart-leaved Twayblade	Listera cordata
Partridge foot	Luetkia pectinata
Fir clubmoss	Lycopodium selago (?)
Skunk cabbage	Lysichitum americanum
Buckbean	Menyanthes trifoliata
False azelea	Menziesia ferruginea
Chickweed monkey-flower	Mimulus alsinoides (?)
Single delight	Moneses uniflora
Sweet gale	Myrica gale
Yellow pondlily	Nuphar polysepalum
Devil's club	Oplopanax horridum
Bog cranberry	Oxycoccus quadripetalus
Elephant's head	Pedicularis groenlandica
Beardtongue	Penstemon davidsonii (?)
Red heather	Phyllodoce empetriformis
Butterwort	Pinguicula vulgaris
Western white pine	Pinus monticola
Moss	Pleurozium schreberi (?)
Cooley's buttercup	Ranunculus cooleyae
Salmonberry	Rubus spectabilis
Great burnet	Sanguisorba officinalis
Rusty saxifrage	Saxifraga ferruginia v.ferruginea
Heart-leaved saxifrage	Saxifraga punctata v.cascadensis
Brown-stem bog moss	Sphagnum lindbergii
Peat moss	Sphagnum magellanicum (?)
Peat moss	Sphagnum palustre
Peat moss	Sphagnum subsecundum (?)

Mountainbells	Stenanthium occidentale
Twistedstalk	Streptopus roseus
Western redcedar	Thuja plicata
Foam flower	Tiarella trifoliata v.laciniata
False ashphodel	Tofieldia glutinosa
False bugbane	Trautvetteria carolinensis
Northern starflower	Trientalis artica
Western hemlock	Tsuga heterophylla
Mountain hemlock	Tsuga mertensiana
Oval-leaved blueberry	Vaccinium ovalifolium
Bog blueberry	Vaccinium uliginosum
False hellebore	Veratrum viride